Book of Abstracts

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A code for Medical Geology fieldwork in Africa: Guidelines on health and safety issues in mapping disease distribution and their geoenvironmental correlates

Oral - Abstract ID: 405

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Whenever there is a rare and strictly locality related disease outbreak whose aetiology cannot be readily and clearly established, a suspected geoenvironmental factor(s) [co-factor(s)] is/are often implicated. In handling such situations, medical geologists work in teams of ready responders that include epidemiologists, public health specialists and toxicologists, who investigate the problem so as to identify causes and risk factors, implement prevention and control measures, and communicate with all stakeholders. Drawing correlations between disease distribution and some geoenvironmental factor(s) [co-factor(s)] often involves substantial amount of fieldwork, whereby medical geologists, just like the other specialists in the investigative team, may be exposed to various hazards. Examples that engender such exposures include field surveys involving observations on patterns of silica dust emission and distribution; sampling of geophagic materials for microbiological analyses; sampling of radioactive tailings for determining uranium migration pathways and particle concentrations in ambient air, or conducting diagnostic experiments in areas of recently reported lead poisoning episodes such as was the case in Nigeria in 2010, and again in 2015. The purpose of a health and safety plan is to provide a means for minimising accidents and injuries that may occur at a specific location or while working on a specific project, and to communicate to all involved what safety procedures are to be followed.

Keywords: Localised diseases; field surveys; health; safety; guidelines

A core-shell structured strategy of iron/carbon materials for the efficient oxidation and immobilization of arsenic in paddy soil

Oral - Abstract ID: 571

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The application of zero-valent iron (ZVI) in remediating arsenic (As) contaminated paddy soil has attracted great attention. However, low efficiency and insufficient longevity still hinder its practical applications. In this study, we have developed a core-shell structured ZVI/Fe_3C/graphite carbon composites (ZVI/Fe_3C/GC), in which nanosized ZVI is wrapped with Fe_3C and porous graphite carbon and well dispersed on the surface of meso-porous carbon. The core-shell structure of ZVI/Fe_3C/GC forms Fe_3C and graphite carbon as cathodes, which couples with nanosized ZVI corrosion by generating the electrochemical reactions of microscopic galvanic cells for Fe(II) long-term slow release. More importantly, the intercalation of Fe_3C serves as a catalyst to enhance oxygen adsorption and electron transfer, thereby promoting reactive oxygen species production. This significantly improves the utilization of ZVI, resulting in higher efficiency toward As(III) oxidation (94%) than nZVI and traditional carbonaceous supported nZVI, and then the formation of $FeAsO_4$ for immobilization, where ·OH and $\cdot O_2^-$ are responsible for As(III) oxidation. Following the addition of ZVI/Fe_3C/GC in paddy soil, the concentration of bioavailability As in soil decreased by 67% and 54% during flooding and drought conditions, respectively, and the As accumulated in rice plants significantly declined by 55.6%. Therefore, the core-shell structure of iron/carbon materials has great potential for efficient and long-lasting remediation of arsenic-contaminated paddy soil.

A double-edged sword effect of selenium supplementation on cadmium exposure revealed by multi-dimensional omics

Oral - Abstract ID: 555

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Cadmium (Cd), as a known Group I carcinogen, could induce damage to various organs. The capability of selenium (Se) to antagonize the toxicity of heavy metals makes it an essential trace element for human health. However, no well-standardized recommended dose ratio of Se and Cd has been established. This study compared the effects of different dietary Se supplementation (low Se, medium Se, and high selenium) on mice exposed to Cd via multi-dimensional omics. Low Se supplementation was effective at diminishing liver oxidative stress and inflammation, evidenced by the increase of antioxidant enzyme activity (SOD, CAT, GSH, GSH-Px). The benefit was associated with its restoration of the gut microbiota and changes in key metabolic pathways, including secondary bile acids, and short-chain fatty acids. Medium or high Se intake aggravated liver pathological damage. The proteomic and metabolomic analysis revealed disrupted growth and energy pathways, which validated the side effects of excessive Se intake. Our study provides insights into the dose of Se supplementation to alleviate Cd-induced detrimental effects.

A ligand strategy to construct sulfur coordinated iron based metal-organic frameworks with selective ·OH generation in Fenton-like reaction

Oral - Abstract ID: 478

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Fenton-like reaction based on hydrogen peroxide (H_2O_2) activation to generate hydroxyl radicals (·OH) with supreme oxidation ability is widely applied for degrading new emerging pollutant in water, while the less active superoxide radical (·O_2) is simultaneously generated and can quench ·OH. Therefore, selective generation of ·OH in Fenton-like reaction is a crucial but challenging work. Herein, sulfur coordinated Fe-based metal organic frameworks (S-Fe-BDC) was constructed by using the ligand of 2,5-dimercapto-1,4-benzenedicarboxylic acid (BDC-SH), and it achieved 97.42 % selectivity of ·OH generation in Fenton-like reaction. S coordination decreased the electronic density of Fe active sites and up-shifted the d-band center, thereby facilitating homolytic cleavage of H_2O_2 to OH generation and avoiding the ·O_2 generation. Benefiting from the selectivity of ·OH generation, S-Fe-BDC exhibited a high Fenton-like activity with a reaction rate constant of 0.36 min^{-1} using bisphenol A (BPA) as the model pollutant, which is increased 75 times compared to Fe-BDC without S coordination. This ligand strategy to construct S-Fe coordination environment at a molecular level can guide the design of Fenton-like catalyst for realizing the desirable goal of selective ·OH generation in the field of treatment of new emerging pollutant.

A method for quantifying the contribution of algal sources to CODMn in water bodies based on ecological chemometrics and its potential applications

Oral - Abstract ID: 1002

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In natural water bodies, especially in eutrophic or waterbloom water bodies, algal sources are an important source of the permanganate index (COD_{Mn}), and their contribution ratio and analytical methods for rapid and quantitative require more research. In this study, continuous monitoring sampling was conducted in the Jiuqu River Basin of the Tuojiang River, and the response relationship between the algal community structure and the COD_{Mn} of the overlying water was analysed by detecting and analysing algal biomass, river water quality indicators, algal source organic matter characteristics and the component characteristics of river COD_{Mn}. A rapid quantitative analysis model of algal source COD_{Mn} contribution was established based on ecological chemometrics with coupled chlorophyll indicators. Studies have shown that algal abundance is closely related to the dynamic changes in COD_{Mn} in water bodies, especially Cyanobacteria, which have a significant advantage in water bodies with high concentrations of COD_{Mn} and can be indicating oxygen-depleted polluted water bodies. The contribution of nascent humic substances in algal source material to the COD_{Mn} of the overlying water was greater than that of protein substances. The contribution of chlorophyll-a to the estimate of COD_{Mn} from algal sources in this study watershed was modeled as $COD_{Mn}\% = [(0.1077 Chla - 0.1483)/\mathit{Overlying\ water}\ COD_{Mn}] \times 24.50\%$, and the components and the methods for establishing of an automatic algal sources COD_{Mn} monitoring and analysis system were proposed. This study provides technical support for the research and quantitative control of oxygen depletion pollution in rivers, lakes and reservoirs during the waterbloom period.

A novel long non-coding RNA linc-93.2 regulates oxidative stress induced by bisphenol A via NF-κB signaling pathway in fish primary macrophages

Oral - Abstract ID: 742

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Increasing evidence suggests that long non-coding RNAs (lncRNAs) play pivotal roles in various biological processes. Here, we identified a novel intergenic lncRNA named *linc-93.2* in the head kidney primary macrophages of common carp (*Cyprinus carpio*) after exposure to a typical environmental endocrine disrupting chemical, bisphenol A (BPA). As a result, *linc-93.2* is more than 3,619 bp in length and predominantly localized to the nucleus of primary macrophages other than cytoplasm, with the highest expression level in spleen followed by head kidney among different organs. Its transcript can be significantly induced in fish primary macrophages *in vitro* and in the head kidney of common carp *in vivo* following the exposure to BPA and its analog bisphenol AF (BPAF). The NF-κB inhibitor PDTC significantly reduced *linc-93.2* expression in macrophages, but co-exposure of macrophages to PDTC with BPA could significantly rescue *linc-93.2* and its target gene expression. After silencing *linc93.2 in vitro* and *in vivo*, the induced production of reactive oxygen species as well as the elevated malondialdehyde level upon BPA and BPAF exposure, which are key indicators of occurrence of oxidative stress in cells or organisms, were significantly attenuated, but the activities of antioxidant enzymes such as superoxide dismutase and catalase were significantly enhanced. These results suggest the involvement of *inc93.2* in regulating oxidative stress induced by BPA and BPAF *in vitro* and *in vivo*. In addition, the results from RNA-sequencing of *linc93.2* silenced macrophages reveal the enrichment of NF-κB signaling pathway and molecular docking prediction also identifies the potential binding sites between *linc-93.2* and NF-κB p65 protein. Overall, the current study demonstrates that *linc-93.2* regulates oxidative stress aroused by BPA and BPAF treatment and participates in the immune processes of common carp via the NF-κB pathway. This study enhances our understanding of the immunotoxicity of bisphenols in teleost fish.

A novel maize biochar-based compound fertilizer for immobilizing cadmium and improving soil quality and crop growth

Oral - Abstract ID: 291

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In this study, a novel biochar-based compound fertilizer (BCF) was synthesized with maize straw biomass, diatomite, triple superphosphate and urea at different temperatures (300 ℃, 450 ℃, 600 ℃) and mixture proportions (5:1:1:x and 10:1:1:x). An investigation was conducted into the effects of BCF at low application rates on the immobilization of available cadmium, soil fertility and crop growth. The lab incubation experiments showed that the low doses of BCF ($B5PN_x$ and $B10PN_x$) contributed to a significant reduction of the Cd availability in soil, with the highest reduction rate of available Cd up to 44.13 %. Field experiments demonstrated that the low doses (< 0.1 %) of BCF（especially for $B5PN_{600}$）led to the improvement of soil fertility and crop growth (including yield and quality) and the significant reduction of Cd contents in crop edible parts. The increase of pyrolysis temperature could enhance the biochar adsorption capacity for Cd^{2+} by increasing both specific surface areas and total pore volume. The modification of urea, diatomite and triple superphosphate played a vital role on cadmium immobilization, soil improvement and crop growth by forming porous adsorption, precipitates or complexation with the increase of functional groups, as well as supplementation of N, P, Si nutrients. This study suggested that the biochar-based compound fertilizer (BCF with a mixture ratio of 5:1:1:x) produced at 600 ℃ could be served as a promising and eco-friendly remediation agent for the arable soils polluted with Cd, with reduction of chemical fertilizers.

A robust iron-based metal-organic framework with ultramicropores for trace benzene adsorption

Oral - Abstract ID: 521

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Volatile organic compounds (VOCs) such as benzene from the indoor air are toxic and extremely harmful to the health of residents even at trace concentrations. Metal-organic framework (MOFs) are adsorbents normally with large surface area and high porosity and was attractive candidates to remove the VOCs. In previous studies, it was observed that adsorption of benzene on MOFs was considerable at relatively pressure p/p_0>0.01, but was largely decreased at p/p_0<0.01, which is a common concentration level of benzene from indoor air pollution. Hence, MOFs with high adsorption of trace benzene at p/p_0<0.01 are required. In this study, an iron-based metal-organic framework (Fe-BHB) with BET surface area of 1160 m^2/g and uniform ultramicropores of 0.58±0.03 nm was prepared using iron salts and a hexacarboxylate linker (BHB) by a solvothermal method, for investigating the adsorption performance of Fe-BHB for trace benezene at p/p_0<0.01 through both the static and dynamic adsorption methods. The structure of Fe-BHB was robust as supported by the unvaried surface area and XRD spectra of Fe-BHB after being soaked in aqueous solution with pH from 0 to 7 for 7 days. Fe-BHB showed a recorded benzene adsorption at p/p_0=0.001 and 298 K, i.e., 2.05 mmol/g. The breakthrough time of benzene at p/p_0=0.001 and 298 K on Fe-BHB was much longer than other MOFs, again supporting the high adsorption performance of Fe-BHB for trace benzene. This could be attributed to the closure of the ultramicropore size of Fe-BHB (i.e., 0.58±0.03 nm) to the dynamic diameter of benzene (i.e., 0.56 nm), which could result in high adsorption affinity according to the Polanyi adsorption theory. After five adsorption/desorption cycles, the adsorption was only decreased by 5%. Therefore, this study provides a robust iron-based MOFs for efficiently removing trace benzene and helps to control the indoor air pollution.

A Tiered Risk Assessment Approach for Assessing Soil Contamination in an Area Adjacent to a Chemical Complex

Oral - Abstract ID: 620

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Previously, poor solid waste management and liquid effluent discharged into nearby waterways caused serious environmental issues around the Estarreja Chemical Complex (ECC) in northwest Portugal. Nevertheless, a thorough environmental risk assessment (ERA) has yet to be done. Thus, Tier 0 data collection and mapping was used to start designing a tiered ERA for this region. Initial findings suggest that ECC past activities may harm the ecosystem, particularly around the main ditch used to transport effluents to the Ria of Aveiro lagoon. Tier 1 was followed, focusing on this area. This step identifies soil contamination risks and optimises the approach for larger-scale assessment. In this study, 23 composite soil samples were analysed for pH, organic matter content, electrical conductivity, and water holding capacity. The chemical Line-of-evidence (LoE) included *Aqua regia* digestion and ICP-MS or AES determination of 34 inorganic elements and TerrAttesT® determination of 200 organic compounds. The ecotoxicological LoE included the follwoing assays: seed germination of three terrestrial plants, earthworm avoidance, microalgae and aquatic plant growth inhibition, aquatic bacteria bioluminescence inhibition, and crustacean acute immobilisation. These two LoE were used to estimate soil contamination-related environmental risk. The rate and magnitude of samples exceeding soil screening values indicate continued presence of contamination at the site. However, inconsistencies between the two LoE indicated high uncertainty, requiring Tier 2 investigation. Thus, a Tier 2 analysis was conducted to evaluate the chemical availability of contaminants in the soil and perform other ecotoxicological assays, which involved measuring biomass production, earthworm reproduction and biomarkers of exposure. The obtained findings allowed a more comprehensive understanding of the (bio)availability of contaminants in soils and enduring consequences of soil pollutants, while also elucidating any apparent inconsistencies from the preceding Tier.

Acrylamide induces spatial and temporal metabolic profiling disturbance during different stages of early zebrafish development

Oral - Abstract ID: 279

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Objective: Acrylamide is a typical food processing contaminant in fried and baked foods, and dietary exposure to acrylamide poses a potential threat to human health. Previous studies have found that acrylamide exposure is strongly associated with zebrafish embryonic dysplasia. However, the underlying mechanism of acrylamide-induced zebrafish embryonic dysplasia remains unclear. Our study aims to investigate the metabolic profile changes of zebrafish embryos at different developmental stages with acrylamide exposure and the toxic mechanism of acrylamide-induced cardiotoxicity.

Materials and methods: 2 hours post-fertilization (hpf) zebrafish embryos were exposed to acrylamide in aqueous solution, and embryos samples were collected from different embryonic developmental stages (6, 24, 48, 72, 96, and 120 hpf). UHPLC-Q-Orbitrap-HRMS was used for untargeted metabolomic analysis of embryo samples. *Tg(cml2: EGFP)* heart-labeled fluorescent zebrafish was used for cardiac phenotypic analysis. qRT-PCR was used to analyze genes expression related to embryonic taurine biosynthesis pathway.

Results: (i) Metabolites changes throughout normal zebrafish development (6 to 120 hpf)) were closely associated with taurine and hypotaurine metabolism. (ii) The pattern of significantly changed metabolites revealed that acrylamide strongly disrupted taurine and hypotaurine metabolism related to deficient cardiovascular system. (iii) Acrylamide exposure disrupted de novo synthesis of taurine during zebrafish early embryogenesis. (iv) Taurine supplementation (10 mM) effectively alleviated acrylamide-induced deficient cardiovascular system.

Conclusion: Acrylamide induces spatial and temporal metabolic profiling disturbance during different stages of early zebrafish development. Taurine could be the novel cardiac effect target for acrylamide-induced cardiovascular toxicity and taurine supplementation could restored the acrylamide-induced cardiotoxicity in zebrafish.

Advanced Pathogen Monitoring Technologies in Aquatic Environments

Oral - Abstract ID: 866

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The aquatic environment, integral to human socio-economic activities, is crucial for biosafety, significantly influencing public health and economic prosperity. Ensuring effective, comprehensive, and timely monitoring of biological pollutants is indispensable for water biosafety, representing a key component of the national biosafety framework. Current methodologies for assessing biological pollution in water bodies, however, are markedly deficient. This report delves into the source, composition, and control of pathogenic microorganisms in complex surface water pollution, underscoring our team's research efforts in the domain of microbial pollutants and environmental health. Our research aims to address the gaps in existing pathogen detection technologies in wastewater scenarios and advocates for the establishment of a predictive early warning system, specifically designed to meet the distinct public health requirements for surveilling waterborne pathogenic microorganisms.

Advancing Breathomics Accuracy through Precise Discrimination of Endogenous and Exogenous Volatiles in Human Breath

Oral - Abstract ID: 421

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Breathomics, a growing field in exposure monitoring and clinical diagnostics, has faced accuracy challenges due to unclear contributing factors. This study aims to enhance the potential of breathomics in environmental health and precision medicine by distinguishing between endogenous and exogenous volatile organic compounds (VOCs) in human breath. We comprehensively analyzed paired samples of ambient air and breath from 271 volunteers using TD-GC×GC-TOF MS, successfully identifying and quantifying 50 common VOCs. Advanced QSPR models were employed to address knowledge gaps related to blood-air partition coefficients and VOC generation and clearance rates. This in-depth approach allows us to establish compartmental models that accurately determine alveolar concentrations of VOCs, devoid of any confounding environmental influences. Our findings highlight the critical role of VOC generation and clearance rates in determining their origins, with the blood-air partition coefficients governing their distribution within tissues. This novel approach surpasses conventional methods, facilitating targeted research in exposure assessment and disease diagnosis. Surprisingly, our results challenge the common understanding that environmental levels always exceed exhaled VOC quantities, revealing prolonged exposure to exogenous VOCs can make individuals secondary sources of pollutants. Additionally, internal exposure to VOCs presents health risks comparable to external exposure, emphasizing the need for holistic assessments covering both internal and external exposure pathways. To highlight the clinical significance of endogenous VOCs, we developed diagnostic models for gastrointestinal diseases, resulting in a remarkable 10% improvement in diagnostic accuracy compared to using direct exhaled concentrations. In the future, applying compartmental models to identify endogenous VOCs holds substantial potential for enhancing the clinical utility of breathomics. This study represents a significant advancement, providing a robust methodology for identifying VOC sources, and setting the stage for better assessment of exposure and precision medicine.

Advantages and drawbacks of the use of limestones for the removal of arsenic from groundwater

Oral - Abstract ID: 332

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Arsenic in groundwater is a health threat in Mexico due to its presence above safe concentrations in many aquifers. Since most drinking water comes from groundwater, its removal is crucial to protect the population´s health. Sustainable and affordable methods are essential, mainly in low-income and isolated sites. We evaluated using native limestones for arsenic removal through batch and column laboratory experiments. These experiments included the assessment of the interference of other ions. In addition, we evaluated the effectiveness of rocks in treating drinking water high in arsenic from two locations. We conducted batch experiments using 20 g of rock and 100 mL of water from the Soyatal formation in Zimapán, Hidalgo, with different particle sizes and agitation times. Results indicated up to 80% removal in groundwater from two wells with initial concentrations of 1.27 mg/L and 0.48 mg/L As. The removal efficiency increased with the rock particles' superficial area and pore volume. Batch experiments were also conducted with limestone samples from various outcroppings south of the Sierra de Guanajuato, Guanajuato State. Results indicated that As removal increased with the calcium carbonate ($CaCO_3$) content and smaller grain size (< 0.05 mm) of the rocks. In groundwater containing 0.076 mg/L As collected from a well close to the sampled rocks, up to 57% removal was achieved. It was found that (bi)carbonate and sulfate hinder the removal of arsenic. Chemical and mineralogical analyses were conducted and interpreted to understand the mechanisms behind the removal, such as scanning electron microscopy with energy dispersive spectroscopy (SEM-EDS), geochemical modeling, and Eh-pH diagrams. In addition, specific samples were studied using X-ray absorption spectroscopy (XAS). It was discovered that the primary retention mechanism was adsorption, specifically by inner-sphere surface complexes Results showed that using native limestones is an encouraging option to remove arsenic from groundwater.

Air pollution attenuated the benefits of physical activity on blood pressure: Evidence from a nationwide cross-sectional study

Oral - Abstract ID: 470

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Importance of the work and objectives: Despite the numerous health benefits of physical activity (PA), the inhaled dose of fine particulate matter (PM2.5) during PA may increase. The trade-off between the harmful effects of PM2.5 exposure and the protective effects of PA remains unclear. This study aims to examine the joint effects of PA and PM2.5 exposure on blood pressure (BP) in Chinese adults.

Methodologies: A total of 203,108 adults aged ≥ 18 years from the China Hypertension Survey study (2012–2015) were included. Individual-level PA was assessed as minutes of metabolic equivalent tasks per week (MET-min/week). The average weekly PM2.5 exposures were estimated using a spatial resolution of 10 km, integrating multiple data sources, including monitoring values, satellite measurements, and model simulations. BP was measured with a professional portable BP monitor. Generalized linear regressions were used to estimate joint associations and further explore two-dimensional nonlinear associations.

Main results and conclusion: The median PA and 4-week PM2.5 average exposures were 3213.0 MET-min/week and 47.8 μg/m3, respectively. PA was negatively associated with BP, while PM2.5 exposure was positively associated with BP. The associations between PA and systolic BP were significantly modified by PM2.5 exposure (P interaction < 0.001). Compared with inactive participants under low PM2.5 exposure, those with the highest level of PA under low PM2.5 exposure had a 0.90 (95 % CI: 0.53, 1.26) mmHg decrease in systolic BP, whereas they had a 0.48 (95 % CI: 0.07, 0.89) mmHg increase under high PM2.5 exposure. When PM2.5 exposure was approximately > 25 μg/m3, the joint exposure to total PA and PM2.5 was associated with an increase in systolic BP. The benefits of PA on BP were counteracted by high PM2.5 levels.

Aligning policies to facilitate wetland restoration for a climate friendly and healthy environment

Oral - Abstract ID: 852

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The restoration of degraded wetlands has the potential to offer significant gains for climate mitigation, biodiversity conservation, and the provision of a host of other ecosystem services crucial for environmental and human health. However, existing governance practices, legislation and policies affecting wetland sites are not always aligned to facilitate restoration and the delivery of these benefits in line with the aspirations contained in high level policies such as the UN decade of ecosystem restoration, the UN sustainable development goals, the EU green deal and the Paris agreement. Through policy mapping and stakeholder engagement, we examine the extent to which policies at European, National, Regional and Local levels are properly aligned both horizontally and vertically to facilitate the restoration of damaged or degraded wetlands, and to identify the policy gaps and conflicts present across six European countries. This process can lead to the formulation of concrete policy recommendations to address policy gaps and conflicts in order to align the policy landscape and to encourage wetland restoration.

An investigation of inequalities in exposure to PM2.5 air pollution across small areas in Ireland

Oral - Abstract ID: 703

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The link between exposure to air pollution and adverse effects on human health is well documented. Yet, in a European context, research on the spatial distribution of air pollution and the characteristics of areas is relatively scarce, and there is a need for research using different spatial scales, a wider variety of socioeconomic indicators (such as ethnicity) and new methodologies to assess these relationships. This study uses comprehensive data on a wide range of demographic and socioeconomic indicators, matched to data on $PM_{2.5}$ concentrations for small areas in Ireland, to assess the relationship between social vulnerability and $PM_{2.5}$ air pollution. Examining a wide range of socioeconomic indicators revealed some differentials in $PM_{2.5}$ concentration levels by measure and by rural and urban classification. However, statistical modelling using concentration curves and concentration indices did not present substantial evidence of inequalities in $PM_{2.5}$ concentrations across small areas.

In common with other western European countries, an overall decline in the levels of $PM_{2.5}$ between 2011 and 2016 was observed in Ireland, though the data indicates that almost all small areas in Ireland were found to have exceeded the WHO's $PM_{2.5}$ annual guideline ($5\mu/m^3$), calling for greater policy efforts to reduce air pollution in Ireland. The recent Clean Air Strategy contains a commitment to achieve the WHO guideline limits for $PM_{2.5}$ by 2040, with interim targets at various points over the next two decades. Achieving these targets will require policy measures to decarbonise home heating, promote active travel and the transition to electric vehicles, and further regulations on burning fossil fuels and tightly enforcing environmental regulations. From a research and information-gathering perspective, installing more monitoring stations at key points could improve the quality and spatial dimension of the data collected and facilitate the assessment of the implementation of the measures in the Clean Air Strategy.

Anaerobic biotransformation of two novel brominated flame retardants: kinetics, isotope fractionation and reaction mechanisms

Oral - Abstract ID: 170

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1,2,5,6-tetrabromocyclooctane (TBCO) and 2,3-dibromopropyl-2,4,6-tribromophenyl ether (DPTE), as safer alternatives to traditional brominated flame retardants, have been extensively detected in various environmental media and pose emerging risks. However, much less is known about their fate in the environment. Anaerobic microbial transformation is a key pathway for the natural attenuation of contaminants. This study investigated, for the first time, the microbial transformation behaviors of β-TBCO and DPTE by *Dehalococcoides mccartyi* strain CG1. The results indicated that both β-TBCO and DPTE could be easily transformed by *D. mccartyi* CG1 with k_{obs} values of 0.0218±0.0015 h^{-1} and 0.0089±0.0003 h^{-1}, respectively. In particular, β-TBCO seemed to undergo dibromo-elimination and then epoxidation to form 4,5-dibromo-9-oxabicyclo[6.1.0]nonane, while DPTE experienced debromination at the benzene ring (*ortho*-bromine being removed prior to *para*-bromine) rather than at the carbon chain. Additionally, pronounced carbon and bromine isotope fractionations were observed during biotransformation of β-TBCO and DPTE, suggesting that C-Br bond breaking is the rate-limiting step of their biotransformation. Finally, coupled with identified products and isotope fractionation patterns, β-elimination (E2) and Sn2-nucleophilic substitution were considered the most likely microbial transformation mechanisms for β-TBCO and DPTE, respectively. This work provides important information for assessing the potential of natural attenuation and environmental risks of β-TBCO and DPTE.

Anthropogenic impacts on polycyclic aromatic hydrocarbon sedimentation in the basin of the Eastern Indian Ocean

Oral - Abstract ID: 552

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Polycyclic aromatic hydrocarbons (PAHs) are widespread environmental contaminants that pose significant concerns in marine environments due to their carcinogenic, mutagenic, and toxic properties. Marine sediments are recognized as the primary repository for these hydrophobic pollutants and can become contaminated with anthropogenic PAHs, which reflect the extent of human activities. While PAHs have been detected worldwide, our understanding of their behavior in the Eastern Indian Ocean basin remains limited. Therefore, our study aimed to investigate the distribution patterns and deposition characteristics of PAHs in surface sediments collected from the Eastern Indian Ocean in 2020. The concentrations of Σ_{16} PAHs ranged from 18.9 to 198 ng g^{-1}, exhibiting a decreasing trend from the coastline to the open basin. The sources of total organic carbon (TOC) and PAHs displayed significant differences, with the latter primarily influenced by traffic emissions and biomass combustion. High-molecular-weight (HMW) PAH concentrations normalized to TOC were positively correlated, while low-molecular-weight (LMW) PAHs normalized to TOC did not show such a relationship. These findings highlight the distinct and varying impacts of human activities on the distribution and deposition of PAHs in intertidal sediments, providing preliminary insights into the fate of persistent organic pollutants (POPs) in the open oceans.

Antimicrobial resistance in the environment – Indo-UK initiative to study the impact of pharmaceutical wastes

Oral - Abstract ID: 148

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In 2020 a joint UK and Indian research council initiative funded 5 independent projects with a total value of £12 million. The projects had an overarching aim to develop a better understanding of the extent of antimicrobial pollution from antimicrobial production wastes, develop validated methods for detection of impacts and assess the impact on human and animal health. The program is multidisciplinary and covers aspects of environmental science, microbiology and policy/stakeholder engagement (https://indiaukamrenvironment.org/).
Within this program, the AMSPARE project is a collaboration between three institutions: in the UK (University of the West of Scotland, Glasgow Caledonian University) and India (IIT Bombay). We focus on the impact of effluent from a central treatment plant, taking wastewater from a range of industries in Mumbai, including a number of pharmaceutical manufacturers. This discharges into a tidal creek, subject to inputs from urban and industrial activities upstream and diffuse pollution from historic waste dumps. Discharges are above PNEC for a number of antimicrobials. We have studied the impact on sediment/water samples from pollutants, microbial ecology and molecular biology to identify resistance genes. Additional work has developed and demonstrated capability for visible light photocatalysis to degrade antibiotics in wastewater and develop low-cost sensors for antibiotic and resistant and susceptible bacteria. We are using these pools of evidence to engage with stakeholders to look to improve monitoring and integrate AMR into regulatory systems. This also look toward future proofing AMR development in the wake of new antibiotics and/or derivatives.

Application of co-pyrolyzed dredged sediment for the in situ remediation of Cd polluted sediments in coastal rivers

Oral - Abstract ID: 978

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The remediation of Cd-polluted sediment in coastal rivers is essential because of its potential hazards to river and marine ecosystems. Herein, a co-pyrolysis product of contaminated dredged sediment (S@BC) was innovatively applied to cap and immobilize Cd-contaminated sediment in coastal rivers in situ, and their remediation efficiencies, mechanisms, and microbial responses were explored based on a 360 d incubation experiment. The results showed that although S@BC immobilization and capping restrained sediment Cd release to the overlying water, S@BC capping presented a high inhibitory efficiency (66.0% vs. 95.3% at 360 d). Fraction analysis indicated that labile Cd was partially transformed to stable fraction after remediation, with decreases of 0.5%– 32.7% in the acid-soluble fraction and increases of 5.0%– 182.8% in the residual fraction. S@BC immobilization and capping had minor influences on the sediment bacterial community structure compared to the control. S@BC could directly adsorb sediment mobile Cd (precipitation and complexation) to inhibit Cd release and change sediment properties (e.g., pH and cation exchange capacity) to indirectly reduce Cd release. Particularly, S@BC capping also promoted Cd stabilization by enhancing the sediment sulfate reduction process. Comparatively, S@BC capping was a priority approach for Cd-polluted sediment remediation. This study provides new insights into the remediation of Cd-contaminated sediments in coastal rivers.

Application of Fractional Grey Model in Urban Air Pollutant Prediction

Oral - Abstract ID: 329

Dr. Qiyu Wang [1]

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Various factors such as industrial exhaust emissions, automobile exhaust, coal-fired power generation, and waste incineration can lead to air pollution in large cities. Air pollution has negative impacts on human health, crop growth, and climate. A reasonable prediction of the main air pollutants in cities will help to take appropriate measures to prevent and control air pollution. Grey system theory is a modeling technique that excels at solving "small data, uncertainty" systems. It has the characteristics of small sample demand, simple modeling process, and high modeling reliability, and has been widely used in many fields. In this paper a fractional order grey system is used to predict air pollutant emission data, which integrates fractional calculus into the grey model. Compared with traditional grey models, it can better reflect the behavioral characteristics of the system. An air pollution dataset from Beijing is used. First defining the training and testing sets, constructing a prediction air pollutants model based on fractional order grey system. Next, an intelligent optimization method is used to determine the cumulative order under the condition of minimum comprehensive simulation error of the simulator prediction, in order to complete the construction of the prediction model. Finally, this method was validated through a test set to achieve effective prediction of major air pollutant emission data.

Aqueous-phase oligomerization mechanism of small α􀀀dicarbonyls and its environmental effect

Oral - Abstract ID: 432

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Small α-dicarbonyls, such as methylglyoxal (MG) and glyoxal (GL), are the major precursors of secondary organic aerosol (SOA) and brown carbon (BrC). However, their aqeuous-phase chemical mechanisms leading to the formation of SOA and BrC remain unclear. Hence, we performed quantum chemical calculations and laboraroty experiments to elucidate the fundamental mechanisms for aqueous-phase oligomerization of MG and GL with and without reduced nitrogen species (RNSs).

Our results show that the initial protonation and hydration of MG and GL lead to the formation of diols/tetrols, and the subsequent protonation and dehydration of diols/tetrols yield carbenium ions (CBs). In the absence of RNSs, the oligomers are yielded via the barrierless nucleophilic addition of CBs to diols/tetrols and subsequent deprotonation of cationic intermediates. CBs are the key intermediates of the rapid oligomerization to form SOA. In the presence of RNSs, oligomerization of MG and GL starts from the nucleophilic addition of CBs to RNSs, followed by deprotonation to yield N-heterocycles (NHCs). Deprotonation represents the rate-limiting step for N-containing cationic intermediates to yield NHCs. Furthermore, BrC formaton is mainly contributed by the reactions between small α-dicarbonyls and RNSs with less methyl groups, which have more abundant and widespread sources in the urban environments. It implies that the reactions of small α-dicarbonyls with secondary amines contribute to the formation of SOA rather than BrC. On the other hand, the light absorption and adverse effects of NHCs on human health are also strongly related to the methyl groups in RNSs. Our results reveal that the CB-mediated oligomerization is a key mechanism of SOA and BrC formation on weakly acidic aerosols and cloud/fog droplets.

Keywords: Small α-dicarbonyls; Aqueous-phase oligomerization mechanism; Secondary organic aerosol; Brown carbon; Environmental effect.

Are emissions from dental practice detectable in outside environment?

Oral - Abstract ID: 637

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Emissions of airborne particulate matter (PM) are one of the main environmental and health challenges of our civilisation. PM can originate from numerous geogenic and anthropogenic sources and its dynamic in an era of climate changes is unpredictable and still poorly understood. Anthropogenic sources are of special concern in urban areas, where emissions from traffic, industry, and construction are usually the predominant and well recognised sources. But what about smaller, overlooked sources? Is it possible to identify PM originating from such specific sources as dental practice in an environment overwhelmed with numerous sources of PM? The main objectives of this research are: (1) to find out if it is possible to identify emissions from such small sources as dental practice in urban environment, (2) to identify characteristic solid particles for dental practice.

The potential geochemical imprint of dental practice in urban environment was studied by sampling and detailed geochemical characterisation of street dust in Maribor, the second largest Slovenian town and an important industrial centre. Samples were taken in a grid across the town, presenting a background, and targeted in immediate vicinity of dental practices. The elemental composition of street dust was determined, and morphological and chemical characteristics of individual solid particles were analysed by using scanning electron microscopy techniques.

The results show that levels of several elements (e.g., Pd, Hg) are significantly higher in dust samples taken at immediate vicinity of dental practices than at background locations. Solid particles consisting of elements and alloys which are regularly used in dentistry were identified in these samples (e.g., Ag-Pd-Cu-O, Co-Cr (Mo) alloys). The results indicate that emissions of PM from dentistry may be identified in the environment, but the influence is limited to the immediate vicinity of dental practices.

Arsenic biogeochemistry in paddy soil and strategies to limit arsenic accumulation in rice

Oral - Abstract ID: 86

Prof. Fang-Jie Zhao [1]

1. *Nanjing Agricultural University*

Rice is the staple food for about half of the world population and is also a major dietary source of inorganic arsenic (As), a class-one carcinogen for humans. Rice accumulates As much more efficiently than other cereal crops. This results from a combination of an elevated As bioavailability in anaerobic paddy soil and efficient uptake of As by rice roots. Paddy soils in many areas in Asia are contaminated with As due to mining activities and irrigation of As-laden groundwater, leading to phytotoxicity in rice crop and substantial yield losses. Understanding the As biogeochemistry in paddy environments and the mechanisms of As uptake and transport in rice plants is important for both food security and safety. Arsenic is a redox sensitive metalloid and is also prone to methylation and thiolation by microorganisms in soil, resulting in a number of As species varying in the toxicity. Factors affecting As species transformation in paddy soil will be discussed. Recent progress in understanding the molecular mechanisms for the uptake and detoxification of different As species in rice will be reviewed. Strategies to limit As accumulation in rice grain will be discussed.

Arsenic-induced enhancement of diazotrophic colonization and nitrogen fixation in Pteris vittata rhizosphere

Oral - Abstract ID: 227

Prof. Jianming Xu [1]***, Dr. Jiahui Lin*** [1]***, Prof. Zhongmin Dai*** [1]***, Prof. Bin Ma*** [1]

1. *Zhejiang University*

Pteris vittata, a fern known for its remarkable capability to accumulate arsenic from polluted soils, has emerged as a highly promising option for phytoremediation. Interestingly, this hyperaccumulator exhibits a significant growth enhancement when exposed to arsenic, even at high concentrations that would be deadly to other plant species. To gain a deeper understanding of this unique characteristic, our research utilized various approaches such as field investigations, greenhouse experiments, multi-omics analysis, nifH-palmprint identification technique for diazotrophs, and microfluidic experiments. The findings of our study emphasize the notable enhancement in nitrogen accumulation and enrichment of diazotrophs in the rhizosphere, primarily involving key taxa like *Bradyrhizobium*, *Rhizobium* and *Cupriavidus*, as a result of increased arsenic levels. Specifically, diazotrophic isolates such as *Bradyrhizobium* sp. J3 and *Rhizobium* sp. G5 showcased their capability to promote the growth of *Pteris vittata*. Furthermore, we observed that certain rhizospheric metabolites induced by arsenic, namely mannotriose, L-valine, and catechin, exhibited chemotactic effects on *Bradyrhizobium* sp. J3. Overall, our research sheds new light on the unique mechanism by which *Pteris vittata* acquires nitrogen. It responds to increased arsenic stress by increasing the production of specific root exudates, leading to the enrichment of certain diazotrophs and ultimately promoting its own growth. These findings underscore the role of arsenic-triggered interactions and presents promising avenues for advancing phytoremediation strategies.

Assessment of potentially toxic elements in Lactarius deliciosus and Suillus luteus mushrooms collected in Victoria, Australia: Is foraging good for your health?

Oral - Abstract ID: 559

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Edible *Lactarius deliciosus* (Saffron Milk Cap) and *Suillus luteus* (Slippery Jack) mushrooms are commonly foraged from pine plantations that have been planted for lumber harvesting in Victoria, Australia. There is a symbiotic relationship between these introduced trees and fungi which enhances foraging ease and mushroom identification, making these mushrooms the most readily foraged in Australia. Pines are planted on legacy mining and industrial sites for the purpose of revenue generation and in an attempt at superficial site remediation. Potentially toxic elements (PTEs) may accumulate in mushrooms growing at these sites and while foraging activities are a healthy outdoors pursuit, the consumption of food with elevated toxic metals is not recommended. It is also difficult for the foraging community to identify sites that are contaminated.

We assess and compare health risks of consuming *L. deliciosus* and *S. luteus* from various Victorian pine plantations (and isolated pine stands) with respect to various PTE's including arsenic, cadmium, and lead. More than 100 mushroom and accompanying soil samples were analyzed with statistically significant PTE accumulation in fungi dependent on location (and prior land use). Health risk indices were calculated and identify a small but significant health risk dependent on foraging location. This risk may be eliminated with the provision of information to foragers on sites of concern. We perceive this to be the responsibility of researchers in partnership with local authorities.

Such partnerships are in keeping with the UN's Sustainable Development Goals. Foraging enables humans to engage with nature which in turn improves mental and physical health, improves cognitive function, reduces stress, is usually social (most foraging occurs in groups) and is directly linked with the provision of food. Engaging with landscape is a positive step to reengage humans to their environment and enhance their commitment to actions that work to sustain the planet.

Association between fluoride exposure and changes in thyroid/parathyroid function in school-age girls: mediation of mitochondrial DNA copy number

Oral - Abstract ID: 267

Mr. Zichen Feng [1], Prof. Guoyu Zhou [1], Ms. Shu Niu [1], Mr. Bin Liu [1], Ms. Guoqing Wang [1], Mr. Chunxiang Li [1], Mr. Qing Sun [1], Ms. Yan Wang [1], Dr. Fangfang Yu [1], Prof. Yue Ba [1]

1. *Zhengzhou University*

Excessive fluoride intake can adversely affect the thyroid/parathyroid, of which mitochondrial dysfunction may have an important role. Mitochondrial DNA (mtDNA) is the intracellular genetic material in mitochondria and is crucial for maintaining mitochondrial function. However, whether mtDNA levels are involved in fluoride-related thyroid/parathyroid function changes remains unclear. Hence, we conducted a cross-sectional study involving 401 children aged 7–13 years old (204 boys and 197 girls) in Tongxu County, Henan Province, China in 2017 to investigate the relationship between fluoride exposure, mtDNA levels, and changes in thyroid/parathyroid function. Results revealed that increased urinary fluoride (UF) levels were positively related to the thyroid volume (Tvol) in the total population (β=0.34; 95%CI: 0.21, 0.46), boys (β=0.45; 95%CI: 0.27, 0.63), and girls (β=0.24; 95%CI: 0.07, 0.40). For every 1.0 mg/L elevation in UF levels, the parathyroid hormone (PTH) levels decreased by 1.40 ng/dL in all children (β=–1.40; 95%CI: –2.50, –0.30). In girls, a negative association between UF levels and mtDNA contents was also observed (β=–0.24; 95%CI: –0.36, –0.11). Furthermore, each 1-unit increase in mtDNA levels correspondence to a 0.33 cm^3 decrease in Tvol in girls (β=–0.33; 95%CI: –0.52, –0.13). However, no significant relationships between fluoride levels and triiodothyronine, thyroxine, and thyrotropin were discovered (P>0.05). Mediation analysis suggested that the link between UF levels and increased Tvol in girls was partially mediated by the mtDNA levels, with a proportion of 33.08%. Our findings revealed a negative effect of fluoride exposure on thyroid/parathyroid, of which the mtDNA levels might serve as a bridge.

Association of exposure to ozone and heat wave with mortality by widowhood status

Oral - Abstract ID: 159

Ms. Ruijun Xu [1], ***Dr. Jing Wei*** [2], ***Dr. Chunxiang Shi*** [3], ***Mr. Rui Wang*** [4], ***Prof. Suli Huang*** [5], ***Dr. Ziquan Lv*** [6], ***Prof. Yun Zhou*** [7], ***Prof. Weiqing Chen*** [1], ***Dr. Hong Sun*** [8], ***Prof. Yuewei Liu*** [1]

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Background: Emerging evidence suggests that ozone (O_3) and heat wave are associated with increased mortality risk. Given widows and widowers experienced higher mortality risk than married individuals, it is essential to understand if the widowhood disparity is attributable to exposure to ozone and heat wave.
Methods: We conducted a population-based case-crossover study of 1 214 763 deaths in Jiangsu province, China during 2015-2021 to investigate the association and interaction of O_3 and heat wave exposures with mortality by widowhood status.
Results: Exposure to both O_3 and heat wave was significantly associated with an increased odds of mortality among either widowed (odds ratio for O_3, 1.06 per 51.3 μg/m^3 increase; odds ratio for heat wave, 1.25) or married subjects (1.03; 1.08), and the associations were significantly higher in widowed subjects. Significant synergistic interactions were observed between O_3 and heat wave exposures, which was significantly stronger in widowed subjects (relative excess odds due to interaction, 0.14 vs. 0.03). The results were similar in stratified analyses by sex and age. Up to 6.43% and 3.56% of deaths were attributable to high-level O_3 and heat wave in widowed and married subjects, respectively.
Conclusions: We found consistent evidence that exposure to O_3 and heat wave was independently and interactively associated with an increased odds of mortality, which was stronger in widowed subjects. These findings suggest that widowed people are more suspectable to O_3 and heat wave exposures and highlight the needs to consider widowhood disparities in preventing premature deaths due to O_3 and heat wave.

Association of Indoor Ozone exposure during Sleep and Cardiorespiratory effects among young adults in China

Oral - Abstract ID: 818

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1. Peking University

The ambient ozone (O_3) pollution has emerged as a major environmental and public health concern in the world. However, there is far less evidence on the health effects of indoor ozone than on ambient O_3. Furthermore, evidence on cardiorespiratory effects of indoor ozone were more limited and conflicted, and the underlying biological mechanisms remained unclear. Sleep accounts for about one-third of a person's lifetime, however, the effects of indoor O_3 during sleep have received less attention. This study aimed to investigate associations of indoor O_3 during sleep with cardiorespiratory function and potential predisposing factors. A prospective study among 81 adults was conducted in Beijing China. The average indoor O_3 concentration during sleep in this study was 20.3 $\mu g/m^3$, which was well below current Chinese indoor air quality standard (160 $\mu g/m^3$). O_3 exposure during sleep was associated with most respiratory indicators of decreased airway function except airway inflammation; An IQR increases in O_3 at 6-hour average was associated with changes of -3.60% (95% CI: -6.19%, -0.93%) and -9.60% (95% CI: -14.53%, -4.39%) in FVC and FEF_{25-75}, respectively. Further, stronger effects were observed among participants with specific dietary patterns (animal food pattern and high salt/sugar pattern), poorer sleep and higher level of depression. This study provides the first general population-based evidence that low-level exposure to indoor O_3 during sleep had greater effects on respiratory than cardiovascular system, and the associations were modified by lifestyles and depression level. As people spend most time indoors and spend one-third of life asleep, this study underlined the importance of paying close attention to indoor air quality, especially during sleep, and emphasized the respiratory system as an important target for indoor O_3 exposure.

Association of short-term exposure to ambient fine particulate matter and ozone with outpatient visits for anxiety disorders: a hospital-based case-crossover study in South China

Oral - Abstract ID: 158

Ms. Ruijun Xu [1], *Ms. Lu Luo* [1], *Ms. Ting Yuan* [2], *Ms. Wangni Chen* [2], *Dr. Jing Wei* [3], *Dr. Chunxiang Shi* [4], *Ms. Sirong Wang* [1], *Mr. Sihang Liang* [1], *Ms. Yingxin Li* [1], *Ms. Zihua Zhong* [1], *Ms. Likun Liu* [1], *Ms. Yi Zheng* [1], *Ms. Xinyi Deng* [1], *Ms. Tingting Liu* [5], *Ms. Zhaoyu Fan* [1], *Prof. Yuewei Liu* [1], *Mr. Jie Zhang* [2]

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Background: The acute adverse effects of ambient fine particulate matter ($PM_{2.5}$) and ozone (O_3) on the occurrence of anxiety disorders remained inconclusive.

Objective: To explore the association of short-term exposure to $PM_{2.5}$ and O_3 with outpatient visits for anxiety disorders, and estimate excess outpatient visits in South China.

Methods: We applied an individual-level time-stratified case-crossover study of 126,112 outpatient visits for anxiety disorders during 2019-2021 in Guangdong province, China. Based on each subject's residential address, daily air pollutant exposures were assessed by extracting pollutant data from high-resolution validated grid datasets (spatial resolution: 1 km × 1 km). Conditional logistic regression model was utilized to quantify the association and the excess outpatient visits.

Results: In single-pollutant models, short-term exposure to ambient $PM_{2.5}$ and O_3 was significantly associated with an increased odds of outpatient visits for anxiety disorders. Each increase of 10 $\mu g/m^3$ in $PM_{2.5}$ exposure at lag 01-day and O_3 exposure at lag 02-day was significantly associated with a 3.14% (95% confidence interval: 2.47%, 3.81%) and 0.88% (0.49%, 1.26%) increase in odds of outpatient visits. These associations remained robust in 2-pollutant models. The proportion of outpatient visits attributable to $PM_{2.5}$ and O_3 exposures was up to 7.20% and 8.93%, respectively. Reducing air pollution exposure levels to WHO or China air quality guideline values would avoid up to 3.47% and 2.62% of outpatient visits for $PM_{2.5}$ and O_3, respectively. People 50 years or older were more susceptible to $PM_{2.5}$ exposure, especially in cool season.

Conclusions: Exposure to ambient $PM_{2.5}$ and O_3 was significantly associated with a higher odds of outpatient visits for anxiety disorders. Our findings suggest that air pollution can contribute to considerable excess outpatient visits and highlight the urgent needs to reduce ambient air pollution in preventing anxiety disorders.

Association of the levels of Polycyclic Aromatic Hydrocarbons in maternal hair during periconceptional period with the Risk of fetal Neural Tube Defects

Oral - Abstract ID: 152

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Importance of the work and objectives: Neural tube defects (NTDs) are among the most common and severe congenital malformations resulting from the failure of the embryonic neural tube to close. Some evidence suggested that NTDs may be associated with maternal exposure to polycyclic aromatic hydrocarbons (PAHs). We aimed to verify the association by measuring the levels of PAHs in maternal hair grown during periconceptional period. **Methodologies:** Data came from an case-control study of external malformations in China. The case group included 79 infants or fetuses with NTDs identified from cooperative hospitals in seven provinces of China from 2017 to 2021. Controls were 168 healthy newborn infants without identified congenital anomalies recruited during same period. Data and hair samples were collected by trained health worker through face-to-face interviews after delivery. Eleven PAHs in hair samples grown during periconceptional period were detected by gas chromatography-tandem mass spectrometry. Unconditional Logistic regression was used to analyze the association between periconceptional PAH exposure and NTD risk, and odds ratio (OR) and 95% confidence interval (CI) were calculated.**Main results:**The concentrations of chrysene (CRH) in hair samples of the NTD group was significantly higher than that of the control group (median 6.91 vs. 3.86 ng/g, $P < 0.001$). The four-category results showed a dose-response relationship between the concentration of CHR and the risk of NTDs (P-trend < 0.001). Subjects exposed to medium-high (P50-) and high (> P75) concentrations of CHR had 3.37 times (aOR = 3.37, 95%CI: 1.37, 8.84) and 5.54 times (aOR = 5.54, 95%CI: 2.29, 14.48) the risk of NTDs than those exposed to the lowest (≤ P25) concentrations of CHR. Conclusion:
Periconceptional exposure to higher concentrations of CHR may increase the risk of fetal NTDs.

Behaviour of solid carriers of potentially toxic elements in Slovenian historical Pb-Zn mining waste deposits as a consequence of climate change

Oral - Abstract ID: 518

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1. Geological Survey of Slovenia

In light of ever-increasing climate change, mining waste deposits (MWDs) represent a constant pollution source worldwide and a huge environmental threat that could also have a significant impact on human health in long-term. It is important to identify effects of climate change on MWDs and diminish their environmental impacts. Aims of study were to estimate contribution of MWDs to sediment and water pollution, identify solid carriers of potentially toxic elements (PTEs), their temporal variations and assess their stability in MWDs, stream sediments and surface stream water.

Studied were MWDs in Pb-Zn mining districts Mežica (NNE Slovenia) and Litija and Pleše (central Slovenia). Sampled were MWD materials (4 locations in Mežica, 2 in Litija, 1 in Pleše area) in 2013, stream sediments draining MWDs in 2013 (22 locations in Mežica, 7 in Litija, 5 in Pleše area), 2017 and 2020 (13 locations in Mežica, 7 in Litija, 1 in Pleše area), and surface stream water in 2017 and 2020 to observe changes in PTE distribution and carriers of PTEs over 4- and 7-year period. Chemical analyses of materials were carried out using ICP-MS and ICP-ES. Microchemical, micromorphological and mineralogical characteristics of solid carriers of PTEs were analysed with SEM/EDS. Solubility of ore minerals and secondary products of ore mineral weathering in simulated surface water was assessed using PHREEQC program.

Results showed that PTEs in stream sediments mostly occur as fine-grained and liberated ore minerals, concentrated in sediments of smaller streams draining MWDs and main streams close to their confluences. Main ore minerals are mostly soluble in surface water under given conditions or under variable micro-conditions in stream sediment. Released PTEs are partly removed by precipitation of stable secondary weathering products. PTE levels in stream waters are low, demonstrating that drainage of MWDs contributes to pollution in solid particulate form.

Benthic macro-faunal community characteristics in Xiatanwei mangrove restoration wetland

Oral - Abstract ID: 278

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In this study, the macro-benthic communities of Xiatanwei mangrove restoration wetland at Xiamen City, China. A total of 70 macro-faunal species were obtained, with polychaete (28 species) as the dominant group. *Cleistostoma dilatatum*, *Mataplax elegans*, *Assiminea brevicula*, and *Cerithidea cingulata* were widely distributed in various plots. The average habitat density of macro-fauna was 442.7 ind.·m^{-2}, and the average biomass was 79.5 g·m^{-2}. The difference between plots was larger than that between seasons. According to the classification of macro-fauna by life forms and functional feeding groups, it was found that the life forms were mainly in-faunal (37 species), and the functional feeding groups were mainly phytophagous group (22 species). The difference of habitats was the main factor affecting the composition of macro-fauna's life forms and functional feeding groups. The ABC method and MPI were used to evaluate the health in the region, and the results showed that the plot of *Aegiceras corniculatum* was slightly interfered, while the other four plots （*Avicennia marina*, *Kandelia obovate* and *Sonneratia obovate* and mud flat） were not interfered, which may be related to the close offshore edge and the high planting density of it. The bivalve and polychaete had significant correlation with pH, total nitrogen and total carbon of sediment.

Big Data Spatial Analytics and Compositional Data Analysis for Exploring Relations between Health and Our Environment

Oral - Abstract ID: 145

Prof. Jennifer McKinley [1]

1. *Queen's University Belfast*

The World Health Organisation (WHO) estimates that almost a third of all global deaths are linked to the environment, whether naturally occurring (geogenic) or formed through human activities such as industrial practices (historical and modern), atmospheric air pollution or traffic pollution. With an ageing population understanding what's in our environment and how potential environmental toxins impact on human health becomes increasingly important. The number of people worldwide living with dementia and cognitive impairment is also increasing, mainly due to people living longer. A growing body of research suggests that where we live might influence our brain health. Exposure analysis undertaken as part of the UKRI ESRC funded SPACE (Supporting Environments for Physical and Social Activity Healthy Ageing and Cognitive Health) project explores how the local environment and pollutants synergistically affect our cognitive health outcomes. Studying long-term health outcomes in the NICOLA cohort, the "Northern Ireland Cohort for the Longitudinal Study of Ageing", comprising 8,000 older people, the SPACE project allows us to explore how different environmental factors relate to brain health. Recent research is presented which seeks to gain a greater understanding of the link between human health and our environment and the potential impacts of air and traffic pollution. The approaches presented acknowledge the compositional nature of the environmental data such as geochemistry data, including the use of compositional log ratios and balances. The statistical relationship is examined between cognitive Metrics provided in the NICOLA dataset with environmental toxins to assess how the participants' health outcomes are linked to their environment.

Bioaccumulation of PHCs in birds from Chinese subtropical regions

Oral - Abstract ID: 226

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Biomagnification of persistent organic pollutants (POPs) is affected by physiochemical properties of POPs and ecological factors of wildlife. In this study, influences on species-specific biomagnification of POPs from aquatic and terrestrial invertebrates to eight songbird species were investigated. The median concentrations of polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) in birds were 175 to 13 200 ng/g lipid weight (lw) and 62.7 to 3710 ng/g lw, respectively. Diet compositions of different invertebrate taxa for songbird species were quantified by quantitative fatty acid signature analysis. Aquatic insects had more contributions of more hydrophobic POPs, while terrestrial invertebrates had more contributions of less hydrophobic PCBs in songbirds. Biomagnification factors (BMFs) and trophic magnification factors had parabolic relationships with log K_{OW} and log K_{OA}. The partition ratios of POPs between bird muscle and air were significantly and positively correlated with log K_{OA} of POPs, indicating respiratory elimination as an important determinant in biomagnification of POPs in songbirds. In this study, the species-specific biomagnification of POPs in songbird species cannot be explained by stable isotopes of carbon and nitrogen and body parameters of bird species. BMFs of most studied POPs were significantly correlated with proportions of polyunsaturated fatty acids in different species of songbirds.

Keywords: bird, insect, POPs, stable isotope, fatty acid.

Biochar Application as a Climate-Smart Agriculture Solution for Mitigating Climate Change

Oral - Abstract ID: 558

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Agriculture is a major source of greenhouse gas (GHG) emissions that may originate from fertilizer applications, fossil fuel use by farm machinery, and animal production. Applying biochar to agricultural soils is a beneficial management practice that can contribute towards climate-smart agriculture and achieve sustainable management goals. We conducted laboratory, greenhouse and field experiments to investigate the effect of biochar application on soil fertility, GHG emissions, and soil carbon (C) sequestration. Biochar application consistently reduced nitrous oxide emissions and increased methane oxidation, with either a reduction in or a minimal effect on soil carbon dioxide emissions. Our field study shows that two years after the treatments were applied, biochar application increased soil organic C in the 0–10 cm soil by 12 Mg ha^{-1} as compared to the control. Applying biochar instead of the feedstock (such as crop residues and manure) used for producing the biochar shows consistent environmental benefits. Our studies clearly demonstrate that biochar application in agricultural production systems is an effective tool for improving soil properties and benefiting the environment.

Biological removal and recovery of lanthanum from electronic waste leachate using the lanthanum binding protein lanmodulin from Methylobacterium extorquens

Oral - Abstract ID: 79

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Modern appliances generate a significant quantity of waste containing heavy metals, including rare earth elements. Several essential components present in this e-waste can be recycled and utilized again in a wide range of applications. Among these essential elements is lanthanum, which is utilized as an alloy in fluorescent light bulbs, electrodes, catalysts, and hybrid vehicle batteries. This study focussed on lanthanum removal and recovery from e-waste leachate using lanmodulin which is a highly selective lanthanum binding protein with picomolar affinity. The effect of different initial concentration of lanthanum and cerium on the sorption capacity of crude lanmodulin extracted from the wild type bacterium *Methylobacterium extorquens* was first examined. The cerium biosorption experiment concluded with only 2-16 % removal efficiency of cerium and a sorption capacity of 8-15 mg Ce/ g protein. On the other hand, La adsorption capacity was very high at 70 mg La/ g protein for 100 mg/L initial lanthanum concentration and 53 % removal efficiency by the protein for 50 mg/L initial concentration with 49.8 mg La/g adsorption capacity. Furthermore, lanthanum was found to be involved in assimilatory and dissimilatory pathways for methanol in *M. extorquens*, which revealed that 0.5% v/v methanol and 0.4 % v/v succinate are optimum for maximum biomass growth of *M. extorquens* in the presence of 1 μM lanthanum. The lanthanum removal and recovery by the protein can be improved further by optimization of other factors such as pH and by using purified lanmodulin protein from the bacterium.

Biological soil crusts as startup for the natural restoration of rare earth elements tailings: A microstructure study

Oral - Abstract ID: 992

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Biological soil crusts (BSCs) are bio-sedimentary complexes that are well known to play critical ecological roles mostly in arid and semiarid landscapes. However, the development and microstructure of BSCs and the contribution of BSCs to soil functions during the restoration on rare earth elements (REEs) tailings under humid subtropical climate are far from understood. A former REE mining site have been studied in Dingnan, Jiangxi province, China, presenting different situations of tailings rehabilitation (i.e., end of exploitation or plant colonization stage). A detailed micromorphological investigation of BSCs development and crust microstructure has been conducted by examining features in thin sections using light microscopy and scanning electron microscopy. Our first results showed that wetting–drying cycles, clay deposition, vesicular horizon formation was the principal formative processes. Complex surficial and internal bio-sedimentary structures, which vary as a function of crust dynamics, provide water and nutrients for the crust organisms (*i.e.* moss, bacteria, fungi). In addition, inside vesicular micro-horizons, unconnected vesicles have been observed. They are known to impede water movement - alternating layers of fine grains which may formed by wet-dry cycle cause pore discontinuities - and that create a capillary barrier effect that may further reduces water infiltration. Considering the heavy rainfall in summer, it is clear that BSCs play a crucial role in resisting erosion in REEs tailings. These phenomena may influence landscape-scale water dynamics and biogeochemical cycling, increasing the availability of soil resources during times of biotic. The role of BSCs on the colonization dynamics of spontaneous vegetation in the tailings will be discussed.

Biotechnological Combination for contaminated soil remediation: exploring rhizosphere plant-microbes interactions

Oral - Abstract ID: 825

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Soil contamination is an extensive problem worldwide and its remediation is a current issue and a future global challenge. In this context, the phytoremediation (a nature based solution strategy) is receiving renewed and significant attention as a non-invasive and environmentally safe remediation approach. Rhizosphere, which represents the interface of soil and plant serving as a hotspot for diverse microbial activity, is known to play a significant role in phytoremediation process. Although soil-plant-microbe relationships have been studied for more than a century, appreciation of the functional consequences of these interactions is relatively recent and reveals new opportunities to improve remediation performance. However, research advancements in this field requires an integrated view of the functions and interactions that exist between a host macroorganism and its associated belowground microbial communities. Indeed, a better understanding of the rhizosphere dynamics could provide new insights on its possible manipulation in the perspective of biotechnological applications in soil remediation. Based on previous research and ongoing projects, an experimental framework for studying the effectiveness of phytoremediation and deepen the biological mechanisms of interaction for different contaminant types (both organic and inorganic) is outlined. Our researches highlights that an integrated rhizosphere network can rise the degrees of pollutants tolerance and ensure a higher remediation efficiency. In addition, the microbial assisted approach demonstrated to be an effective biotechnological contribution. Finally, exploring the association of plant and microorganisms omics can add new information with potential implications in the environmental biotechnology field. All the above may represent a clear opportunity to guide next-generation biotechnologies for in-situ soil remediation that are fundamental to both to reduce soil pollution and restore its ecosystem function.

Bivalves as future source of sustainable natural omega-3 polyunsaturated fatty acids

Oral - Abstract ID: 166

Prof. Karsoon Tan [1]

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The increasing global population poses a huge challenge to food security, especially in terms of providing adequate sustainable and affordable high quality lipids. This article reviews the sources of natural omega-3 LC-PUFA and identifies the future direction for producing high quality lipids to meet growing market demands. In general, bivalve lipids appear to be a high quality source of lipids that are beneficial to human health regardless of species and habitat. There is also reason to believe that the development of bivalve farming worldwide and selective breeding of bivalves to increase the accumulation of omega-3 LC-PUFA can meeting some, if not all, of the growing demand for omega-3 LC-PUFA. Such information will aid to establish a promising source of high quality natural omega-3 LC-PUFA and ensure that all consumers have access to sufficient omega-3 LC-PUFA at an affordable price to support a healthier and balanced diet.

Black shales as an important source of soil Cd in farmland and its potential hazards

Oral - Abstract ID: 142

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Black shales, e.g., those from Cambrian, contain high contents of Cd (usually 1-10 mg/kg) and other heavy metals. In order to evaluate its potential risk, the process of Cd release during weathering after black shale exposure to the surface, its movement into farmland, and its absorption by rice, were investigated in a typical region in China, by collecting and chemically analyzing the samples of bedrock, soil profiles, rice grains paired with their rooted farmland soils. The results showed that weathering of black shales will release large amount of Cd through acid surface water, but the soil developed from its eluvium may contain very low Cd concentration, even below the background value. Acid water produced during the process may be the source of soil Cd for the lowland farmlands. Soils polluted usually have very high proportion of active Cd, indicted by the results of the 7-step sequential extraction (water soluble and ion exchangeable Cd larger than 50% of the total Cd). More than a half of the rice samples growing in the polluted farmland exceeded the food restriction guideline of 0.2 mg/kg (GB2762-2017). We also found that the Chinese standard of “Soil environmental quality: Risk control standard for soil contamination of agricultural land (GB15618-2018)” is not suitable for this type of high Cd background because of its underestimation of this kind of risk. We recommended DTPA extracted Cd as an indicator for this kind of pollution and 0.34 mg/kg may be the key value for risk assessment. This potential hazard has been neglected for a long time during the construction of road, railway, factories, etc in black shale embedded areas. We appeal measures be taken to cut this pollution source.

Body burden of exposure to volatile organic compounds from using feminine hygiene products: Integrating measurement data and physiologically based toxicokinetic model

Oral - Abstract ID: 173

Dr. Nan Lin [1]

1. *Shanghai Jiao Tong University*

Increasing studies have informed noteworthy health risks of dermal exposure to volatile organic compounds (VOCs) via using feminine hygiene products (FHPs). However, there are currently no studies depicting the absorption, metabolism and excretion dynamics, as well as the potential body burden after exposure. In this study, we integrated measurement data of eight typical VOCs in five categories of FHPs and in urine of 25 females and a physiologically based toxicokinetic (PBTK) modeling approach to unveil the toxicokinetics of VOCs in human body compartments from the use of FHPs, and to identify chemicals and products that could cause significant body burden. Via skin absorption, the levels in all compartment presented a rapid rise at the moment of use but mostly at low levels (~0.93 ng/mL of *p*-cymene in kidney) and decreased shortly by high-efficient metabolism via liver. Only adipose presented cumulation trend, especially for *p*-cymene, hexane and n-nonane, which have higher partition coefficients between adipose and blood and were the dominant chemicals in body. The much lower estimates than measurements in urine (1:10^3) of *p*-cymene, hexane and n-nonane proposed a question that using urinary concentration as an exposure may lead to bias because of the accumulation difference in different compartments. *n*-Nonane also contributed a noteworthy non-cancer risk when using moisturizer. Benzene in FHPs showed a significant cancer risk via skin absorption, and moisturizer was the dominant contributor, albeit benzene had limited contribution to the total absorption amount of all exposure route and all target VOCs. Our results show that dermal exposure to VOCs via using FHPs could induce significant body burden and health risks. We also recommend that comprehensive assessment of exposure burden and risks should be conducted via combining levels with exposure route and toxicity.

Cadmium–Induced Growth Responses in Artemisia absinthium, Carthamus tinctorius, Matricaria recutita, Origanum vulgare, and Salvia officinalis

Oral - Abstract ID: 605

Mr. Christos Kikis [1], ***Dr. Kyriakos Giannoulis*** [1], ***Prof. VASILEIOS ANTONIADIS*** [1]

1. University of Thessaly

In this study we investigated the impact of Cd on the growth of *Artemisia absinthium*, *Carthamus tinctorius*, *Matricaria recutita*, *Origanum vulgare*, and *Salvia officinalis*. The aim was to identify and propose suitable plant species for the phytomanagement of Cd–contaminated soils. Specific objectives were to (i) evaluate the translocation of Cd in these plants, (ii) design eco-friendly solutions for remediating polluted soils, and (iii) identify economically viable crops that can thrive in Cd–contaminated soils. The experiment lasted for 8 weeks, involving planting the plants in 2-L pots filled with perlite. Each plant had six replicates (three with Cd treatment, three as control). The initial 4 weeks focused on plant germination. In the subsequent 4-week period, a total of 1 mg Cd per week was added. Pots were grouped into those of the 1st, 2nd, 3rd, and 4th week. Those of the 1st week were treated with only 1 mg Cd for each pot. Those of the 2nd week were treated with 2 mg Cd per pot, week 3 pots got 3 mg Cd per pot, and week 4 pots were treated with 4 mg Cd per pot. At the end of each week, any toxic effects of the added Cd were recorded, as well as plant height, fresh weight, dry weight, number of leaves, and cadmium accumulation. Results showed that *M. recutita* had a remarkable resilience to Cd exposure with no adverse effects on growth. Conversely, *O. vulgare* exhibited leaf toxicity as early as the first week of exposure, while *C. tinctorius* and *A. absinthium* exhibited significant decrease in dry weight. On the other hand, *S. officinalis* displayed tolerance to Cd, maintaining unaffected growth. In conclusion, *M. recutita* and *S. officinalis* showed a great potential for cultivation in Cd–contaminated soils. However, practical applications would require further investigation and field trials.

Cause-specific accidental deaths and burdens related to ambient heat in a warming climate

Oral - Abstract ID: 376

Prof. Haidong Kan [1]

1. *Fudan University*

Future warming is projected to increase the heat-related mortality burden, especially for vulnerable populations. However, most previous studies focused on non-accidental morbidity or mortality, with far less research on heat-related accidental events. In this study, we collected individual accidental death records among all residents in Chinese mainland from June to August during 2013–2019. We used an individual-level, time-stratified, case-crossover study design to estimate the association between daily mean temperature and accidental deaths, and estimate its variation in seven geo-climatic zones, age (5–64, 65–74, ≥75), and sex (male, female). We then estimated the temperature-related excess accidental deaths under global warming scenarios of 1.5, 2, and 3℃. As the results, a total of 711,929 accidental death records were included in our study. We found that higher temperatures were associated with increased risks of deaths from the total accidental events and four main subtypes, including traffic, falls, drowning, and unintentional injuries. We also found that younger individuals (ages 5–64) and males faced a higher risk of heat-related mortality due to total accidents, traffic incidents, and drowning. For future climate scenarios, even under the 1.5℃ climate change scenario, 6,939 (95% eCI (empirical Confidence Interval): 6,818–7,067) excess accidental deaths per year are attributed to higher summertime daily temperature over mainland China, and the number of accidental deaths would increase by 16.71% and 33.59% under the 2℃ and 3℃ climate change scenarios, respectively. For residents living in southern coastal and northwest inland regions, the projected increase in accidental death is higher. In conclusion, this nationwide study confirms that higher summer temperatures are linked to an increased risk of accidental deaths. Younger age groups and males face a higher risk. This indicates that current estimates of the health effects of climate change might be underestimated, particularly for younger populations.

Cellular toxicology of carbon nanomaterials in environmental media

Oral - Abstract ID: 1012

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Owing to their potential in a variety of application technologies, carbon nanomaterials have inspired extensive research. However, the cytotoxic mechanism is poorly understood. Our research investigated the cytotoxic effect of graphene oxide (GO), graphene oxide nanoribbons (GORs) and CQDs in vitro.

The cytotoxicity of graphene oxide (GO) nanosheets with different morphologies regulated with Pb^{2+} was estimated using A549 cells. The cell viability significantly decreased when A549 cells were only exposed to GO; whilst more cells survived after exposure to GO regulated by Pb^{2+}. After aggregation and/or re-assembly, the membrane puncturing, phospholipid extraction, and oxidative stress were inhibited to various extents, contributing to the reduced cytotoxicity of GO as well as Pb^{2+}.

The GORs significantly inhibited the growth and reproduction of *E. coli* in a concentration-dependent manner. Interaction between GORs and *E. coli* cytomembrane resulted in polysaccharide adsorption by GORs and the release of lactic dehydrogenase. Furthermore, GORs effectively depleted the metal ions as nutrients in the culture medium by adsorption.

When the exposure time exceeded 24 h, the CQDs altered the surface charges of cells and induced lipid peroxidation by adhesion on the surface of *E. coli*, leading to an increase in the permeability of the cell wall. When the concentration of CQDs reached 200 μg/mL, the osmotic pressure of the extracellular environment was significantly reduced. These are the main factors that lead to cell edema and death.

In conclusion, the toxicity mechanisms of different carbon nanomaterials are different, and further evaluation of their toxicity is needed to provide a theoretical basis for their future safe application.

Changes and determinants of iron-bound organic carbon in coastal wetlands

Oral - Abstract ID: 884

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There is a strong correlation between the biogeochemical cycles of iron (Fe) and organic carbon (OC). Iron oxide-bound organic carbon (Fe-OC) is not only regarded as a high-efficiency "rust sink", but is also relatively stable and hard to degrade, which plays a vital role in the sequestration and stabilization of blue carbon in coastal wetlands. However, the deposition of Fe-OC in coastal environments is poorly revealed. This study aims to elucidate the changes and influencing factors of Fe-OC in coastal wetlands, which is of profound significance for understanding the coupling relationship of Fe-C. This study comprehensively investigated the concentration, characteristics and distribution patterns of Fe-OC in sediments from 6 coastal wetlands in eastern China, and explored the effects of climatic factors and soil physicochemical properties on Fe-OC. The results showed that the abundance of Fe-OC ranged from 0.24 to 1.27 mg g^{-1}, and its concentration decreased with increasing latitude (R^2 =0.23, p <0.05). The concentration of Fe-OC was highest in the surface layer (10-20 cm), followed by the middle layer (50-60 cm), and lowest in the deep layer (90-100 cm) on average. The contribution of Fe-OC to soil OC ranged from 1.88% to 28.99%. Based on the δ^{13}C isotope analyses, we found that Fe-OC was relatively enriched in ^{13}C. On average, the molar ratio of OC:Fe was 9.35 ± 3.37, indicating that the reactive iron oxides were mainly bound to OC by coprecipitation. In coastal wetlands, temperature, precipitation and pH were the main factors affecting Fe-OC storage. The results indicated that hot and humid areas were beneficial for Fe-OC accumulation, while Fe-OC was negatively correlated with pH (R^2 =0.30, p <0.01). This study provides important information for understanding the deposition and distribution of Fe-OC, and assessing the carbon burial capacity and control mechanism in coastal wetlands.

Changes in land surface temperature over metropolis by using time series remote sensing images (2000-2020) in Chengdu City, China

Oral - Abstract ID: 604

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Monitoring changes in land surface temperature (LST) over cities is critical to human living environment and health, and is also essential to achieving the 2030 Agenda for Sustainable Development's goal of keeping global temperature rise below 2°C. Scholars have conducted extensive research on the urban heat island effect, but due to the coarse scale or discontinuous time, there has been no more refined continuous monitoring of the urban interior. This paper takes Chengdu City in China as the research object, and uses the geographically weighted regression (GWR) algorithm to downscale the LST products of MOD11A2 from 2000 to 2020, obtaining a long time series of LST products with the 30m spatial resolution. The results show that: (1) From 2000 to 2020, the LST in Chengdu became higher and higher in summer (increasing at a rate of 0.17°C/year) and lower and lower in winter (decreasing at a rate of 0.18°C/year). (2) Spatially, with the expansion of urban to other areas outside the central urban areas (Jinjiang, Chenghua, Jinniu, Qingyang and Wuhou District), the area of summer high temperature areas in other areas shows a trend of expansion, while the area of summer high temperature areas in the central urban area does not change much. The area of the winter high temperature area showed a fluctuating decrease in the central urban areas, while the area of the winter high temperature area in other regions increased first and then decreased. (3) The increasing trend of summer LST in Chengdu is similar to the global trend, but the growth rate is significantly higher. Compared with other cities in the world, it has been found that the LST of Chengdu City varies greater, which may be related to the topography of basin.

Characteristics of Cadmium Isotope Fractionation in Topsoil-Rice System in Carbonate Rock Region of Western Zhejiang, China

Oral - Abstract ID: 395

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The cadmium isotope presenting great potential in studying the geochemical behavior of Cd in topsoil-rice system. To study the geochemical behavior of Cd element in topsoil-rice system in carbonate rock region of western Zhejiang, in this study, the Cd isotope composition and fractionation characteristics of topsoil-rice system were studied by using Cd isotope technique in 16 sets of soil-rice samples in this area. The results show that the $\delta^{114/110}$Cd in the topsoil ranges from -0.34‰ to 0.47‰, the average value (+0.12 ± 0.02‰) is higher than the surface soil of Wushan County, China ($\delta^{114/110}$Cd: -0.146‰, -0.056‰). The $\delta^{114/110}$Cd in the rice ranges from -0.13‰ ~ 0.81‰, and mean value is +0.33 ± 0.03‰. The topsoil-rice fractionation coefficient in study areas ($\Delta\delta^{114/110}Cd_{rice\text{-}topsoil}$ = 0.210 ± 0.014‰, ranges from -0.47‰ to 0.65‰) has a similar result with Hunan province ($\Delta\delta^{114/110}Cd_{rice\text{-}topsoil}$ = +0.25‰), and lower than those in polluted areas in southern China ($\Delta\delta^{114/110}Cd_{rice\text{-}topsoil}$ = +0.40‰). The enrichment factor (EF) of cadmium in rice is 47.57% (range from 3.86% to 194.12%) in topsoil-rice system, and rice grown in the surface soil rich in light Cd isotopes has a higher EF of soil Cd element. Industrial dust deposition is the main factor leading to the difference of Cd isotope fractionation in topsoil-rice system.

Characteristics of Cd flux in the plow layer soil around the mining area under high geological background environment

Oral - Abstract ID: 136

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Guangxi, located in the southwestern part of China, is a typical geological high-background area. The intense weathering of carbonate rocks, black rock series, and basic-ultrabasic rock bodies in conjunction with metal deposits has led to soil heavy metal cadmium (Cd) content higher than other regions. The ecological risks of high soil Cd content caused by natural factors and the anomalies caused by human pollution are vastly different. Overstandard areas of Cd in rice grains often appear in regions with low soil Cd content. The bioavailability of Cd is closely related to soil physical, chemical properties, chemical composition, and mineral components, as well as different crops exhibit substantial sensitivity differences to Cd. To clarify the extent of the impact of mining activities on the environmental quality of cultivated soil in high geological background areas, a systematic comparative study was conducted on the Cd transport pathways and transport flux density in the cultivated soil of mining-impacted areas and control areas. The results showed that in both the mining and control areas, the main input route of Cd was through atmospheric dry and wet deposition, and the high flux density areas of atmospheric dry and wet deposition input were mainly distributed around the mining area. The main output route of Cd was through surface water infiltration. The crop harvesting output flux density was higher in the mining area, and the rate of overstandard Cd content in rice grains grown in the mining area was higher, while corn grains didn't exceed the standard. Therefore, it's suggested that Cd-contaminated soil in this area can be remediated through monitoring and crop rotation adjustments. This will provide a theoretical basis for the development of land resources and rational mining in high geological background areas, ensuring the safe utilization of arable land resources to the maximum extent.

Chemical and Biological Characteristics of Dust in Relation to Health – A Medical Geology Perspective

Oral - Abstract ID: 32

Prof. Jose Centeno [1]***, Dr. Saverio Fiore*** [2]***, Prof. Samuel Hernandez*** [1]

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Abstract: It is currently unclear which characteristics of inhaled particles that cause airways disease. For example, pneumonia has been observed following acute inhalation of particles with a number of different sizes and compositions (WHO, 2000), suggesting that it might not be one dust particle property or load alone that is the causing agent, but some other factor or a combination of them.

Dust particles are characterized by morphology (primarily size) and composition. Morphology is often referred to as the diameter of the particle, given a certain particulate matter (PM) value and is normally presented as a concentration, with the unit $\mu g/m^3$.

Adverse effects on health are caused not only by physical characteristics of the inhaled particles (i.e. shape and size), but also by toxic elements adsorbed to the particle surface, and by the potential presence of harmful biological pathogens which may be retained and mobilized by dust. This session will focus in understanding the physical and chemical characteristics of dust as well as microorganisms from a medical geology perspective.

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Chemical Earth Program: Global Geochemical Observation Networks

Oral - Abstract ID: 333

Prof. xueqiu wang [1], ***Dr. Bimin Zhang*** [1], ***Dr. jian zhou*** [2], ***Dr. wei wang*** [2], ***Dr. mi tian*** [2], ***Dr. qinghai hu*** [2], ***Dr. chaosheng zhang*** [3]

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There is a critical need for human to establish a global geochemical observation network to provide authority big data for monitoring chemical environmental changes of the Earth. The International Centre on Global-scale Geochemistry under auspices of UNESCO and China Government initiated an International Scientific Cooperation Program on ***Chemical Earth***. The program will focus on the establishment of Global Geochemical Observation Networks for documenting data of nearly-all natural chemical elements in the Earth surface. A digital ***Chemical Earth*** platform and Mobile APP was created. The big data can be used for monitoring environments, for discovering mineral resources, for improving the efficiency of agriculture, and for studying the behavior of elements in the food chain and their health effects on humans and other biota.

Up to 2022, Global Geochemical Baselines Networks has covered a total area of about 39 million km^2, nearly accounting for 33% of the global land, with 1 soil sample location per 80 km by 80 km. Three-round revisit sampling campaigns throughout China were carried out to monitor the changes of chemical elements in 1995, 2010, 2018 respectively. Toxic metals of As, Cd, Cr, Cu, Hg, Ni, Pb and Zn, particularly Cd at top soils significantly increase from 1990s to 2010s by comparing the datasets of 15 years interval sampling between 1995 and 2010 in China. The facts show that geochemical observation at decade interval using catchment sediment and soil sampling can be applied to quantifying or monitoring the environmental changes of toxic metals induced by human activities.

The program also promotes the scientific data popularization through Mobile app allowing anyone to access soil geochemical data. The pilot study case in Yongqing county near to Beijing shows that the popularization data were very helpful for farmers to improve the efficiency of agriculture for green food cultivation.

Chemical Speciation and Release Behavior of Copper in Contaminated Soil Aggregates: The Influence of the Intra-aggregate Radial Distribution

Oral - Abstract ID: 277

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The microscale heterogeneity inherent in soil, manifested through aggregate structures, profoundly impacts the aging process, speciation, and subsequent release behavior of copper (Cu). Upon introduction into the soil matrix, Cu undergoes a gradual diffusion within aggregates, engaging in reactions with surfaces situated in the intra-aggregate region. Consequently, the radial distribution of Cu along the soil aggregate plays a pivotal role in influencing both its speciation and release behavior. However, the quantitative ramifications of this radial distribution on the aging and release dynamics of Cu within the soil aggregate remain inadequately elucidated in current literatures.

In this investigation, soil aggregates ranging from 1.0 to 3.0 mm were meticulously prepared. Different methods were employed to introduce Cu, establishing distinct initial radial distributions within the aggregates, including two designed groups, uniform and non-uniform Cu distribution. Subsequently, these soil aggregates underwent a 62-day incubation under constant temperature and humidity conditions. Remarkably, the initial radial Cu distribution exerted more pronounced effects on both speciation changes and release capacity of Cu during the aging processes compared to aggregate size. Additionally, a non-uniform Cu distribution resulted in a slower Cu stabilization rate. Cross-sectional analysis using LA-ICP-MS indicated that, despite intra-aggregate diffusion being driven by Cu concentration gradients, homogenization within millimeter-scale aggregates did not occur over the two-month aging period. This suggests that microscopic concentration distribution and Cu speciation may undergo continued changes during prolonged aging driven by intra-aggregate diffusion.

Our findings provide insights into the Cu aging process from the perspective of aggregate-scale structural and contaminant heterogeneity, which can help develop comprehensive risk assessment models for Cu in heterogeneous contaminated soils.

Chemodynamics of polycyclic aromatic hydrocarbons and their derivatives in the Yellow Sea and East China Sea

Oral - Abstract ID: 568

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The continuously released polycyclic aromatic hydrocarbons (PAHs) can be converted into various derivatives with greater toxicity and environmental persistence. The terrigenous polycyclic aromatic compounds (PACs), encompassing both PAHs and their derivatives, play a significant role in marine organic carbon dynamics, especially in estuaries and marginal seas. In these regions, the intricate interplay between land and sea, complex hydrodynamic conditions, and robust biological activities collectively influence the occurrence and transport of PACs. Notably, current research on PAHs' derivatives in marine environments is limited, and the distinct physicochemical properties of PAHs and their derivatives could result in divergent environmental behaviors. In this study, the dissolved and particulate PAHs and their alkylated/nitrated/oxygenated derivatives (A-PAHs/N-PAHs/O-PAHs) in coastal water of the southwestern Yellow Sea (YS) and East China Sea (ECS) were comprehensively discussed. Results confirm higher levels of O-PAHs and A-PAHs than PAHs and N-PAHs. The spatial heterogeneity of contaminants was regulated by substantial riverine runoff and ocean currents. Lagrangian Coherent Structure analysis further revealed the existence of a transport barrier at the shelf break of the southwestern YS where contaminants hardly crossed and tended to accumulate. The relationship between dissolved compounds and chlorophyll *a* indicated both biodegradation and the biological pump contributed to the depletion of PAHs and A-PAHs from surface seawater while the biological pump was the major driver for N-PAHs, despite their complicated water-particle partition behavior due to variations in physicochemical properties in the presence of nitro groups. Source identification demonstrated that pyrogenic and petrogenic sources dominated the YS and ECS, respectively, while photochemical transformations appeared more active in the YS.

Child and adolescent health in a time of environmental crisis

Oral - Abstract ID: 668

Prof. Michal Molcho [1]

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Child and adolescent health is defined as the extent to which children are able to develop the capacities that allow them to interact successfully with their biological, physical, and social environments and to develop and realize their potential. The current environmental crises children face limit their ability to flourish and reach their full potential, putting at risk their ability to meet their needs. Children and adolescents, who are undergoing physical, mental and social developments, are particularly vulnerable to environmental crises. Their immune system is under-developed, their bodies are less able to regulate extreme temperatures, and undernutrition impact their growth and development. While all children and adolescents are more vulnerable to environmental crises, poor and marginalized populations are more impacted. Moreover, 1 in 2 children in the world live in poverty, more than half a billion children live in extremely high flood occurrence zones, and 83% of children in Europe and Central Asia are exposed to air pollution.

This paper presents the environmental risks to which children and adolescents are exposed, and the polycrisis they face. The paper will quantify the direct impact of these on young people's physical and mental health, as well as the indirect impact on their health, using the lenses of the social determinants of health and health inequality. Lastly, the paper will propose and discuss measures to mediate the impact of environmental crisis through local, national and global actions.

Chlorinated organic pollutants in global flooded soils and sediments: potential risk of increased methane emission

Oral - Abstract ID: 713

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Chlorinated organic pollutants (COPs) were widely detected in anaerobic environments, but their environmental risk was usually underestimated without the consideration of multi-process coupling effect. In this study, we firstly applied meta-analysis to identify the occurrence status and environmental risk of COPs from 246 peer-published literatures, including 25 kinds of COPs from 977 sites. Environmental risk assessment found 73.3% of selected sites were at a security level but the rest were not, especially for the wetland soils and sediments. We then further applied meta-analyses, incubation experiment and quantum modelling to investigate the associations between reductive dechlorination and methanogenesis. Results indicated the accelerated methanogenesis were commonly synergistically coupled with the accelerated removal of COPs. Some methanogens were showed as the core taxa co-occurring with dechlorinators in the microbial networks of COP-polluted environments. Also, methanogenic species could promote some COP dechlorination by regulating cell metabolic functions, e.g., the coenzyme F430 could reduce the activation barrier of reductive dechlorination. Further regulation based on a mixed culture through microbial electrolysis cell verified the possibility to synchronously regulate these two processes via the application of suitable electrostimulation. Collectively, our work provides a novel insight into the multiple environmental function of methanogens that likely contribute to COP dechlorination, and the associations between dechlorination and methanogenesis may occurred and can be modified in COP residual paddy soil. Caution is thus necessary to be paid on the potential risk of increased methane release from flooded soils and sediments polluted with COPs.

Acknowledgement

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Climate and health impacts of carbon neutrality and clean air pathways in China

Oral - Abstract ID: 481

Prof. Shuxiao Wang [1], *Dr. Bin Zhao* [1], *Mr. Yisheng Sun* [1], *Ms. Xiaochun Wang* [1], *Dr. Da Gao* [1], *Dr. Yicong He* [1]

1. *Tsinghua University*

China faces the dual challenge of air pollution and climate change, for it is the largest carbon emitter in the world and its air pollution leads to over one million premature deaths yearly. China has pledged to achieve the "Beautiful China" and "Carbon Neutrality" goals by mid-century, aimed at improving air quality and neutralizing its carbon emissions. It is important to recognize that these goals are intricately coupled, given that CO_2 and air pollutants share similar emission sources; and that air pollutant such as $PM_{2.5}$ can drive climate change and climate change can also impact the level and fate of pollutants. Therefore, it is imperative that a synergistic approach be taken to develop action plans and evaluate their benefits to simultaneously and efficiently meet these goals. In this study, we developed GCAM-ABaCAS (Global Change Analysis Model coupled with Air Benefit and Cost and Attainment Assessment System), which interlinks emissions of CO_2 and air pollutants by considering the combined effects of socioeconomic development, climate targets and air pollution measures on both emissions. We visualized future emission scenarios considering different stresses on air quality and climate target attainment and evaluated their air quality and climate impacts using a deep-neural-network source-receptor model and a global climate model CESM2, respectively. The results suggest that current decarbonization measures have strong co-benefits of minimizing SO_2, NO_x and $PM_{2.5}$ emissions, while also improving provincial equality of air quality across China. Further pursuing carbon neutrality with more NH_3 and NMVOC control will lift 200 million people to WHO APG $PM_{2.5}$; however, temperature increase from pollution reduction may counteract CO_2 reduction. Finally, fixing on carbon neutrality by 2060, we show that different technology pathways can have quite different health benefits, stressing the need to further optimize the actions.

Climate, Soil, and Health Nexus: Grand Challenges in a Changing Environment

Oral - Abstract ID: 83

Dr. Donald Sparks [1]

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Climate change is the most vexing challenge of the 21st century. More intense storms, flooding, higher temperatures, sea level rise, wildfires, droughts, permafrost melting, and biodiversity loss are some of the major impacts of environmental change. Their effects are inextricably tied to human health, food and national security, and social and economic inequities. We must be at the forefront in addressing and providing solutions to these vexing challenges that threaten humankind. It is also incumbent that we tackle the research needs in an interdisciplinary manner by forging collaborations with natural scientists, social scientists, engineers, and humanists, and health scientists We must also communicate the results and solutions in a meaningful way to decision makers and the public. This presentation will focus on the impacts of a changing climate on coastal vulnerabilities and resiliency, soil and water contamination, food production, and security. Opportunities will be presented on how to address some of these complex challenges.

Coastal Ocean Under Intensifying Human Activities and Changing Climate: from Science to Sustainability and needs for a digital twin platform

Oral - Abstract ID: 40

Prof. Minhan Dai [1]

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Situated between the land and the open ocean, the coastal ocean possesses rich spatial, economic, and biological resources and diverse ecosystems, providing invaluable services for human society. However, pressures on this vital region from human development and climate change have intensified ever since the Industrial Revolution, which has adversely impacted human society and impaired the regional and global ocean health.

This presentation will begin with our current understanding to the health of the global and regional coastal ocean and their ecosystems. We will then zoom into the East Asia Seas to identify key knowledge gaps to sustainably use and manage the coastal ocean. Here, I will explain why cross-sectoral partnerships, scientific innovation and seamless knowledge transfer to achieve a tangible integration of science, governance and society are the keys to tackling the coastal problems. I will present the progress of an on-going project entitled "Coastal Zones Under Intensifying Human Activities and Changing Climate: A Regional Programme Integrating Science, Management and Society to Support Ocean Sustainability (COASTAL-SOS)", which was endorsed by the UN Decade of Ocean Science for Sustainable Development Program (2021-2030). The project aims to advance scientific understanding of critical coastal ocean health issues and to transform scientifically acquired knowledge to provide feasible solutions. One of the important goals of COASTAL-SOS is to provide an integrated science database and modelling platform, or Digital Twin of the Coastal Ocean (DTCO) for digital transformation to meet the demands of the coming era for rapid, dynamic transformation of ocean observations and human societies intended to realize smart coastal communities. This presentation will then showcase our on-going efforts in constructing DTCO of different coastal systems, including Digital Twins of Xiamen Bay and Shansha Bay, and a Digital Twin of an offshore farming system.

Combatting neonatal, maternal and child deaths from ionising radiation exposure around gold and uranium mines in South Africa: a medical geology perspective

Oral - Abstract ID: 67

Prof. Theophilus Davies [1]

1. *Mangosuthu University of Technology*

The exposure of pregnant women and children to ionising radiation around gold and uranium mining areas in South Africa has long been a source of concern, and many questions related to this problem still remain unanswered.

There is therefore an urgent need to study the incidence of neonatal, maternal and child deaths in areas of the Country with high exposure to ionising radiation exposure due to mining.

In this paper, a background is provided on experimental studies on neonatal, maternal and child deaths from ionising radiation exposure in South Africa, and an illustration made on why the inclusion of medical geologists in teams investigating these exposures can lead to much improved prognosis, diagnoses and therapy; as well as prevention and other forms of intervention for combatting the exposure outcomes.

Keywords: Research gaps; ionising radiation exposure; mining; South Africa; neo-natal, maternal and child deaths; radioprotection

Combined application of milk vetch, and biochar mitigate soil cadmium risk in paddy field

Oral - Abstract ID: 419

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Background: Cadmium (Cd) in paddy soil poses significant risks to humans due to its strong biological migration and toxicity. Co-incorporation of Chinese milk vetch (MV) is a common agricultural practice in Southern China; however, the effects of combining MV with biochar on Cd bioavailability remain unclear.

Objectives and methods: We intended to filter the biochar which could reduce Cd availability better and investigated the effects of MV, biochar, and their combinations on Cd uptake by rice through field experiment. And clarify their synergistic mechanism of Cd reduction through adsorption experiments and structural characterization by FTIR, XRD, SEM-EDS etc.

Results: After the filter experiment, Sesbania biochar has the highest effect on decreasing Cd availability. For the field experiment, The combined use of MV significantly reduced the exchangeable Cd content in the soil, promoted the transformation of active Cd to stable state, and further strengthened the Cd reduction effect of MV and biochar application; Combined biochar with MV significantly increased the content of iron and manganese plaque (IMP), with iron and manganese plaque increased and Cd content in IMP increasing. The combination significantly reduced brown rice Cd uptake more than 60%. The passivation effect of soil Cd and the barrier effect of IMP on rice root surface jointly reduce rice Cd uptake. Meantime, MV could increase abundance of sulfate reducing bacteria which could improve the formation of CdS to decrease Cd availability. The adsorption experiment showed that MV dissolved organic matter and decomposition solution increased Cd adsorption of biochar by increase biochar functional group content.

Conclusion: Application of combined MV with biochar decreased Cd bioavailability. MV could strengthen Cd adsorption ability of biochar and increase microorganism abundance related to Cd reduction. It was an effective method for Cd-contamination paddy field remediation.

Cost and Health benefits of promoting clean cooking and heating in rural China

Oral - Abstract ID: 102

Prof. Tao Shu [1], *Prof. Shen Guofeng* [1], *Prof. Hefa Cheng* [1]

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Solid fuels including coal and biomass fuels used in residential sector in rural China are major emission sources of air pollutants, contributing significantly to air pollution and associated adverse health impacts. In the past, energy used for cooking has experienced rapid transition towards clean ones, driven by living condition improvement. A campaign promoted recently has replaced coal with clean energy for heating in more than 70% of rural households in Northern China Plain. The transition towards clean cooking and heating resulted substantial health benefits. Still, more than 40 million rural households are using solid fuels for cooking and most rural households in northern China heat their home using coal or biomass fuels in winter. Therefore, how to promote clean cooking and heating at reasonable cost is not only a research question, but also important for decision making. Here we provide a general framework for clean cooking and heating in rural China with cost-benefit analysis. It is shown that annualized cost for clean cooking ranges from 960 to 1,300 RMB per household. By invest 24.3 billion RMB to cover 50% of the 44 million households using solid fuels for cooking, 370 thousands premature deaths can be avoided annually. For clean heating, pipelined natural gas is more expensive than electricity. Taking cost, safety, and energy security into consideration, heating using natural gas is not recommended. Per household cost of grid upgrading for clean heating depends on population density. In northern China, if 8,000 RMB per household can be invested in power grid upgrading, 75% of households in northern China can be covered. In that case, a total investment of 88 billion RMB can cover full costs for infrastructure, facility, and electricity consumption of these households, resulting in reduction of 430 thousands premature death each year.

Coupled hydrogeochemical cycles and aqueous release potential from used peatlands

Oral - Abstract ID: 413

Prof. Andre Banning [1]

1. University of Greifswald

While peatlands cover only 3% of the planet's land surface, they host ca. 10% of the global non-glacial freshwater, and are responsible for up to 20% of the DOC transferred to the oceans. Peatlands play a crucial role for drinking water supply in many regions including Ireland where about 80% of the population depends on peat-fed surface water. Peatlands also control downstream surface and groundwater quality on a global scale. They are generally considered to be sinks for most dissolved chemical species, thus providing ecosystem services such as water filtration. However, retention capacity varies seasonally and depends on water source, mobility controlling hydrobiogeochemical processes like mineral weathering, precipitation, dissolution or adsorption, and redox conditions, let alone anthropogenic impacts like drainage, agricultural use or peat cutting which may result in peatlands acting rather as sources than as sinks for unwanted substances endangering downstream ecosystems, water resources and ultimately public health.

While it is widely acknowledged that carbon budgets and trophic states of peatlands are critical and substantially impacted by peatland use, relatively little is known about the mentioned factors´ influence on trace element cycling in – and release from – peatlands. This presentation revisits several international studies on coupled element dynamics and mobility in such systems to highlight relevant processes, future research needs, and the urgency to remediate the situation by e.g., rewetting and paludiculture.

DOC concentrations in streams and rivers draining upland peatlands have increased rapidly in recent decades due to peat degradation which will be further accelerated by projected climate change and other human impacts, especially in Ireland. This is likely going to further deteriorate downstream water quality, also concerning co-mobilized trace elements like uranium (as we see in e.g., groundwater downstream of a fen in southern Germany) or methylated selenium emitted from a Swiss peatland.

Current status of research on geogenic pollution and disease in Africa

Oral - Abstract ID: 644

Dr. Thobeka Makhathini [1], **Prof. Theophilus Davies** [1]

1. Mangosuthu University of Technology

The key environmental pollution issues confronting the African people are soil, water, air, waste, and climate change. The processes that produce pollution belong to the geogenic and anthropogenic milieu and can result in various diseases and social challenges. A systematic review of the decadal literature (2015 to 2023) was undertaken using the PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analysis) Protocol to permit a dissection of the nexus between soil, water, and air pollution and the distribution of the myriad environmental diseases that continue to plague the African people. Despite the numerous studies on ways of eliminating diseases due to soil, water and air pollution in Africa, several gaps remain in our knowledge of pollution abatement and how best to combat these diseases. Bridging these knowledge gaps would require a precise understanding of the relationships between pollution sources, exposure pathways, and uptake mechanisms, a feat that would serve in broadening the diagnostic spectrum and mitigation options for these diseases.

Decreasing mercury levels in consumer fish over the three decades of increasing mercury emissions in China

Oral - Abstract ID: 233

Prof. Hua Zhang [1]

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Fish consumption is the primary dietary route of human exposure to methylmercury.It has been well documented that elevated mercury concentration in fish in North America and Europe is linked to anthropogenic mercury emissions.China is the world's largest producer,consumer,and emitter of mercury,as well as the world's largest commercial fish producer and consumer.Although mercury pollution in fish in China is currently receiving much attention worldwide,its status remains largely unknown.Here,we conducted a meta-analysis on total mercury concentrations in marine and freshwater fish samples,covering 35,464 samples collected in China over the past 30 years.It is found that,opposite to the increasing emission and documented mercury contamination events,mercury levels in fish have gradually decreased in China over the past 30 years.The results were in sharp contrast to those found in North America and Europe.The mercury concentrations in fish were significantly anticorrelated with the fish catch and fish aquaculture and were inverse to trophic levels.Overfishing and the short lifecycle of aquaculture fish,both reducing the trophic level and the duration of mercury accumulation,were the most likely causes leading to the decline of mercury concentrations found in fish in China.

Defects Engineering in Goethite for Sustainable Paddy Soil Remediation

Oral - Abstract ID: 786

Prof. Liping Fang [1], ***Prof. Fangbai Li*** [2]

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The contamination with arsenic (As) in paddy soils is a global challenge, and arsenite [As(III)] has a relatively higher bioavailability and toxicity compared to arsenate [As(V)], determining the uptake rate of As by rice plants. It suggests that the process of radial oxygen loss (ROL) near the rhizosphere zone can induce the microbially generated Fe(II) on iron oxides (e.g. goethite) reacting with oxygen to form reactive oxygen species (ROS) that can oxidize As(III) in soils. Herein, we explored the role of structural defects of iron oxides (e.g. goethite) on the generation of ROS and the oxidation/adsorption of As(III), as well as the underlying mechanisms. The incorporation of Cu does not significantly vary the crystalline structure of goethite, while the ESR spectra suggests the increasing spinning of paramagnetism of goethite due to the increased oxygen vacancies (OV). The goethite with higher Cu contents will generally leads to a higher removal of As(III) . More importantly, the presence of Fe(II) significantly leads to a higher As(III) oxidation, and the oxidation extent is highly related to the OV contents, showing an enhanced formed As(V) from 1.5 to 3.5 mg/g. The increase of Fe(II) from 5 to 20 mg/L significantly enhances the oxidation rate from 25 to 35% at pH 7.0. Quenching experiments further demonstrate that superoxide (O_2^{*-}) and H_2O_2 are the main ROS species for As(III) oxidation, with a contribution of 65~80%, and 40~50%, respectively. The electron transfer from the adsorbed Fe(II) species will favor the generation of ROS, and the following the oxidation of As(III). The presence of OVs will accelerate this process. The findings of this work provides a new insight into in As(III) fate near the rhizosphere zone and possibly developing Fe mineral based materials by tuning structure of iron oxides for As(III) oxidation and its regulation in paddy soils.

Detection of environmental risk factors of ALS: Airborne Lead and Lead Compounds

Oral - Abstract ID: 655

***Dr. Meifang Li* [1], *Ms. Emily LuyTan* [1], *Prof. Xun Shi* [1], *Prof. Angeline Andrew* [2], *Prof. Jiang Gui* [1], *Mr. Barton Guetti* [3], *Ms. Kathleen Sullivan* [2], *Dr. Erik Pioro* [4], *Dr. Rebecca Kuenzler* [5], *Dr. Kevin Cornell* [2], *Dr. Elijah Stommel* [1]**

***1.** Dartmouth College, **2.** Dartmouth Health, **3.** Where Technologies LLC, **4.** Northwestern University, **5.** Cleveland Clinic Foundation*

ALS is a fatal neuromuscular disease. Environmental contaminants have been linked to ALS. However, contaminant sources remain inconclusive. This study developed a geospatial analysis procedure to comprehensively detect the impact of airborne Pb on ALS, using data about 695 ALS mortality cases (diagnosed during 2013-2015) and 3,519 controls in Ohio. Each subject has age, sex, and migration history information. The Pb data is the US EPA AERMOD data covering 2000-2020. We first estimated the yearly Pb exposure for each subject based on the location in that year and then calculated the cumulative, median, maximum, and minimum of each subject's exposure for the periods 1, 2, …, and up to 12 years before the index year. We then performed logistic regression to compare cases and controls, considering age, sex, and population density as confounding factors. We have found:

1) The impacts of pure Pb and Pb compounds are considerably different. Pure Pb tends to be significantly and positively associated with ALS in areas where population density is lower (OR 1.6~3.5), and the association has at least a 5-year lag effect. The positive association of Pb compounds with ALS is generally stronger (OR 1.7~4.2) and is much less related to the population density and migration history.

2) Considering pure Pb and Pb compounds together results in a more complex pattern. The combination has a generally positive association with ALS (OR 1.7~3.6), and the association in urban areas tends to lag at least eight years.

3) Cumulative, maximum, and median of the Pb exposure for a given period before the index year generated relatively consistent results. The results from the minimum are largely not significant.

Determination of 10 phenols in water using direct injection by liquid chromatography- high-sensitivity triple quadrupole tandem mass spectrometry

Oral - Abstract ID: 281

Mrs. Yi Huang [1], ***Mr. Chen Wang*** [2], ***Mrs. Zhu Rao*** [3], ***Mrs. Jing Jia*** [3], ***Mr. Zhipeng Yang*** [3]

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With the rapid economic development and frequent industrial and agricultural activities, significant amounts of industrial waste, pharmaceuticals, personal care products, and urban household waste are being discharged into the environment. These pollutants contaminate both surface water and groundwater through various pathways such as atmospheric deposition, leaching, and rainfall. Phenolic compounds, in particular, have emerged as common organic pollutants in water bodies and fall into the category of typical Endocrine Disrupting Chemicals (EDCs), which exhibit multiple effects on organisms. Compounds such as nonylphenol, bisphenol A, and other phenolic being included in the list of key concerns in China, the United States, the European Union, and other countries.

In this study, a direct injection method was developed for the determination of 10 organic phenolic compounds in water using a Liquid Chromatography- High-sensitivity Triple Quadrupole Tandem Mass Spectrometry. The method only requires a simple centrifugation of the sample, and subsequent testing after adding the internal standard. The detection limit of the method is 0.2 ng/L~ 1 ng/L. Compared with the methods of ISO 18857-2-2009 and ASTM D7574-09, the overall analytical time of this method is reduced from 5 hours to 15 min. Additionally, complicated pre-treatment techniques such as derivatization, SPE have been eliminated, which greatly minimizes the use of organic solvents. The required sample volume is significantly reduced from 250 mL to 1 mL, while maintaining high sensitivity. Therefore, it can rapidly detect the phenol residues in water with a high degree of sensitivity and selectivity.

Obviously, this method provides technical support for the rapid analysis of organic phenols in water and helps better grasp the level of phenolic compounds contamination in the environment and their distribution characteristics. The implications of this research are significant for protecting human health and safeguarding the ecological environment.

Developing evaluation index system for rural livability from a geological perspective

Oral - Abstract ID: 767

Prof. Xingchun Jiao [1], ***Ms. Yue Lan*** [1], ***Dr. Dong Zhu*** [2], ***Dr. Bo Pan*** [3]

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Livability is an organic unity of natural environment and human environment. Previous studies usually focused on livability in city and impacts of human-induced factors. With the rising of one-health view, researches on impacts of geological environment on rural livability has caused increasing concern in recent years. Some evaluation indicator systems had been developed from humanity perspective, which focus on assessing the livability considering social environment and facility environment dimensions. In this study, influencing factors including climate, geological background of tectonic structure and lithology, the accumulation and dispersion of geochemical materials, and intensity of the human activities are incorporated into a 3-level integrated indices system. Case studies were conducted in Anji and Longyou, Zhejiang Province to evaluate the rural livability in two sites with significant different geological background status. The results showed that Longyou has much higher livability index than Anji, due to the green land that was rich in selenium and high in bioavailability. The evaluation index system could reflect the livability of regional geological environment to human beings, and provide guidance for rational utilization of geological resources beneficial to health and avoidance of geological risks adverse to health.

Development of a certified reference material for accurate determination of the leaching of Pb and Zn in solid waste

Oral - Abstract ID: 172

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With the acceleration of urbanization and industrialization, solid waste generation has increased and has become a global concern. Effective management of solid waste is being strengthened in both developed and developing countries due to its adverse impacts on human health and the environment. Therefore, the implementation of precise analysis method is of great significance for reliably enforcing the current laws and regulations. Certified reference materials (CRMs) with high accuracy and traceability play a significant role in the calibration of equipment and validation of analytical method. However, there is still a lack of suitable solid waste CRMs for quality assurance and quality control. Thus, a CRM (GBW(E)085538) was developed for accurate determination and reliable measurement of the leaching of Pb and Zn in solid waste according to the requirements of ISO 17034 and the recommendations of ISO Guide 35. This study describes the steps followed for the development of the CRM. These steps include material preparation, homogeneity and stability during transport and storage, assignment of certified values and their uncertainties. The material was dried, ground, sieved and well-mixed, and the final bulk material was bottled in 1 kg portions. Analytical techniques like inductively coupled plasma-mass spectrometry (ICP-MS), inductively coupled plasma-optical emission spectrometer (ICP-OES) and flame atomic absorption spectrometry (AAS) have been used for the characterization of property values. Concurrently, an inter-laboratory comparison study involving 9 qualified laboratories was implemented to support the certification study. The certified value of Pb and Zn were (4.66 ± 0.21) mg/L and (2.95 ± 0.14) mg/L with 7-month stability. The new CRM can be used as an effective tool in testing laboratories for analytical method validation, quality assurance and quality control. It also plays a significant role in accurate determination of the leaching of Pb and Zn in solid waste.

Differences of lipid distribution between PFOA and PFOS-exposed mice and underlying mechanism

Oral - Abstract ID: 987

Dr. Ling Wang [1]

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The distribution and metabolic balance of lipids in organisms are essential for its maintenance of normal life activities. Due to their structural similarity to fatty acids, per- and polyfluoroalkyl substances (PFAS) can interfere with lipid transport and metabolic processes in organisms, causing abnormal energy metabolism and even inducing metabolic diseases. Previous studies have shown that PFAS with different structures have distinct toxicity, but the differences of lipid distribution caused by PFAS and its molecular mechanism need to be further explored.

We systematically investigated the effects of the most typical PFAS-perfluorooctanoic acid (PFOA) and perfluorooctanoic acid (PFOS) on lipid distribution, especially the abnormal distribution of lipid droplets (LDs) in hepatocytes by using a combination of metabolic rate monitoring, histopathology, molecular biology and proteomics. The content of LDs in the nucleus (nLDs) was detected by flow cytometry, demonstrating that PFOA induces abnormal accumulation of nLDs. Then the effects of PFOA and PFOS on LDs generation and transport pathways related to lipid exchange between cytoplasm and nucleus were analyzed with proteomics techniques. It was verified that PFOA can affect the expression levels of key proteins MTP, Ces1d, and Seipin in the molecular pathways related to the formation and aggregation of nLDs in hepatocytes, resulting in the abnormal accumulation of nLDs in mouse hepatocytes. Finally, several PFAS with different carbon chain lengths and structures were selected for exposure experiments to explore the structure-effect relationships between PFAS structures and the distribution and contents of nLDs and cytoplasmic LDs in mouse hepatocytes. The abnormal accumulation of LDs is closely related to a variety of metabolic diseases, and the results of this study are beneficial to the analysis of the human health effects of PFAS and to the development of PFAS alternatives with high biosafety.

Dissolved black carbon mediated photochemical transformation of contaminants in aqueous solution

Oral - Abstract ID: 324

Dr. Zhicheng Zhou [1]

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Dissolved black carbon (DBC) is the water-soluble fraction of black carbon continuum, and also an important constitute of dissolved organic matter. It is ubiquitous in natural aquatic environment. The structure model of DBC is a condensed aromatic ring substituted with abundant oxygen-containing functional groups, and mostly consisted of 5-8 aromatic ring. There are different numbers of photoreactive functional groups in the DBC's structure, such as carboxyls, hydroxyls and aromatic ketones. Previous studies have shown that DBC exhibited strong photoreactivity as compared with many well-studied DOM types (e.g., dissolved humic substancess/DHS), and might significantly affect the photochemical processes of contaminants in aquatic environments.

In this study, we investigated the mediated effect of DBC on the photochemical transformation of 2 model contaminants (17β-estradiol and As(III)). DBC was prepared from the water extraction of bulk black carbon derived from biomass. The photochemical experiment was conducted in a 40-mL glass vials placed in a water-circulating jacket, and the simulated sunlight was generated by a xenon lamp.

The presence of DBC facilitates the photo-transformation of 17β-estradiol and As(III), with a mediation efficiency significantly higher than DHS (1.2 - 4.7 times higher). Triplet-exited states plays a critical role during the DBC-mediated photoreaction, with a contribution over 50%. The high mediation efficiency of DBC is owing to its high quantum yield of triplet-exited states. The strong ability of DBC to produce triplet-exited states is related to the structure of DBC, and can be attributed to its higher contents of aromatic groups and smaller molecular sizes.

Dissolved Organic Matter Ignited the Enrichment of Iodine in Groundwater

Oral - Abstract ID: 243

Prof. Xianjun Xie [1], ***Dr. Xingtao Liu*** [1]

1. *China University Geosciences Wuhan*

High iodine groundwater has emerged as a globally recognized type of geological pollution in recent years, with prolonged high iodine intake leading to serious thyroid disorders. The hydrogeochemical environment and certain microorganisms in high iodine groundwater have been identified, yet knowledge of the functional metagenome and thermodynamic mechanisms remains limited. This study conducted metagenomic analysis, dissolved organic matter (DOM) fluorescence characteristics (EEM), and molecular composition testing (FT-ICR MS) on typical high iodine groundwater samples from the Hetao Basin in Inner Mongolia. Computational analysis has provided initial insights into the DOM molecular performance and thermodynamic properties which reveals how microbial metabolism involving DOM degradation affects the iodine cycle. Additionally, it sheds light on the role of microbial functional genes in controlling the iodine cycle. The study results elucidate that with increased iodine concentration, the DOM molecules exhibit lower stability and higher unsaturation, making them more susceptible to microbial utilization. This infers microbial involvement in the iodine enrichment process in aquifers. Functional genomics testing suggests that high iodine groundwater is typically located from sulfate-reducing to methanogenic zones. When the abundance of functional genomes associated with nitrogen, sulfur, iron, and iodine metabolism doubles, a corresponding increase in the total iodine concentration in groundwater is observed. This correlation enables the identification of key microbial pathways involved in the migration and transformation of iodine. The pathways include direct reactions (iodate reduction and organic matter dehalogenation), enzyme-guided reactions (nitrate reductase), and indirect iodate reduction via metabolic byproducts (HS^- & Fe(II)). Metagenomic analysis combined with high-precision DOM studies represents an advanced approach for the precise elucidation of the micro-mechanisms of iodine migration and transformation. Consequently, this research provides theoretical underpinnings and novel insights for understanding the genesis and enrichment mechanisms of naturally occurring high-iodine groundwater.

Keywords: High iodine groundwater, Dissolved Organic Matter, Microorganism, Metagenomics, Biogeochemistry

Distinct physiological and molecular responses of regulated endogenous IAA on fluoranthene uptake in ryegrass

Oral - Abstract ID: 593

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Polycyclic aromatic hydrocarbons (PAHs) can be absorbed, translocated, and accumulated by plants. Fluoranthene (Flu), a tetracyclic aromatic hydrocarbon, was frequently detected at high levels, particularly in soil. Flu in soil can accumulate in plants and in humans through the food chain, posing significant health risks. Our previous research indicated that the uptake of fluoranthene (Flu) in ryegrass exhibited concentration-dependent behavior. Specifically, the bioconcentration factor (BCF) of Flu increased and subsequently decreased with the increasing Flu concentration. To unravel the underlying mechanisms, we employed integrated transcriptomic and physiological analyses. The results showed that increased IAA enhanced H^+-ATPase activity, and H^+-ATPase facilitates active transport of Flu by providing energy and regulating H^+ flux under low-concentration Flu treatments. In addition, the uptake of Flu exhibited a negative correlation with antioxidant enzyme activities under high-concentration Flu treatments. Key genes associated with IAA, including TAA1, ALDH, and AAO1/2, as well as H^+-ATPase-related genes (ATP5A1, ATP5B, ATP5H, ATP6E) and the ABC transporter protein gene ABCB1, played pivotal roles in Flu uptake. To elucidate the modulation of plant responses to Flu pollution by endogenous IAA, the IAA promoter (α-aminobutyric acid [α-AB]) and an IAA inhibitor (naphthylphthalamic acid [NPA]) were employed. Results demonstrated that Flu+AB treatment enhanced Flu accumulation, while Flu+NPA treatment diminished it. The promoted H^+-ATPase activity under Flu+AB treatment and increased superoxide dismutase (SOD) activity under Flu+NPA treatment contributed to these effects. Furthermore, Flu+AB treatment elevated the transpiration rate in ryegrass, thereby promoted the Flu translocation, whereas Flu+NPA treatment showed the opposite trend. In summary, hormone synthesis and active transport pathways collectively modulated Flu uptake, providing potential avenues for regulating Flu accumulation in plants.

Distribution of inorganic contaminants along the Uruguayan coast

Oral - Abstract ID: 151

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The aim of this work was to study the distribution of relevant inorganic contaminants in environmental samples from Ciudad de la Costa, the second most populated city of Uruguay. For this task aluminum (Al), cadmium (Cd), chromium (Cr), nickel (Ni) and lead (Pb) levels were determined in sand, water, and plant material from six beaches that are located in the area. Analytical methods based on electrothermal atomic absorption spectrometry determinations were successfully validated. Accuracy was ensured by using appropriate certified reference materials and spiking procedures. Average metal concentrations in sand and water samples were compared with the maximum limits established by international or national regulations (when available), being far below these limits in all cases. Inorganic contaminants levels in sand were below those previously reported in sediments from Montevideo Bay, showing a less polluted

area while moving away from the highly industrialized center of Montevideo. This may indicate that the inorganic contamination in the studied area is rather low, despite the rapid increase in anthropic activities in recent years. To give a deeper characterization of the ecosystem, metal accumulation and mobility within a common plant of the zone, Ammophila arenaria, were studied. Results showed that concentrations in roots were one order of magnitude higher in comparison to aerial parts. In addition, the bioaccumulation coefficient (BAC) showed that the plant accumulates Cd, Cr and Ni, while a low accumulation for Pb was observed. Finally, a Cr(VI) speciation analysis in Ammophila arenaria was performed, showing Cr(VI) percentages below 4.6%, which is relevant from the (eco)toxicological point of view due to the high environmental mobility and bioavailability of this valence state. This work constitutes the first environmental surveillance report of this kind, regarding this populated area of the country.

Double-walled Al-based MOF with large microporous specific surface area for trace benzene adsorption

Oral - Abstract ID: 449

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Volatile organic compounds, such as benzene vapor, widely exist in indoor and cause health risk for humanity, even at trace concentration. Double-walled metal-organic frameworks (MOFs), synthesized using Zn and Co, are potential porous materials for trace benzene adsorption. Aluminum is with low-toxicity and abundance in nature. Therefore, a novel double-walled Al-based MOF, named as ZJU-520(Al), with large microporous specific surface area of 2235 m^2/g and pore size distribution in the range of 9.26 – 12.99 Å, was synthesized. It is with excellent thermal-chemical stability, and consisted by helical chain of AlO_6 clusters and 4,6-Di(4-carboxyphenyl)pyrimidine ligands. ZJU-520(Al) exhibits unprecedented trace benzene adsorption up to 5.98 mmol/g at 298 K and P/P_0 = 0.01. Adsorbed benzene molecules are trapped on two types of sites. One (site I) is near the AlO_6 clusters, another (site II) is near the N atom of ligands, using Grand Canonical Monte Carlo simulations.

Earthworms took differential strategies faced with specific neonicotinoid-A kinetic metabolomic study

Oral - Abstract ID: 424

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Metabolomic responses of earthworms to neonicotinoids are important for understanding their molecular-level toxicity and assessing their ecological risks, but little is known until now. We investigated impact of imidacloprid (IMI, 52.6 ng/g) and dinotefuran (DIN, 52.5 ng/g) on *Eisenia fetida* metabolomics under single- and dual-compound exposure scenarios for one to four weeks. Dissimilar metabolites and anti-stress strategies were found for different neonicotinoids and exposure scenarios. Specifically, IMI exposure first increased *myo*-inositol and UDP-glucuronate associated with transmembrane absorption and transformation to IMI-urea, and then increased glutathione and fourteen amino acids (TCA cycle precursors) to resist stress and replenish energy. In contrast, worms exposed to DIN first prepared TCA cycle intermediates from glucosamine-6-phosphate and amino acids, suppressed urea cycle and DIN transformation, and then alleviated oxidative stress by increasing carnosine, nicotinate-D-ribonucleotide and nicotinamide-β-riboside. Dual exposure increased four eicosanoids by 1.6-1.9-fold, possibly associated with membrane lipid peroxidation; the amino acids consumed to balance the energy metabolism exhibited a wave-like pattern. This study first systematically revealed the compound/time/exposure scenario- dependent effects of trace neonicotinoids on earthworm metabolomics and advanced the understanding of their action modes. Neonicotinoid transformation was closely related to worms' metabolic profiles, providing important insights in contaminant fate in soil ecosystems.

Ecosystem Health and Sustainable Development

Oral - Abstract ID: 72

Prof. Bojie Fu [1]

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Human impact on the natural environment has intensified, ushering in the Anthropocene era. The Earth's surface processes are increasingly shaped by human activities, leading to a myriad of resource issues, disasters, and ecological challenges. Globally, 60% of ecosystem services are in a state of degradation. One of the primary challenges confronting humanity is the simultaneous satisfaction of present and future needs while preserving the atmosphere, water, soil, and biological resources provided by ecosystems.

To address these challenges, we have proposed a comprehensive framework for regional sustainable development known as the pattern–process–service–sustainability model. This approach was applied in a case study of the Loess Plateau in China, an area plagued by severe soil erosion. The study evaluated changes in key ecosystem services, including water regulation, soil conservation, carbon sequestration, and grain production. A thorough analysis of trade-offs among these services was conducted against the backdrop of evolving landscapes due to the implementation of the Chinese government's Grain to Green Program (GTGP). The findings revealed significant transformations in ecosystem services, prompting the discussion of adaptive management strategies focused on restoring and enhancing the sustainable capacity of ecosystems.

In the context of advancing Sustainable Development Goals (SDGs) globally, we have proposed a systematic classification framework categorizing the 17 SDGs into three groups: "Essential Needs," "Objectives," and "Governance." Emphasizing the role of effective governance, this framework aims to minimize essential needs while maximizing anticipated objectives. Additionally, we introduced a systems approach for global sustainable development, denoted as 'classification–coordination–collaboration.' This approach serves as a roadmap for achieving short-term breakthroughs while ensuring substantial progress in the long run, facilitating the realization of key SDGs.

Ecotoxicological effects of PFAS compounds on acute avoidance, lethality, and reproduction of earthworms (Eisenia fetida) and soil microbial communities

Oral - Abstract ID: 126

Mr. Viraj Gunarathne [1], ***Ms. Felizitas Boie*** [2], ***Dr. Tatiane Medeiros Melo*** [1], ***Mrs. Marina Schauerte*** [1], ***Mr. Robin Vieler*** [1], ***Prof. Jörg Rinklebe*** [3]

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This study aimed to evaluate the ecotoxicological impacts of selected PFAS compounds on earthworms (*Eisenia fetida*) and soil microorganisms. The evaluation encompassed three PFAS compounds—namely, PFBS, PFHxS, and PFOS—with concentrations ranging from 100 to 1100 mg/kg, examining acute avoidance, acute lethality, and reproduction of earthworms in an artificial soil medium. The artificial soil medium constituted with peat, clay, and sand at a 1:2:7 ratio (pH = 7.2) was divided and individually spiked with PFAS compounds at appropriate concentrations. Subsequently, the spiked soil underwent pre-incubation for 100 days at 60% of its water-holding capacity. The acute avoidance test utilized 10 earthworms per vessel, while acute lethality and reproduction tests were conducted with 8 earthworms per vessel. The acute avoidance test data were acquired after 2 days whereas the observations were made for the acute lethality test after 14, 28, and 56 days and the reproduction test after 28 and 56 days. Subsamples of soil were separated at the end of the pre-incubation period from each treatment vessel to evaluate soil microbial community structure using PLFA extraction and analysis. Earthworm avoidance exceeded 70% for all the PFAS-treated soil while 100% avoidance was reported for PFOS-treated soil with concentrations exceeding 300 mg/kg. PFHxS and PFOS resulted in significantly higher lethality for earthworms compared to the PFBS. PFHxS ≥ 500 mg/kg and PFOS ≥ 800 mg/kg caused 100% lethality for earthworms. The reproduction was restricted to PFBS 100 and 300 mg/kg, and PFHxS 100 mg/kg treatments only after 56 days. Comparatively low levels of soil PFAS contaminations yielded an augmentation in PLFA biomass, whereas elevated concentrations hindered PLFA biomass in comparison to the control treatment. The findings suggested increasing toxicity of the studied PFAS compounds in the order of PFBS, PFHxS, and PFOS in the contexts of earthworms and soil microorganisms.

Effect mechanism of antibiotic-microplastic combined pollution on the nitrogen cycle in water-plant-sediment micro-ecosystem

Oral - Abstract ID: 708

Dr. Siyu Zhang [1]***, Dr. Hao Wang*** [2]***, Mr. Zhe Wu*** [1]***, Mr. Wei Hua*** [1]***, Prof. Jianfeng Peng*** [1]

1. *Tsinghua University,* ***2.*** *Peking University*

New pollutants have been considered relatively new threats to the environment. Limited research exists on the combined pollution characteristics of antibiotics and microplastics (MPs) in the water-plant-sediment ecosystem, as well as their effects on the growth of plants. Current research predominantly focuses on the toxicological effects of single pollutants on aquatic plants. This study utilized the aquatic species *Vallisneria natans* (*V. natans*) as the experimental subject. Standard polyethylene (PE) microplastics and antibiotic sulfonamide (SA) found in the environment were employed to investigate the physiological and ecological response mechanisms of *V. natans*. Substantial variations were observed in developmental traits, physiological parameters, nutritional distribution, and antioxidant capacity under the singular stress of polyethylene and the combined pollution of PE-SA. The structure and diversity of microbial communities in water and sediments exhibited differences. Low concentrations of polyethylene significantly influenced microbial diversity in the floating water. Polyethylene and sulfonamide compound pollution stress inhibited the generation of dissolved oxygen in roots and the degradation of sulfonamide in the water environment under PE-SA combined pollution stress. Under the stress of PE-SA combined pollution, polyethylene can inhibit the degradation of sulfonamide in the water environment. With PE-MPs in the system, the nutrient elements cycle in the ecosystem was significantly affected by polyethylene, indirectly influencing the growth, physiological state and photosynthesis of *V. natans.* Under the combined pollution stress of PE and SA, there was a positive impact on the growth, physiological state, and photosynthesis of *V. natans*. However, concentrations of nutrient elements and sulfonamide in the overlying water negatively affected the growth, physiological state and photosynthesis of *V. natans*. The significance of this study lies in elucidating the effects of PE-SA on aquatic vascular plants and providing new insights for developing control strategies to mitigate the toxicological impacts of MPs and antibiotics on freshwater ecosystems.

Effect of molecular size fractionation on the redox properties of dissolved organic matter

Oral - Abstract ID: 266

Mr. jiang Xiao [1]**, *Prof. Zhenqing Shi*** [1]

1. *South China University of Technology*

Soil dissolved organic matter (DOM) acts as a critical electron transfer mediator regulating a series of redox processes such as greenhouse gas emissions and the biogeochemical cycle of metal minerals and contaminants. The redox properties - electron-accepting capacities (EAC) and the electron-donating capacities (EDC) of DOM, highly depend on their intrinsic physicochemical properties, such as molecular weight (MW). However, little is known about the MW-dependence of DOM redox properties at the molecular level.

The objective of this study is to investigate the redox properties of size-fractionated DOM, and build the relationship between MW and redox properties of fractionated DOM. To achieve this, heterogenous DOM samples were isolated into different size fractions based on molecular size by a serial ultrafiltration technique. The UV–vis/fluorescence spectroscopy and FT-ICR-MS were employed to analyze the optical properties and molecular composition of the size-fractionated DOM, respectively. The results demonstrated that MW fractionation changed the molecular composition of DOM. With increasing MW the aromaticity of the size-fractionated DOM increased while its aliphaticity decreased. Moreover, our results showed that the EAC and EDC of DOM increased with the increase of MW of the fractionated DOM, and were positively related to the high MW fractions (condensed aromatics and polyphenol compounds) while negatively related to light MW fractions (aliphatic/protein compounds). Interestingly, sulfur-containing compounds of DOM had considerable contributions to EDC, which may be related to the existence of heteroatom S in soil DOM. Overall, our results highlight the importance of MW as a key predictor of DOM's redox properties. This study will help to understand the changes in redox properties of DOM during environmental processes, such as mineral adsorption fractionation, at the molecular level.

Effect of Per- and Polyfluoroalkyl Substances on the Reactivity and Selectivity of Trichloroethylene-NAPL Degradation by Sulfidized Nanoscale Zerovalent Iron

Oral - Abstract ID: 586

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1. *Zhejiang University*

Per- and poly-fluoroalkyl substances (PFASs) and nonaqueous phase liquid (NAPL) are common co-contaminants in the groundwater at fire-fighting and military training sites. However, it is unclear how PFASs affect the dechlorination performance of sulfidized nanoscale zerovalent iron (S-nFe^0), which is an emerging promising remediation agent for NAPL. Herein, S-nFe^0 synthesized with controllable S speciation (FeS or FeS_2) were characterized to evaluate their interactions with PFASs and their dechlorination performance for trichloroethylene NAPL (TCE-NAPL). The surface-adsored PFASs blocked materials' reactive sites and inhibited aqueous TCE dechlorination. In the presence of TCE-NAPL, the materials with improved hydrophobicity after PFASs adsorption tended to enrich at the NAPL-water interface, and the reactive sites were re-exposed after the accumulation of PFASs into the NAPL phase, accelerating dechlorination. This PFASs-induced phenomenon enabled the materials to exhibit a higher reactivity (up to 1.8-fold) with a high electron efficiency (up to 99%) for TCE-NAPL dechlorination. Moreover, regardless of coexisting PFASs, nFe^0-FeS_2 with higher hydrophobicity was more easily enriched at the NAPL-water interface than nFe^0-FeS, and has stronger reactivity and selectivity. These results reveal that small but previously overlooked coexisting PFASs can promote selective reduction of TCE-NAPL by S-nFe^0, highlighting the importance of hydrophobicity and transportation of materials induced by S and PFASs for NAPL remediation.

Effectiveness of a novel organoclay in contrast to colloidal activated carbon for the PFAS immobilization under dynamic redox conditions and assessing the response of soil microbial communities

Oral - Abstract ID: 127

Prof. Jörg Rinklebe [1], ***Mr. Viraj Gunarathne*** [2], ***Mrs. Marina Schauerte*** [2], ***Ms. Felizitas Boie*** [3], ***Dr. Xing Yang*** [4], ***Dr. Tatiane Medeiros Melo*** [2], ***Mr. Frederik Dörnen*** [2], ***Dr. Bosch Julian*** [5], ***Dr. Andreas Fritzsche*** [6]

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This study evaluated the effectiveness of Intraplex® A, a novel adsorptive organoclay against Intraplex® B, a colloidal activated carbon for the immobilization of per- and polyfluoroalkyl substances (PFAS) under pre-defined redox regimes. Shifts in soil microbial community structure were assessed to determine the ecotoxicological effects of amendment addition. The PFAS-contaminated soil collected from a former military airport site in Viersen, Germany was treated with Intraplex® A and Intraplex® B and pre-incubated along with untreated contaminated soil. An automated microcosm system was employed to control the redox potential and subsamples were collected at five pre-defined redox windows ranging between -100 to +500 mV. The liquid- (<0.45 µm) and solid-phases (>0.45 µm) of sub-samples were divided and respective phases were used to determine dissolved PFAS concentration and microbial community structure via PLFA analysis. Intraplex® B treatment reported significantly less dissolved PFAS concentrations in all redox windows used compared to the Intraplex® A and control treatments. Intraplex® B thus maintains a superior adsorption capacity toward PFAS regardless of the redox potential. Nonetheless, the comparatively higher percentage of short-chain PFAS remained in the liquid-phase of Intraplex® B treatment indicating its' relatively low affinity toward short-chain PFAS. The PLFA profiles obtained for all three treatments indicated comparatively similar patterns implying negligible ecotoxicological effects of amendment application for native microbial communities. The findings of this study underscore the high effectiveness and ecologically safe use of Intraplex® B for remediation of PFAS-contaminated soil under redox potential fluctuations.

Effects of cadmium stress on the enrichment characteristics and photosynthetic capacity of pepper from different varieties

Oral - Abstract ID: 536

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This study aimed to explore the differences of cadmium(Cd) stress response in the different pepper varieties, and screen out varieties with low Cd accumulation and strong Cd tolerance. The twelve pepper varieties were selected to study the effect of different cadmium levels (0 and 2.5 $mg \cdot kg^{-1}$ Cd) on cadmium migration and enrichment ability, and its photosynthesis characteristics. The results showed that the varieties with the highest and lowest Cd concentrations are Ruanpi 2307 and Xingxiu in roots, stems and leaves among twelve pepper varieties, respectively. The Cd concentrations in the fruits of Longfu, Changxing 8 and Xiangxin 28 were lower than the other nine varieties, and the order was Xiangxin 28＞Changxing 8＞Longfu. At the same level of Cd, the enrichment and transport coefficients of Cd in roots, stems, leaves and fruits of Xiangxin 28, Changxing 8 and Longfu were lower than others. The target hazard quotient (THQ) model showed that the health risk from pepper consumption was the highest in the Xingxiu (1.37), Chengyan (1.15), Xiangla 699 (1.13), and the values of THQ in Changxing 8 (0.73), Xiangxin 28 (0.72), Longfu (0.58) was the lowest. The effect of Cd on gas exchange and chlorophyll fluorescence in Xiangyan 55, Ruanpi 2307, Xiangxin 28 and Longfu were not significant, and the value of the net photosynthetic rate (Pn) and maximal photochemical efficiency (Fv/Fm) in Xiangyan 55 and Longfu were higher than those in Ruanpi 2307 and Xiangxin 28. The Fv/Fm of Chengyan and XiangLa 14 were lower than that in other varieties, indicating that the photochemical efficiency of these two varieties was lower than that of other varieties under Cd stress. The comprehensive evaluation results of cadmium tolerance showed that Xiangxin 28 and Longfu could be cultivated as low Cd accumulation and cadmium-tolerant variety.

Effects of PFAS exposure on children gut microbiota dysbiosis and neurobehavioral development

Oral - Abstract ID: 589

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Studies on the role of the gut microbiota in the associations between per- and polyfluoroalkyl substance (PFAS) exposure and adverse neurodevelopment are limited. Umbilical cord serum and faeces samples were collected from children, and the Strengths and Difficulties Questionnaire (SDQ) was conducted. Generalized linear models, linear mixed-effects models, multivariate analysis by linear models and microbiome regression-based kernel association tests were used to evaluate the associations among PFAS exposure, the gut microbiota, and neurobehavioural development. Perfluorohexane sulfonic acid (PFHxS) exposure was associated with increased scores for conduct problems and externalizing problems, as well as altered gut microbiota alpha and beta diversity. PFHxS concentrations were associated with higher relative abundances of *Enterococcus spp.* but lower relative abundances of several short-chain fatty acid-producing genera *(e.g., Ruminococcus gauvreauii group spp.)*. PFHxS exposure was also associated with increased oxidative phosphorylation. Alpha and beta diversity were found significantly associated with conduct problems and externalizing problems. *Ruminococcus gauvreauii group spp.* abundance was positively correlated with prosocial behavior scores. Increased alpha diversity played a mediating role in the associations of PFHxS exposure with conduct problems. Our results suggest that the gut microbiota might play an important role in PFAS neurotoxicity, which may have implications for PFAS control.

Effects of Phosphate on Immobilization of As in Soil by Fe-modified Biochar

Oral - Abstract ID: 463

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Arsenic (As) contamination in soil is a serious problem worldwide. Biochar, as a porous carbon-rich material, is commonly used as soil amendments and immobilizers to various potentially toxic elements. However, the pristine biochar may increase the As mobility and plant-availability. To ease the disadvantages, further modification of biochar by embedding Fe-containing materials has been frequently studied. Phosphate, as a dominant component in fertilizers, is applied in soil in a huge amount. It has similar chemical properties with arsenate As(V) and can compete with the active adsorption sites on the Fe-modified biochar. To study the effects on the effects of phosphate on the immobilization of As in soil by Fe-modified biochars, batch adsorption experiments were conducted first then followed by a soil incubation experiment for 30 days. Three different Fe-modified biochar, zero-valent iron-modified biochar (ZBC), magnetite-modified biochar (CSBC), and goethite-modified biochar (GBC), were used owing to their different mechanisms of As immobilization. Our results suggested that As(V) in solution were mainly controlled by chemical and electrostatic adsorption. When arsenate co-existed with phosphate, competitive adsorption occurs in different pH solutions and adsorption times. When the concentration of the phosphorus solution is higher, the competitive adsorption of arsenate and phosphate on the surface of biochar becomes more obvious. The effect of phosphate on soil arsenic fixation in GBC and CSBC remediation was investigated through 30-day soil incubation experiments. Phosphate application increases soil arsenic availability and concentrations of water-soluble arsenic. Adding CSBC alleviates the impact of phosphate on arsenic and significantly reduces the bioavailability of soil arsenic. CSBC can change the speciation of As in soil, achieving the immobilization of arsenic. In addition, the rich organic matter of biochar also improves the enzyme activities of soil catalase and soil peroxidase, which is beneficial to soil health.

Effects of polystyrene micro/nanoplastics on soil denitrification and microbial community

Oral - Abstract ID: 645

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Recent studies have revealed a lack of knowledge regarding the impact of nanoscale plastics on biogeochemical cycles in natural environments. Our research aims to address this gap by investigating the effects of nanoplastics (NPs) on denitrification processes in wetland soils, and contrasting them with the more extensively studied microplastic particles (MP). A study was conducted to investigate the impact of polystyrene (PS) particles of varying sizes (100 micrometers, 7 micrometers, and 80 nanometers) on denitrification activity and the bacterial communities hosting nirS and nirK genes in wetlands. The results indicated that the presence of PS-MP did not significantly affected denitrification rates. However, PS NPs significantly improved denitrification efficiency. Exposure to nanoparticles resulted in changes in the community composition. Further analysis confirmed the crucial role of nirS-type denitrifier in promoting denitrification, potentially by accelerating the release of organic substrates from the nanoparticles. Additionally, the study of microbial interactions revealed that nanoparticle treatments fostered denser and more complex networks among denitrifiers. It was indicated that nanoparticles (NPs) may have a stronger impact on denitrification compared to their larger microplastic (MP) counterparts. This study provides insights into how plastic pollution affects nitrogen cycles in wetland ecosystems. Further investigation is needed to understand the potential rise in gaseous nitrogen emissions resulting from NP contamination in these globally distributed ecosystems.

Effects of resistant environment on microbially mediated arsenic mobilization in geogenic contaminated groundwater

Oral - Abstract ID: 930

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Geogenic contaminated groundwater (GCG) is widely distributed on the globe. The excessive use of antibiotics in medicine and breeding has led to the accumulation of antibiotics in groundwater, which further induced the production of antibiotic resistance genes (ARGs). Consequently, geogenic contaminants and resistome may co-enrich in supplying aquifers, exerting increasingly unpredictable risks to human health and ecosystem functions. Currently, many studies explored the effects of ARGs on microbial migration or transport, but paid little attention to the environmental effects of ARGs as a driving force on evolution of GCG. Here, we present the first line of novel insights into the impacts of resistant environments on microbially-mediated arsenic mobilization and transformation in GCG. Specifically, field investigations in the Datong Basin, northern China, were combined with laboratory microcosm experiments, functional gene quantitative sequencing, and hydro(bio)geochemical modeling to provide quantitative understanding on controlling factors affecting the distribution of resistome and on the migration processes of arsenic in resistant environments. Overall, the results indicate that in shallow (<30 m) and deep aquifers (>30 m), high-level antibiotics (two or more antibiotics with detected concentrations >1 μg/L) inhibit Fe(III) reduction, and in shallow aquifers, high-level antibiotics inhibit sulfate reduction additionally. Indigenous microorganisms may develop a synergistic efflux resistance mechanism against antibiotics and As in resistant environments. Reverse simulation of profiles at different antibiotic levels reveals that reductive dissolution of iron oxides driven by sulfate reduction may be inhibited, thereby suppressing the migration of As. However, dual stress from As and antibiotics could trigger a cross resistance mechanism, whereby *qepA* controls the production of proteins that simultaneously excrete arsenic and ofloxacin. Our results provide not only new insights into the environmental effects of resistome, but also theoretical basis for the management of high arsenic groundwater in the Anthropocene.

Electron transfer between water and hydroxyl groups on solid surface determine OH and H radical generation in contact electrification

Oral - Abstract ID: 982

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Redox reactions occurring at the microdroplets and aqueous interface are the most important chemical processes in chemistry, catalysis, and even biology. Despite advances in oxidation processes in aqueous microdroplets, our understanding of reduction processes observed in microdroplets is very limited. Here we report that hydrogen radical was spontaneously generated when contact happened between water and SiO_2 based on the measurements of fluorescence probe analysis and electron spin resonance spectra. The production of hydrogen radicals was further confirmed by the reaction of nitrate with hydrogen radicals to form nitrite. We found that the amount of substances involved in the contact process, including water and SiO_2, determines the yield of hydrogen radicals. Additionally, the production of hydrogen radicals linearly correlated with the electron transfer caused by contact electrification. We propose a possible mechanism that hydrogen radical is generated from hydrogen ions by trapping a single electron. Our observations suggest that reactive oxygen species and reductive species are coexisting in the aqueous microdroplets.

Emerging Challenges to Drinking Water Safety: Persistent Microbial Contaminants

Oral - Abstract ID: 425

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The effective control of microbial contaminants is a fundamental requirement for ensuring the safety of drinking water. The persistent presence of emerging microbial contaminants, such as dormant bacteria like "Sleeping Beauty" bacteria, health-effect cellular components like antibiotic resistance genes (ARGs), and bacterial endotoxins, poses new challenges in this regard.
Disinfection processes such as chlorination, chloramination, and UV treatment can induce bacteria to enter a "Sleeping Beauty" state. In this state, bacteria lose their ability to reproduce, but they still maintain physiological activity and can potentially recover under suitable conditions. Transcriptomic studies have shown significant upregulation of genes related to self-protection, giving them extraordinary tolerance.
Antibiotic resistance genes (ARGs) exhibit stable and persistent presence in drinking water. In addition to non-antibiotic selective pressures like mutagenic disinfection byproducts, the most significant and common characteristic of drinking water—oligotrophic—can eliminate the fitness cost of resistant bacteria, allowing them to survive in drinking water with (almost) no antibiotics, without being outcompeted by wild-type bacteria.
Bacterial endotoxins, lipopolysaccharides (LPS) from Gram-negative bacterial cell walls, have emerged as a new problem in light of the COVID-19 pandemic. The stagnant residence of bacteria in distribution systems, leading to a cycle of growth-decay-regrowth, has resulted in a sharp increase in the levels of this contaminant.
The aforementioned microbial contaminants may lead to an underestimation of the epidemiological risks posed by pathogenic microorganisms in drinking water, and can further amplify existing microbiological risks through revival and horizontal gene transfer. Their control requires further in-depth research and exploration.

Emissions of biogenic volatile organic compounds from urban green spaces in the core districts of Beijing

Oral - Abstract ID: 543

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Urban green spaces (UGSs) are often positively associated with the health of urban residents. However, UGSs may also have adverse health effects by releasing biogenic volatile organic compounds (BVOCs) and increasing the ambient concentrations of ozone (O_3) and secondary organic aerosols in urban areas. BVOC emissions from UGSs might be underestimated because of the lack of consideration of the UGS land-use type in urban areas. As such, in this study, we used a newly released satellite dataset, Sentinel-2, with a resolution of 10 m, to derive the classification distribution of UGSs and predict the UGS emissions of BVOCs in Beijing. The results showed that, in 2019, the annual emissions of BVOCs from UGSs were approximately 2.9 Gg C (95% confidence interval (CI): 2.4–3.3) in the six core districts, accounting for approximately 39% of the total UGS emissions in Beijing. Compared with the results based on Sentinel-2, the BVOC emissions might be underestimated by approximately 37% (95% CI: 11–63) using the commonly used satellite dataset. UGSs produced the highest BVOC emissions in summer (from June to August), accounting for 75.2% of the annual emissions. UGSs contributed the most to the O_3 formation potential in summer, accounting for 41.5% of the total. We could attribute a considerable amount of the O_3 concentration (27.0 μg m^{-3}, 95% CI: 21.4–32.6) to the UGS BVOCs produced in the core districts of Beijing in July. The new BVOC emissions dataset based on Sentinel-2 vegetation information facilitates modeling studies on the formation of surface O_3 in urban areas and assessments of the impact of UGSs on public health.

Emulsified oil adsorption using sorbent developed from co-pyrolysis of oily sludge and sawdust

Oral - Abstract ID: 761

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Co-pyrolysis of oily sludge and biomass is a promising method to increase the quality and yield of biomass-derived pyrolytic oil. However, it is necessary to find a pathway to use the chars from co-pyrolysis. The objective of this study was to investigate the performance of chars produced from the co-pyrolysis of oily sludge (O) and sawdust (S) at different temperatures (400-700 °C) and feedstock S: O mass ratios (1:1-4:1) on oil adsorption from emulsified oils (conventional heavy crude oil and very low sulfur fuel oil). The results showed that a higher S: O mass ratio can increase the oil adsorption capacity of the char. The largest oil adsorption capacity was obtained by the char prepared at a co-pyrolysis temperature of 600°C with an S: O mass ratio of 4:1. The maximum oil adsorption capacity (495.19 mg/g) for conventional heavy crude oil was obtained from the Langmuir isothermal model. The adsorption kinetics followed the pseudo-second order. The characterization results showed that the larger surface area (from 54.1 m^2/g for 600-OS to 475.2 m^2/g for 600-4:1 char) and pore volume (from 0.08 cm^3/g for 600-OS to 0.28 cm^3/g for 600-4:1 char) were shown with the higher S: O mass ratio. The results of water contact angle also show that the hydrophobicity of the char increases with the temperature (from 129.6° for 400-4:1 to 144.2 ° for 700-4:1). Fourier transform infrared spectroscopy (FTIR) indicated that adding sawdust can increase the non-polar functional groups on the char after co-pyrolysis (from 400-600 °C). However, a higher pyrolysis temperature (700 °C) can remove these functional groups. Furthermore, oily wastewater with low pH and high salinity was also found to be favorable for oil adsorption. The char developed from the co-pyrolysis of oily sludge and biomass shows application potential in removing emulsified oil from oily wastewater.

Enhanced anaerobic digestion of complex organic carbon under tetracycline-stressed conditions

Oral - Abstract ID: 137

***Ms. Yuyin Wang* [1], *Dr. Guangxue Wu* [1]**

1. *University of Galway*

Tetracycline exerts inhibitory effects on anaerobic digestion systems fed with complex carbon sources. This study comprised two main parts. Firstly, it investigated the effects of tetracycline on anaerobic digestion systems with two operational modes, continuous-flow reactors (CFRs) and sequencing batch reactors (SBRs). Secondly, both operational modes and powdered activated carbon (PAC) addition were employed to regulate complex carbon sources and tetracycline removal. Tetracycline hindered chemical oxygen demand (COD) removal, resulting in a decrease of 23.9% (CFRs) and 20.5% (SBRs), with volatile fatty acids (VFAs) accumulation. Methane production rates were decreased by 24.5% (CFRs) and 48.8% (SBRs) due to tetracycline. Nevertheless, PAC addition proved effective in mitigating these adverse effects, achieving complete COD removal in the PAC-amended CFR and enhancing maximum methane production rates by 15.6% (CFRs) and 13.8% (SBRs). For tetracycline removal, biodegradation was the dominant pathway with PAC enhancing this process. Importantly, PAC improved tetracycline biodegradation by 24.4% (CFRs) and 19.2% (SBRs), without reinforcement of adsorption. In comparison between the two operational modes, CFRs exhibited superior recovery under COD shock loading, with increased methane production rates and enhanced pollutant removal compared to SBRs. Additionally, the impact of PAC on propionate degradation differed under the two operational modes, with PAC primarily enhancing methane production rates in CFRs but propionate degradation in SBRs. Prolonged tetracycline exposure inhibited the enrichment of functional microorganisms, such as propionate-oxidizing bacteria and methanogens, while the continuous-flow mode and PAC addition provided a conducive environment for the enrichment of these functional microorganisms, especially *Geobacter*. Detected ethanol in CFRs suggested the potential presence of direct interspecies electron transfer (DIET), elucidating the enhanced pollutant removal. Meanwhile, genes encoding carbon dioxide reduction in *Methanothrix* further suggested DIET contributing to efficient methane production in CFRs and PAC-amended reactors.

Enhanced pollutants reduction by zero-valent iron composites through ball milling: Synergy of electron storage and electron transfer.

Oral - Abstract ID: 616

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The electron storage quantities and electron transfer rate of the reductants are the most critical factors to determine the contaminants degradation in aqueous solution. Zero-valent iron (Fe^0) has been considered as a potential reducing agent due to its considerable amount of electron storage, and a variety of modification methods have been explored to strengthen the low electron transfer rate of the Fe^0 in the past 30 years. In this study, Fe_3O_4, sulfur, biochar and oxalic acid were prepared for the reduction of pollutants, such as hexavalent chromium (Cr(VI)), 1,2-dichloroethene (cDCE) and vinyl chloride (VC) . The results that the synthesised Fe^0-Fe_3O_4 composite showed a splendid synergy between the abundant electron storage of Fe^0 and the fast electron transfer of Fe_3O_4. Meanwhile, biochar enhanced the corrosion of sulfidated zero-valent iron to increase FeS production and enhance the electron transfer, β-elimination, and hydrogenolysis involved in cDCE and VC dechlorination. The effectiveness of ZVI composite was confirmed in a field demonstration, during which cDCE and VC concentrations significantly decreased within 10 days following injection. The findings of this study can help inform the rational design of ZVI for in-situ remediation of chlorinated hydrocarbons in groundwater.

Enhanced Water Resource Allocation in Zhangzhou City Utilizing Type-2 Fuzzy Multi-Objective Programming Algorithm

Oral - Abstract ID: 286

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Abstract

The spatial imbalance in water resources distribution and conflicts in water allocation significantly impact the socioeconomic progression of Zhangzhou City, located in Fujian Province, China. This study proposes a novel approach employing Type-2 Fuzzy Multi-Objective Programming (T2FMOP) to strategically plan the water resource system in Zhangzhou City. Predictive modeling of water resources data for the ensuing ten years in Zhangzhou City was achieved using the Back Propagation Neural Network (BPNN) method. This study optimized the allocation of water resources between different sectors in Zhangzhou City to improve the pressure on water supply. The developed model addresses uncertainties inherent in the water resources system while accommodating diverse participant interests encompassing economic and environmental considerations. The economic benefit objective was attained through an increase in the net benefits of water supply, while the environmental benefit objective was realized by reducing COD_{cr} emissions from wastewater. Various scenarios were meticulously designed across distinct planning periods, each reflecting varying satisfaction levels of decision makers (DMs). The analyses conducted using the T2FMOP model elucidate that scenario-based outcomes contribute to enhancing economic efficiency while simultaneously maximizing environmental benefits. The results indicated the feasibility of restructuring the water distribution framework in Zhangzhou City, fostering the growth of the secondary industry to propel economic advancement. An analysis of the water distribution scheme, as derived from the model results, indicated a 5.5% reduction in water consumption, simultaneously ensuring economic efficiency. This result represents favorably with the co-development of environmental and economic aspects. Furthermore, this study establishes a clear correlation between water resource allocation and its direct impact on both economic and environmental benefits. The insights gleaned serve as a valuable reference for resolving water resource programming challenges, offering crucial guidance for sustainable water management practices in Zhangzhou City.

Enhancing the Nexus between Geology and Health: A Vital Imperative to Attain Sustainable Development Goal 3 (SDG 3) - Interlinking the Two Fields.

Oral - Abstract ID: 168

Prof. Emmanuel Arhin [1]

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The fields of Geology and Health are intrinsically linked, necessitating the involvement of the practice of both Geoscientists and Medical Professionals. The reason is, that the quality of soil, which is controlled by geological factors as well as anthropogenic activities, has a direct bearing on human health. Soil that is tainted with contaminants such as heavy metals, pesticides or radioactive elements can pose serious threats to human health through ingestion, inhalation or direct skin contact. In addition, soils that lack vital nutrients such as selenium or iodine can give rise to ailments such as goitre or thyroid cancer. Additionally, toxic arsenic exposure can cause hypertensive and diabetic conditions. This is the fundamental rationale for Geoscientists to collaborate with medical professionals in tackling these emerging diseases, which result from the interplay of natural environments and anthropogenic activities.

The above challenges call for an integrated solution on a platform created by both parties, the Geoscientists and the medical professional. The Geoscientist needs to identify areas susceptible to contaminants or locate areas prone to essential element deficiency. In this study over 4000 samples were taken at a depth of 40cm from a nominal diameter hole of 30cm to examine distributions and concentrations of trace elements. These samples were taken from soils developed in various geological settings. The results obtained from the analyzed samples enabled the identification of hotspots and cold spots for disease-causing elements that could trigger adverse health effects upon exposure. These findings demonstrate the impact of geology on human health, underscoring the significance of improving soil health for the benefit of flora and fauna and human physical and mental welfare. Consequently, it concluded that achieving SDG3 necessitates collaboration between Geoscientists and medical professionals and that the two parties should work as a team to prevent emerging diseases.

Enhancing Water Quality Assessment in Urban River Ecosystems: A Case Study of Siliguri City's Rivers

Oral - Abstract ID: 440

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Monitoring water quality in urban river ecosystems is crucial but challenging for assessing the Water Quality Index (WQI) status. The WQI is a widely recognized method for evaluating water quality in aquatic systems. This study aimed to assess WQI status in Siliguri city's urban rivers, which experience a tropical climate, using a modified NSF-WQI and an enhanced RMS-WQI model. Water samples were collected from seventeen sites across five specific rivers during both pre-monsoon and post-monsoon periods. The modified NSF-WQI followed the four key elements of the WQI model, while the improved RMS-WQI incorporated three components to enhance effectiveness and address uncertainty issues. Both models employed PCA and Laplacian scores for indicator selection, particularly for the Mahananda River. Existing literature sources were consulted to generate sub-indices, and an equal-weight approach was used to determine indicator weights. Both multiplicative and Root Mean Square (RMS) aggregation methods were applied. The final WQI assessment for the prominent Mahananda River ranged from marginal to fair with the improved RMS-WQI, while it varied from medium to good with the modified NSF-WQI in the pre-monsoon and post-monsoon seasons, respectively. For the other rivers, the improved RMS-WQI primarily yielded results in the marginal to fair range, while the modified NSF-WQI results spanned from bad to good during both seasons. However, the study suggests that the enhanced RMS-WQI may offer an effective method for assessing tropical rivers, especially when dealing with uncertainty and ambiguity, compared to the NSF-WQI, as validated in previous research.

UserKeywords: Urban river; Water quality; Water Quality Index; RMS-WQI; Siliguri city

Enrichment mechanism of element in soil with natural geological high background and its ecological risk identification

Oral - Abstract ID: 363

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Natural geological high background refers to the enrichment of elements such As Cd, Pb and Hg in soil is related to the types of parent rocks and their weathering process. Spatial distribution of soil with high elements concentrations is associated with specific geological bodies. The concentrations of heavy metals in soil are significantly higher than their regional background values, or the biological availability of heavy metals in soil is significantly higher. The types of natural geological high background areas are divided into inherited type and secondary enrichment type and alluvial type. The inherited type mainly refers to the soil developed from (ultra)basic rocks, coal strata, black rock series, metal sulfide and phosphate ore deposits. The accumulation of heavy metals in soil inherited parent rocks, and the increase of biological availability is caused by the intense soil acidification caused by sulfide oxidation. The secondary type mainly refers to karst area. The enrichment of trace elements in soil is related to the primary enrichment in the stage of carbonate decomposition and the secondary enrichment caused by the enrichment of iron, manganese and aluminum oxides in the stage of soil formation of acid insoluble matter. The high concentrations of heavy metals in soil of alluvial plain developed in Quaternary sediments are governed by source rocks and mineral deposits in the river catchment, particle compositions, and sedimentary environment. Hot spot analysis and geographical weighted regression analysis can effectively identify the primary factors driving enrichment of trace elements in soil. A predicting model for concentrations of heavy metals in crops can be accurately established by using machine learning and big data such as element concentrations and physicochemical properties of soil. It will provide basis theories and technologies for land resource classification and management, crop safety production by using regional soil survey data.

Enrichment of geogenic organoiodine compounds in alluvial-lacustrine aquifers: molecular constraints by organic matter

Oral - Abstract ID: 326

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Organoiodine compounds (OICs) are dominant iodine species in groundwater systems. However, molecular mechanisms underlying the geochemical characteristics of geogenic OICs-contaminated groundwater yet remain unclear. Based upon multi-target field monitoring in combination with ultrahigh-resolution molecular characterization of organic components for alluvial-lacustrine aquifers, we identified a total of 939 OICs in groundwater under reducing and circumneutral pH conditions. In comparison to those in water-soluble organic matter (WSOM) in sediments, OICs in dissolved organic matter (DOM) in groundwater typically contain fewer polycyclic aromatics and polyphenols compounds but more highly unsaturated compounds. Consequently, there were two major sources of geogenic OICs in groundwater: the migration of OICs from aquifer sediments and abiotic reduction of iodate coupled with DOM iodination under reducing conditions. DOM iodination occurs primarily through the incorporation of reactive iodine that is generated by iodate reduction into highly unsaturated compounds preferably containing hydrophilic functional groups as binding sites. It leads to elevation of OICs concentrations up to 183 μg/L in groundwater. This work proves that the application of FT-ICR MS can provide crucial information on the molecular characteristics of OICs and OM for a better understanding of complex biogeochemical behavior of iodine. This research reminds the importance of considering the coexistence and transformation of multiple iodine speciation in the environmental evaluation and remediation of iodine-contaminated groundwater. This research provides new insights into the constraints of DOM molecular composition on the mobilization and enrichment of OICs in alluvial-lacustrine aquifers, and thus improves our understanding of the genesis of geogenic iodine-contaminated groundwater systems.

Enrichment of methylated arsenic in alluvial-lacustrine aquifers: evidence from gas isotopes and metagenomics

Oral - Abstract ID: 628

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Arsenic methylation is considered to be one of the major biological detoxification pathways for As, and can also be an effective apporach for remediation of As-contaminated groundwater. Previously, methanogenesis have differentially affected As methylation in paddy soils and hot spring systems. However, studies on the mechanisms associated with methanogenesis on As methylation in Quaternary groundwater system are limited. In this study, we elucidated the mechanism of the effect of methanogenesis on arsenic methylation in groundwater in the Quaternary alluvial-lacustrine plain of the middle reaches of the Yangtze River, China, by combining carbon isotopes of methane and carbon dioxide with evidence from metagenomics. Methylated arsenic concentrations in groundwater ranged from 4.08 to 76.1 μg/L. The MMA concentrations ranged from 1.3 to 61.3 μg/L and the DMA concentrations ranged from 2.79 to 53.4 μg/L. Both MMA and DMA increased with increasing methane concentrations, suggesting that the enrichment of methylated arsenic in groundwater may be influenced by methanogenesis. Gas isotope evidences suggest that the methanogenesis in groundwater is dominated by hydrogenotrophic pathway, with a small amount of methylotrophic methanogenesis. The results of metagenomics suggest that different methanogenic pathways have different effects on arsenic methylation. Hydrogenotrophic methanogenesis may inhibit arsenic methylation while methylotrophic methanogenesis promotes the process of arsenic methylation. This study provides new microbiome evidence for arsenic methylation mechanism under methanogenic conditions in similar Quaternary alluvial-lacustrine plain aquifers.

Environmental Radiation Studies in Urban Environment: Case Study of Yerevan, Armenia

Oral - Abstract ID: 514

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Importance and objectives. Human average annual effective dose from natural radiation sources makes 2.4 mSv/year, with the primary contribution of natural radioactive gas radon. Certain characteristics of Armenia's capital city of Yerevan, such as the prevalence of NORM-enriched igneous rocks, active faults, indicate potential radon hazards. Despite various indoor radon studies conducted since the 1970s, no relevant maps have been developed. To address this, comprehensive studies, encompassing spatial patterns of naturally occurring radionuclides (NOR) in soil, along with measurements of radon activity in both soil and drinking water, were conducted from 2022 to 2024. The primary objective of these studies was to assess the radon risk in Yerevan.

Methodologies. The urban soil survey method was applied to evaluate the spatial distribution of naturally occurring radionuclides (NOR). A survey of radon in soil was systematically carried out at 34 randomly chosen locations, taking into consideration the geological structure of the area. The monthly collection of drinking water samples was conducted across 12 districts in Yerevan. Radon measurements were performed using a RAD7 detector with associated accessories from DURRIDGE. To determine activity concentrations of NOR, an HPGe-based gamma spectrometer (CANBERRA) was used.

Main results and conclusion. Soil gas radon activity ranges from 483.4 to 38375 Bq/m^3 in summer period. The highest radon activity was recorded in soils with high sand content (up to 81%) derived from sedimentary rocks (alluvial, proluvial sediments and sandstones). The activity of radon in soil gas correlated negatively with the activity concentrations of Ra-226, U-238 and Th-232 in soil. The Th/Ra ratios for Yerevan soil varied from 0.8 to 1.51. Radon in water varied from 0.04 to 11.0 Bq/L, the highest average activity was recorded in August and September of 2023.

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Environmental safety assessment of new biopesticides using chitosan nanoparticles loaded with essential oils

Oral - Abstract ID: 851

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Essential oils (EOs) are naturally occurring, hydrophobic, fragrant compounds derived from aromatic and medicinal plants with biocide activity. Even though they have a natural origin, they can be hazardous to the environment, and they can also be susceptible to environmental conditions. In this study, ionic gelation technique was used to produce the chitosan nanoparticles incorporating four different EOs: *Satureja montana*, *Thymus vulgaris*, *Anethum graveolens,* and *Coriandrum sativum.* Although several formulations have already included these EOs, nothing is known regarding their ecotoxicological profile. Therefore, in this study, the environmental safety of these formulations was evaluated, following standard guidelines (OECD and ISO) for testing with terrestrial and aquatic non-target model organisms. Also, the characterization of the EOs and corresponding nanoformulations was performed including the evaluation of several parameters (e.g., phenols content, antioxidant activity, encapsulation efficiency, chemical composition, nanoparticles size, PDI, and zeta potential and in-vitro release). The main compound of *Satureja montana*, *Thymus vulgaris*, *Anethum graveolens,* and *Coriandrum sativum* was carvacrol, thymol, carvone and linalool, respectively. Also, the *S. montana* and *T. vulgaris* EOs were the ones with highest phenol content and antioxidant activity. The chitosan particles were successfully produced, presenting an average size of 200 nm and positive charge. In addition, nanoparticles protected essential oils from the external environment while reducing their toxicity to non-target species. The knowledge of the effects of nanobiopesticides on non-target species is scarce and regulation still relies on active ingredients rather than on different formulations. However, it cannot be assumed that new formulations are always safer, and the best approach is to test its safety, before evaluating their efficacy as biocides and before to place them in the market.

Environmental standard limit concentration arsenic exposure is linked to anxiety, depression and autism-like changes in early-life stage zebrafish

Oral - Abstract ID: 22

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Arsenic is a world-wide environmental pollutant that can impair human health. Previous studies have identified mental disorders induced by arsenic, but the environmental exposure concentrations in the early life stages associated with these disorders are poorly understood. In the present study, early life stage zebrafish were used to explore the effects on mental disorders under "environmental standard limit concentrations" arsenic exposures of 5, 10, 50, 150 and 500 μg/L. Following exposure, huc and hb9 proteins were decreased in larval zebrafish, demonstrating damage to central and peripheral motor neurons. Furthermore, arsenic exposure changed the locomotor behavior in larval zebrafish and was further associated with anxiety, depression and autism-like behavior in both larval and juvenile zebrafish. Transcriptomics showed that immediate early genes (IEGs) *fosab, egr1, egr2a, ier2b, egr3* and *jund* were decreased after arsenic exposure in larval and juvenile zebrafish. Benchmark dose (BMD) and Benchmark dose limit (BMDL) were calculated based on neurobehavior indices. Changes were noted at concentrations as low as 0.81 μg/L, which is less than the reported concentrations in aquatic environments and World Health Organization (WHO) and US Environmental Protection Agency (EPA) guidelines. Together, arsenic exposures at "environmental standard limit concentrations" impaired the nervous system in early life stage zebrafish, manifesting as anxiety, depression and autism-like changes. These mental disorders may be attributed to downregulation of IEGs. Our results provide new experimental support for revised arsenic safety limits for aquatic environments, and they suggest that exposures to arsenic specifically and environmental chemicals may be factors affecting mental health.

Ethical and GDPR-Compliant Sharing of Multimodal Stress Data: Contributions to Environmental and Health Research

Oral - Abstract ID: 36

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This paper introduces a multimodal dataset, curated for stress analysis, which integrates physiological and behavioural data while adhering to stringent ethical guidelines and GDPR privacy standards. The evolving landscape of data in Environment and Health sectors necessitates the development of innovative methodologies to facilitate responsible data sharing. Our contribution lies in providing a comprehensive dataset for stress analysis and establishing robust methodologies for its evaluation and dissemination.

The dataset includes data from Electroencephalogram (EEG), Electrooculogram (EOG), Galvanic Skin Response (GSR), Head Inertial Measurement Unit (IMU), Electrocardiogram (ECG), and video recordings. To address privacy concerns, only metadata derived from video analysis are shared, ensuring participant confidentiality and compliance with GDPR regulations. This strategy balances the need for rich behavioural data with the imperative to uphold ethical standards in data protection.

Expert and novice participants engaged in a stress-inducing 3-level task game, designed to elicit varied stress responses associated with monitoring of multiple semi-autonomous systems. This structured methodology allows for a detailed examination of stress reactions and their implications on health and well-being.

The paper elucidates the methodologies employed to ensure ethical and GDPR-compliant data sharing, offering a framework for responsible dissemination of sensitive information. By making the dataset and associated code available, we aim to promote collaborative research, contributing to advancements in environmental, health, and well-being outcomes. The tools and methodologies presented serve as a reference for the research community, advocating for transparency, accessibility, and responsible data sharing practices in the dynamic field of Environment and Health research.

Examining the Potential Impact of a Peatland Policy Portal for Europe in Reducing GHG Emissions

Oral - Abstract ID: 775

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Restoration efforts and legislation have the potential to transform peatlands from sources of carbon emissions in their degraded state into sites of carbon sequestration in their natural, healthy state. There are unfortunately many blockages in restoration efforts, including: unimplemented policies, gaps in the legislative coverage, and even conflicts between different levels and branches of government; there is also a recognized deficit in the capacity to easily explore the peatlands of Europe and their relevant legislation in a cohesive way. In order to address these challenges and others related to a possible technological solution of fast-tracking peatland policy development, we examine the potential of a European Peatland Policy Portal as part of the EU Life Multi-Peat project. We track the construction of this portal, drawing on geographic and policy data shared by different countries to provide a map of Europe's peatlands, complete with the georeferenced policies that affect them. Our exploration of this project aims to examine the move from manual sharing of data to an automatic pipeline as well as a move towards a more comprehensive toolkit for peatland policy analysis and development.

Exploring Forest Characteristics Associated with Lyme Disease using Random Forest and Gradient Boosting Analyses

Oral - Abstract ID: 1006

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1. *Dartmouth College*

Lyme disease is the most common vector-borne disease in the US. It is caused by the bacterium Borrelia burgdorferi and transmitted to humans through the bite of infected Ixodes ticks. Evidence suggests that landscape characteristics, including spatial structure and land cover type composition, may impact the risk of Lyme disease. This study, using data from the state of New Hampshire, USA, built a Random Forest regression model and gradient boosting model (XGBoost) to identify the landscape characteristics and their combinations that are most related to Lyme disease. We first calculated 57 landscape ecological metrics characterizing fragmentation or diversity for all 15 land cover types found in New Hampshire, based on the National Land Cover Database (NLCD) data of 6 years, and then correlated those metrics with town-level Lyme disease rates of two 5-year periods (2001-2009 and 2010-2014). The XGBoost model yielded a mean squared error of 339.04 and an R-squared value of 0.81. Permutation feature importance analysis also revealed the top 20 landscape characteristics that have the highest impact on Lyme disease rates according to the model. Conversely, the Random Forest regression model exhibited a higher mean squared error of 1070.02 and a lower R-squared value of 0.40, suggesting a less optimal fit compared to XGBoost. These findings underscore the effectiveness of XGBoost and Random Forest regression models in identifying landscape characteristics associated with Lyme disease risk. This study contributes to our understanding of tickborne disease-landscape associations and can be leveraged for the future construction of high-quality predictive models.

EXPLORING THE HEALTH EFFECTS OF SILICA EXPOSURE

Oral - Abstract ID: 694

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This study was primarily an empirical investigation in the field of occupational medicine to explore the health effects of silicosis. The relative lack of an in-depth literature review on this topic was the primary impetus of this study, which advanced this important, but neglected area by determining the health effects of silicosis. The objective of the study was to enhance awareness and implement appropriate control measures to prevent new silica occupational exposure. This study adopted a realistic problem-solving approach using an empirical solution to find answers within occupational medicine through a literature review. The study examined occupational health matters related to silica dust exposure through a thematic analysis of 30 articles that were available on the Internet. The articles that were not relevant to this study were discarded based on the researcher's discretion. The themes were derived as they emerged continuously from the data. The information was read and the themes were identified on sentence by sentence basis, with the underlying or wider message of an article. These themes were reviewed to ensure that they fit the nature of the theme and maps of the analysis were created. These themes were further defined and named and the literature review study was produced on thematic analysis. The findings demonstrate that a responsible approach to silicosis is required to prevent further exposure of workers in the working environments and promote the health and well-being of workers. The results of the study exposed a research gap on issues that are related to effective control measures and strategies in the workplace to prevent silica exposure.

Keywords: silica, silicosis, silo-tuberculosis, occupational lung disease

Exploring UN Sustainable Development Goals using Advanced Database Technologies: An Experience Report from an Undergraduate Business Course

Oral - Abstract ID: 853

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MOTIVATION AND OBJECTIVE

In the era of big data, fostering critical thinking among students is crucial for addressing global challenges (Hassani et al, 2021). This study reports on students' experiences working on an assignment that encouraged them to engage with UN SDGs and use advanced database technologies to explore polymorphic data obtained from various sources. The key objective was to enable them to develop competencies in data modeling, querying, and visualization, thereby contributing to their ability to address important environmental and health problems within an international context.

METHOD

Students worked collaboratively to select SDGs, identify relevant indicators, obtain data, and create a MongoDB database. They used Python for data cleansing and transformation. Using a novel prompting methodology, students employed OpenAI technologies to generate code derived from natural language query specifications. They imported the query output into Tableau and created interactive visualizations. Finally, they prepared a comprehensive report to document findings and reflect on the challenges of working with SDG data, with all its well-known associated difficulties (Jütting & McDonnell, 2017; MacFeely, 2017).

RESULTS

Based on thematic analysis of student feedback, several themes emerged: (1) all groups emphasized the importance of acquiring technical skills for data analysis and visualization, (2) many groups encountered challenges related to data availability and completeness, such as outdated data, missing data for specific regions or time frames, and inconsistencies between databases, (3) students highlighted the development of critical thinking and problem-solving skills throughout the assignment, particularly in formulating queries and addressing unexpected findings.

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Exposome and Female Reproductive Health

Oral - Abstract ID: 31

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Increasing evidences have revealed a close relationship between various environmental exposures and reproductive health. The real-world complex exposure scenario along with intricate interactions effects of these exposures has high demands of exposome-wide association studies for human risk assessment. With the development of exposomic studies, applying exposome to link environmental factors and reproductive health outcomes has obvious potential advantages. However, the reliability of utilizing exposomic information is always of high concern for researchers. To date, there is no available effective platform to standardize the analysis of exposomic data. In the present study, we aim to propose one new framework of exposomic analysis and build up one novel integrated platform “ExposomeX” to expediate the discovery of the “Exposure-Biology-Disease” nexus. We have developed 14 standardized modules to accomplish six major functions including statistical analysis (E-STAT), exposome database search (E-DB), mass spectrometry data processing (E-MS), meta-analysis (E-META), biological link via pathway integration and protein-protein interaction (E-BIO) and data visualization (E-VIZ). Using ExposomeX, we can effectively analyze the multiple-dimensional exposomic data and investigate the “Exposure-Biology-Disease” nexus by exploring mediation and interaction effects, understanding statistical and biological mechanisms, strengthening prediction performance, and automatically conducting meta-analysis based on well-established literature databases. The performance of ExposomeX has been well validated by re-analyzing three typical multi-omic dataset. Additionally, ExposomeX can efficiently help discover new associations, as well as relevant in-depth biological pathways via protein-protein interaction and gene ontology network analysis. Some application publications can be found for exposome characterization (*Environ Health Perspect*, 2023, 131(3):37009), neural tube defects (Environ Sci Technol Lett. 2023, 10: 192–197) and spontaneous preterm birth (***Environ Sci Technol Lett***, 2023, 10, 11, 1036–1044). In sum, we have proposed a novel framework for comprehensive exposomic analysis, which can be accessed using both R and online interactive platform (http://www.exposomex.cn/).

Exposomics and Health Effects of Toxic Organic Pollutants in Occupationally Exposed Populations in Coking Contaminated Sites

Oral - Abstract ID: 381

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The coking industry in China faces intricate challenges regarding contamination and its potential health risks for humans. In this study, we specifically focused on coking plant workers to investigate internal (urine and serum) and external (soil, atmosphere, and water) exposures to toxic pollutants using both target and non-target approaches. Polycyclic aromatic hydrocarbons (PAHs) and their derivatives (including hetero-, methyl-, nitro-, oxygen-, and halogenated PAHs) were the predominant pollutants detected in the environment of the coking plant. Utilizing high-resolution mass spectrometry, corresponding pollutants and their metabolites were identified in the serum and urine samples of the occupational exposed workers. In addition, beyond the commonly detected PAHs and their metabolites, several previously overlooked yet toxic compounds were identified, including 2-aminonaphthalene in the serum, and quinolin-2-ol, naphthylmethanol, N-hydroxy-1-aminonaphthalene, hydroxydibenzofurans, hydroxyanthraquinone, and hydroxybiphenyl in the urine. Notably, PAH derivatives, despite their lower concentrations compared to unsubstituted PAHs, exhibited a more significant impact on oxidative stress and hepatic and renal function damage. This study highlighted the urgent need for increased attention to the health implications of occupational exposure in coking sites. Furthermore, it could also serve as a crucial reference for the control of coking contamination not only in China but also globally.

Exposure effect of indoor air pollutants in rural communities identified through health predictors

Oral - Abstract ID: 790

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In rural areas of Pakistan, a study of 112 households examined significant impact of household activities on environmental and indoor air quality, specifically focusing on the combustion of biomass and exposure to cooking fumes. The combustion of biomass for cooking and heating in these locations releases a complex mixture of particulate matter and toxic compounds, causing significant indoor pollution. These activities are pivotal in releasing particulate matter and organic pollutants, which are identified as significant predictors multiple health risks. Our finding reveal sources of indoor pollution such as tobacco smoke and volatile organic compounds, biomass burning and cooking fumes in inadequately ventilated spaces lead to elevated levels of indoor pollutants. This scenario is particularly concerning in rural households where traditional cooking practices are common, posing significant health risks to the inhabitants. Exposure to these pollutants, especially in settings lacking proper ventilation, has been linked to an increased incidence of respiratory and cardiovascular conditions, with rise in cases of asthma and Chronic Obstructive Pulmonary Disease (COPD) among the population studied. Results show shift in particulate matter (PM2.5) concentration patterns, previously noted during the COVID-19 lockdowns with a decrease outdoors and an increase indoors, is exacerbated in rural settings by the continuous use of biomass for cooking. We conclude critical need for interventions aimed at improving indoor air quality in rural households, including the adoption of cleaner cooking technologies and the enhancement of home ventilation, to mitigate the adverse health effects associated with biomass burning and cooking fumes. Homeowners using biomass for cooking and heating in rural Pakistan must manage indoor air pollution. Implementing strategies to reduce exposure to cooking fumes and improve indoor air quality is essential for preventing respiratory and cardiovascular diseases in these communities.

Factors Influencing Concentrations of PFAS in Drinking Water: Implications for Human Exposure

Oral - Abstract ID: 578

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To evaluate possible factors influencing per- and polyfluoroalkyl substances (PFAS) concentrations in drinking water and to estimate human exposure to PFAS via drinking water, concentrations of ten high-concerned PFAS were measured in samples of tap water from the UK (n = 41) and China (n = 14) as well as in bottled water which including 87 brands originating from 15 different countries (n=112) by LC-MS/MS. Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) were detected in nearly all samples and were the dominant PFAS detected in bottled water. Detection frequencies for other target PFAS were between 67% and 93%. Concentrations of Σ_{10}PFAS in glass bottled water (mean ± SE = 1.4 ± 0.092 ng/L) exceeded those in plastic bottled water (0.93 ± 0.17 ng/L), were higher in still water (1.06 ± 0.24 ng/L) than in sparkling water (0.87 ± 0.18 ng/L), and were significantly greater ($p<0.01$) in natural mineral water (0.82 ± 0.092 ng/L) than in pure water (0.47 ± 0.040 ng/L). Significantly ($p<0.001$) higher Σ_{10}PFAS concentrations were present in tap water from China (mean ± SE = 9.2 ± 1.2 ng/L, PFOS and PFBS dominant) than in UK tap water (2.7 ± 0.23 ng/L, PFBS & PFOA dominant). Concentrations of PFOA and PFOS in tap and bottled water were markedly higher than the new USEPA interim health advisory (HA) limit of 0.004 and 0.02 ng/L for PFOA and PFOS respectively, but those of PFBS were well below the HA value of 2000 ng/L. High PFAS detection rates in drinking water highlights the need for monitoring of a wide range of PFAS. Adult daily exposure to Σ_{10}PFAS via tap water alone exceeded substantially that ingested via bottled water in both the UK and China. Boiling and filtration can reduce substantially (50% - 90%) exposure to Σ_{10}PFAS via drinking tap water.

Fingerprinting Air Pollution Culprits

Oral - Abstract ID: 121

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Air Quality is perceived as thresholds and exceedances of limits derived for mass concentrations and even exposure models assume similar (equal) toxicity per total inhaled dose, while the real aerosol effects depend on particle physico-chemical properties and, thus, sources.

Our results from the Irish national transboundary air pollution network, with 3 aerosol mass spectrometer nodes delivering near real-time speciation of particulate matter data and subsequent source apportionment, reveal that extraordinarily-high air pollution exceedances (>15 times the World Health Organisation guideline) are driven by the 'green', 'renewable' solid fuels (wood and peat) with disproportionate contribution to pollution levels – whereas as little as 12% of the consumed fuels produce 70% of the air pollution[1].

Moreover, we show that peat and wood burning has the highest contribution to particle oxidative potential (OP), thus toxicity. Unexpectedly large OP was registered in a small Irish town Birr with values higher than those measured in European, USA and Asian megacities. Likewise, the OP from insoluble PM fraction was higher at residential cite in Birr (population <6,000) than the one measured at a kerbside site in Dublin (population ~1.3 million), despite dominant traffic emission contribution to the overall insoluble aerosol fraction.

In contrast, during summer, secondary sources and long-range transport dominate aerosol concentrations, but changes in reactive oxygen species with aerosol aging are largely unknown. Moreover, health effects from secondary organic aerosol are particularly uncertain.

A sophisticated source apportionment, in combination with particle oxidative stress (potential toxicity) capability, is crucial to inform efficient air policy implementation that targets the biggest and the most toxic air pollution culprits.

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Flexible Au tapes for on-site detection of microplastics using surface-enhanced Raman scattering

Oral - Abstract ID: 725

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Analysis of microplastics is essential for human health. While current research primarily focuses on examining microplastics in aquatic environments, there is a lack of in situ techniques for detecting microplastic particles in the atmosphere. In this study, surface-enhanced Raman scattering (SERS) was utilized with flexible materials for on-site microplastic detection. An Au nanoparticle (AuNP) tape created through a “drop-coating and peel-off” approach demonstrated excellent SERS performance. The size, shape, and electromagnetic field enhancement of the AuNP tape were assessed using various techniques including scanning electron microscopy, transmission electron microscopy, UV–visible spectroscopy, atomic force microscopy, and the finite-difference time-domain method. The use of AuNP tape as a SERS substrate allows for convenient and reliable identification of microplastics in the atmosphere due to its outstanding transparency and sensitivity.

Food contamination and health impacts: Geochemical and environmental pollutants

Oral - Abstract ID: 709

Prof. Ming Hung Wong [1]

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Chemical food safety is currently one of the significant public health issues in the world, especially in developing countries. This paper aims to review the significant geochemical and environmental pollutants found in our food items, citing examples related to the Pearl River Delta region, which has undergone a rapid socio-economic change during the past 40 years. The region has been transformed into the world center for electronic/electrical, textile, and pharmaceutical productions, in addition to the active mining and agricultural industries. Chemicals emitted can be found in different environmental media. Water and wastewater water treatment processes cannot remove these chemicals effectively. Flame retardants can be transformed into more potent congeners after waste treatment. Oral intake is the predominant exposure pathway for most PTS found in food, followed by inhalation and dermal contact. The toxicity or potency of chemical food contaminants will depend on the types of chemicals, their concentrations, and the consumption rates. These contaminants may impose short-term (at high dosage, may be fatal) and long-term (at low dosage, may cause cancers and histological damages) health impacts. It is vital to trace the sources and fates of PTS, their speciation, bioavailability, and bioaccessibility so that we can deter their entry into our food production systems. Bioassay, genotoxicity, and mutagenicity tests can be used to evaluate the toxicity and potency of these food contaminants and biomarkers to provide a rapid warning system. ‘Chemical food safety’ is a critical global food safety concern, and we should ensure that food is safe in the entire food chain. Several case studies focus on the geochemical cycles and health impacts of a) Geochemical pollutants that crops absorb from soil: As and F; b). Environmental contaminants, including trace metals: Hg and Pb; POPs: PCB and PCDD/Fs; and c). Emerging chemicals of concern: PBDE, bisphenol A, and phthalates.

Formation and Stability Mechanism of Cd-organic-mineral Colloids in Aquatic Environments : Nanoscale Distribution and Molecular Transformation

Oral - Abstract ID: 923

Mr. Yanjun Jiang [1], ***Prof. Ye-tao Tang*** [1], ***Prof. Weihua Zhang*** [1], ***Mr. Wenjun Yang*** [1], ***Prof. Miaoyue Zhang*** [1], ***Prof. Rongliang Qiu*** [1]

1. *Sun Yat-sen University*

Naturally-occurring colloids and nanoparticles are crucial in transporting heavy metal contaminants in soil-water systems. In flooded soil conditions, organic matter can promote the reduction and dissolution of manganese minerals, releasing Cd and forming mineral-organic colloids. However, the formation mechanism of these colloids, particularly at different pH levels, remains unclear. In this study, the Cd(II)-depod birnessite was dissolved to form nanoparticles by a model humic substance, Suwannee River fulvic acid acid (SRFA), at pH values of 4.5, 6, and 8. These nanoparticles were separated and characterized using AF4-UV-ICP-MS. We observed that the nanoparticles were primarily associated with three sizes ranges: 0.3 - 40 kDa (F1), 130 kDa - 250 nm (F2) and 450 nm - 1 μm (F3), with higher pH (pH= 8) favoring the formation of Cd-organic-mineral colloids.
Structural characterization by TEM and XAFS revealed that Cd immobilization and FA sequestration occurred through physical isolation, surface adsorption, and complexation during birnessite phase transformation under FA reduction, enhancing the stability of the formed mineral-organic nanoparticles. FT-ICR-MS was used to analyze the macromolecular composition before and after oxidation by birnessite at different pH levels. The results suggested that a portion of phenolic compounds was preferentially sorbed and oxidized to form mineral-organic nanoparticles, leading to the formation of nanoparticles with higher oxygen content and degree of polymerization. This oxidation mechanism on polar mineral surfaces, such as birnessite, might be more selective and pronounced at lower pH levels.
These findings provide insights into nanoscale mechanisms influencing the fate of Cd and FA during mineral transformation, contributing to a better understanding of Cd-organic-mineral nanoparticles formation.

From ONE Health to WHOLE Health: A Metacoupling Framework for Understanding Environment-Health Dynamics

Oral - Abstract ID: 247

Prof. Daniel Sui [1]

1. *Virginia Tech*

Understanding the intricate interplay between environmental dynamics and human health is a pressing challenge in the realm of public health. The One Health approach has revolutionized our comprehension of the interconnectedness of human, animal, and environmental health. The WHOLE Health approach has gain growing acceptance by integrating human biological health with mental health and social wellbeing. However, to attain a more comprehensive understanding, it is imperative to transcend boundaries and incorporate a more holistic perspective in order to create a new synergy of ONE Health with Whole Health.

This paper introduces a groundbreaking approach, leveraging the metacoupling framework, to bridge the gap between One Health and WHOLE Health paradigms. Metacoupling, a novel lens encompassing the interactions within and between coupled human and natural systems across local to global scales, provides a structured methodology to explore the intricate relationships shaping environmental and health outcomes.

Drawing upon interdisciplinary studies, this presentation elucidates how the metacoupling framework acts as a versatile tool, integrating diverse data sources and methodologies. It reveals emergent properties of interconnected systems, untangling the synergies and feedback loops between environmental factors, human behaviors, and health outcomes. By assimilating diverse datasets and analytical approaches, this framework enables a more nuanced understanding of the complex relationships influencing health across spatial and temporal scales.

The synthesis of One Health with the WHOLE Health perspective through the metacoupling framework offers a pathway to comprehend the broader ecological, social, and economic determinants influencing human health. This talk aims to present a cohesive blueprint for researchers and policymakers to adopt an integrated approach, fostering a paradigm shift in our understanding of the environment-health nexus.

Geochemical baseline studies of mineral potential areas and mining surroundings in Finland

Oral - Abstract ID: 800

Ms. Tarja Hatakka [1], ***Dr. Jaana Jarva*** [1], ***Ms. Raija Pietilä*** [1], ***Dr. Timo Tarvainen*** [1]

1. *Geological Survey of Finland*

Since 2002, the Geological Survey of Finland (GTK) has examined geochemical baselines around the rural and sub-urban areas of the Finnish towns and cities. Different soil parent materials are used, and the samples represent both topsoil and subsoil. These mappings not only focus on the geological characteristics but also on the land use. In 2016, mineral potential areas and mining surroundings were included in the geochemical mapping.

Today, altogether 22 mineral potential areas and mining surroundings have been studied. Here, anthropogenic influenced sites were avoided. In addition to soil samples, some groundwater and surface water samples have been investigated from these sites. The studied waters extended the understanding about geochemical baseline of the sites and the present of potentially harmful elements. The near-total element concentrations in soil samples were determined from <2 mm grainsize and *aqua regia* leach. For risk assessment purposes, selected soil samples were analysed with weaker extraction methods, such as ammonium-acetate and ammonium-oxalate leach as well as cation exchange capacity, to estimate mobile and bioavailable concentrations of elements. In addition, the acid production capacity of selected soil samples was determined. In many investigated areas, the geogenic concentrations of harmful elements exceeded the Finnish threshold values. However, their leachability in weaker extractions was often low.

The geochemical baseline information is important in land use planning when assessing the possible soil contamination and remediation needs, and when considering the re-use of excavated soil material. For estimating the regional or local baseline concentration, the upper limit of geochemical baseline for potentially harmful elements can be used instead of soil threshold value given by the national environmental legislation. Risk assessment benefits from a selection of different analytical methods. It is essential to provide end-users with nationally comparable and scientifically sound geochemical baseline data that enhance the rationality and transparency of decision-making.

Geochemical characteristics and ecotoxicological risk of arsenic in water-level-fluctuation zone soils of the Three Gorges Reservoir, China

Oral - Abstract ID: 697

Dr. Dongyu Xu [1], *Prof. Bo Gao* [1]

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The Three Gorges Reservoir (TGR) has formed the water-level-fluctuation zone (WLFZ) due to reservoir regulation. However, as a sensitive zone in reservoir, little is known about the geochemical process and ecotoxicological risk of arsenic (As) in WLFZ soils under the anti-seasonal flow regulation. Hence, the anthropogenic contamination, mobility and ecotoxicological risks of As in WLFZ soils of the TGR were comprehensively assessed using the geochemical baseline concentration (GBC), chemical fractions, diffusive gradients in thin films (DGT) and toxicity data. The As concentrations in WLFZ soils showed a trend of increasing at the early stage of water impoundment and then stabilizing in recent years, which presented a low ecological risk of As according to the assessment by pollution indices. Based on GBC calculations, the average anthropogenic contribution of As was 13.95 %, indicating a slight influence of human activities. The distribution of labile As measured by DGT in WLFZ soils was mainly controlled by the Fe/Mn oxides, pH and organic matter. The DGT-induced fluxes in soils (DIFS) model further implied that resupply of As to soil solution was partially sustained by the soil solid phase, in which the resupply capacity was low and limited by the adsorption and desorption kinetics. In addition, the DGT was combined with toxicity data to obtain the risk quotient (RQ) and probabilistic risk assessment. The RQ value was lower than 1, indicating a low toxicity risk in WLFZ soils. Furthermore, the As in WLFZ soils had a low probability (5.97E-3 % and 7.77E-2 % in the mainstream and tributary, respectively) of toxic effects toward the aquatic biota. This study provides a comprehensive evaluation for the mobility and toxicity risk of As in WLFZ soils, which is beneficial to the prevention and control of heavy metals pollution in the riparian soils of lakes and reservoirs.

GEOSCIENCES FOR SOCIAL, ENVIRONMENTAL AND ECONOMIC DEVELOPMENT

Oral - Abstract ID: 860

Dr. Cassio Silva [1]

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Geosciences are of fundamental importance to humanity due to their knowledge and systemic approach to the system of planet Earth, providing research into methods and approaches that aim to optimize the management of the use of natural resources, making them compatible with their ecological limitations and incorporating the variable environmental and social aspects of the territorial use planning process. Provide technical subsidies for various sectors such as: mining (mineral resources); energy (oil, gas, coal, peat, hydropower, nuclear, wind and solar); agriculture (soil fertility, fertilizers, soil improvers and water availability); public health (quality of water, soil and air); urbanism (indication of restrictions or expansion); housing (building material); civil defense (slides, floods, earthquakes, land subsidence); transport (road works); tourism (geoparks and areas of scenic beauty); environment (diagnosis and recovery of degraded areas) and planning, as well as for various public institutions, river basin committees, private companies and also for government programs, such as ecological-economic zoning, territorial planning, studies of the continental shelf and coastal environments . Interventions carried out in the physical environment cause serious problems, both for our quality of life and for the environment. We are totally dependent on the geological characteristics of natural environments, as we extract the necessary raw materials (minerals, water, food, etc.) for our survival and social development. It is therefore necessary to know and understand all its meanings, since, once modified, removed or destroyed, aspects of geodiversity almost always undergo irreversible changes. Due to the intimate relationship between the components of the physical environment, when providing support for the development of biotic components (biodiversity), the stability relationships between these two major environmental components must be viewed in a systemic way. It is increasingly necessary to know the past, to understand the present and predict the future, for the well-being of the population on planet Earth.

Gestational PFHxS exposure and developmental toxicity

Oral - Abstract ID: 250

Prof. Yichao Huang [1]

1. *Anhui Medical University*

Numerous studies have revealed that prenatal exposure to per- and polyfluoroalkyl substances (PFASs) is associated with various adverse birth outcomes, among which evidences on the associations between perfluorohexane sulfonate (PFHxS) exposure and developmental impairment draw particular attention. PFHxS was recently included in the Stockholm Convention and the State Council of PRC's new pollutant control action plan, thus research into the toxic effects, especially developmental toxicity, of PFHxS warrants critical attention. This presentation, building on epidemiological correlation analyses, will introduce an established animal models to further clarify the developmental toxicity effect of prenatal PFHxS exposure and its mechanism through combined omics screening, toxicity pathway analyses, and molecular validation, which provide a theoretical basis for identifying environmental causes of developmental diseases. Future research will be conducted in the prospective Anhui "Towards Improved Maternal & Fetal health via multi-point Exposure Monitoring (TIMFEM)" birth cohort for association study and mechanism validation.

Global biogeography and projection of soil antibiotic resistance genes

Oral - Abstract ID: 271

Dr. Guoyu Yin [1], ***Prof. Min Liu*** [1], ***Prof. Lijun Hou*** [1]

1. East China Normal University

Although edaphic antibiotic resistance genes (ARGs) pose serious threats to human well-being, their spatially explicit patterns and responses to environmental constraints at the global scale are not well understood. This knowledge gap is hindering the global action plan on antibiotic resistance launched by the World Health Organization. Here, a global analysis of 1088 soil metagenomic samples detected 558 ARGs in soils, where ARG abundance in agricultural habitats was higher than that in nonagricultural habitats. Soil ARGs were mostly carried by clinical pathogens and gut microbes that mediated the control of climatic and anthropogenic factors to ARGs. We generated a global map of soil ARG abundance, where the identified microbial hosts, agricultural activities, and anthropogenic factors explained ARG hot spots in India, East Asia, Western Europe, and the United States. Our results highlight health threats from soil clinical pathogens carrying ARGs and determine regions prioritized to control soil antibiotic resistance worldwide.

Global seafood mercury: from oceans to tables

Oral - Abstract ID: 541

Dr. Qinqin Chen [1]***, Dr. Qingru WU*** [1]***, Ms. Yuying Cui*** [1]***, Prof. Shuxiao Wang*** [1]

1. *Tsinghua University*

Seafood consumption is a major pathway for exposure to methylmercury (MeHg), a pervasive global neurotoxin. The amount of MeHg in seafood consumption is linked to MeHg in seafood value chain, which was not well understood. Here, we investigated MeHg contents and amounts in seafood production, trade, and consumption worldwide in 2019. We found that most countries having seafood-MeHg exposures beyond the World Health Organization's recommended threshold are high-income economies. The high-income group's exposure was 10-fold that of the low-income group, due to high consumption and long-neglected high seafood-MeHg content inherited from production. Notably, 46% of MeHg in production was redistributed by trade marked by inequality, with higher-MeHg-content seafood exported from high-income to lower income groups. Eventually, the seafood-MeHg exposures resulted in global premature deaths of 65900 and economic losses of 3.06 trillion USD in 2019. Therefore, targeted measurements are required to reduce health risks in high-MeHg-exposure and socioeconomically disadvantaged groups.

Global water cover analysis based on remote sensing and GIS

Oral - Abstract ID: 473

Prof. Cunjian Yang [1]***, Mrs. He Huang*** [1]

1. *Sichuan Normal University*

This study aimed at discovering the global distribution feature of water cover on three levels such as grid of 0.004167degree and 10 degree based on Modis image, and 2 degree based on land cover with resolution of 10 meter from sentinel images. The global water cover was reclassified into four types according to visual interpretation of the Modis image covering all earth surface. Discovered respectively by visual interpretation and sample analysis of the Modis image, the spectrum feature knowledge of each water cover type was used to formulate its extraction model, which was employed to extract the four water cover types from the Modis images. The extraction accuracy of each water cover type was evaluated. The gloabal distribution feature of the percentage of each type in grid of 10 degree was analyzed based on the four water cover types. Furthermore, the global distribution feature of the percentage of water in grid of 2 degree from the global land cover with resolution of 10 meter was analyzed. The global distribution feature of water across the equator to north and south polar was described on the grid belt of 10 degree. By using the method given here, global water cover with four types can be obtianed from Midis images in about several hours. The results of the study can help to understand the global water circulation and achieve global sustainable development.

Health Concerns Related to Residential Coal Combustion in the U.S. Appalachian Region and on the Navajo Reservation

Oral - Abstract ID: 140

Dr. Robert Finkelman [1]***, Ms. Teresa Kline*** [2]***, Mr. Kyle Crane*** [2]

1. Uni, 2. Summit Consulting LLC

Coal dust has likely resulted in coal miners' health problems since the first mines were opened in China some three thousand years ago. Coal dust has contributed to a range of respiratory diseases in miners including silicosis, pneumoconiosis, emphysema, bronchitis, and black lung disease (commonly referred to as Coal Worker's Pneumoconiosis). Although there has been substantial improvement in reducing accident-related coal miner deaths, health problems due to inhalation of coal dust remains a problem for coal miners as well as for the households reliant on coal for heating and cooking. Respirable dust from residential coal fires contains organic particles (soot), quartz and pyrite which contribute to respiratory problems. Within this context and as a key part of its mission to protect coal miners from death, illness, and injury, the U.S. Mine Safety and Health Administration (MSHA) received support from Summit Consulting to conduct a study on this topic. The study explored the following topics: 1) Where are cases of black lung occurring across the U.S. as a result of non-mining activities such as burning coal for heat? 2) How do those locations align with former and current coal mining communities? 3) Is the incidence of black lung higher in the Navajo Nation and Appalachia than it is in other parts of the U.S.? Of particular interest to this study was whether incidences of black lung are disproportionately higher in the Navajo Nation and Appalachia, compared to other parts of the country. To address these questions, Summit Consulting conducted a literature review, performed statistical analysis (descriptive and inferential) of publicly available data to identify black lung incidence, and designed a series of predictive models to predict the number of black lung cases or deaths. This presentation will discuss the methods and findings resulting from this study.

Health effects of exposure and supplement of selenium: a two-step study

Oral - Abstract ID: 139

Prof. Lei Huang [1], ***Mr. Chen Li*** [1]

1. Nanjing University

Objectives: China is recognized as one of the countries facing a significant Se deficiency. Additionally, Se contents in the human body may decrease with age. Thus, a two-step study was conducted to explore the health effects of Se exposure and supplementation among the community middle-aged and elderly.

Methods: Firstly, a retrospective cohort study was conducted to compare the differences in Se contents and some other health outcomes between the middle-aged and elderly residing in Se-rich regions, Wentang Town in Yichun City, China, and non-Se-rich regions. The second step of this study, a before-after self-control Se-supplementation study, among such populations residing in non-Se-rich regions was conducted. The subjects orally received Se tablets for a duration of 30 days, with a daily dosage of Se of 120 μg. The hair-Se contents (H-Se), serum-Se contents (S-Se), and some relevant blood biochemical indices were measured. Multiple linear regression models and linear mixed-effect models were fitted to assess the effects of Se-exposure and Se-supplementation, respectively.

Results: For the first step, the H-Se, S-Se, and level of total cholesterol (TC) of the subjects from Se-rich regions were all significantly higher than their counterparts. Notably, a positive association was observed between S-Se and lipids (low-density lipoprotein cholesterol and TC) (both $p < 0.030$). For intervention study, a significant increase of 22.40% in H-Se and 21.62% in S-Se after the supplementation. Moreover, the Se-supplementation also exhibited positive effects on some health indices, including significant decreases in alanine aminotransferase, homocysteine, and fasting glucose (all $p < 0.050$). Additionally, the level of high-density lipoprotein cholesterol was also decreased significantly.

Conclusions: Overall, this study demonstrated that the community middle-aged and elderly residing in Se-rich regions or receiving quantitative Se-supplementation could effectively improve Se levels in their bodies and some health indices, excluding lipids, including liver function, cardiovascular health, and glucose metabolism.

Heterogeneity of phosphorus sources invokes distinct niche partitioning pathways of ectomycorrhizal fungi in forest soils

Oral - Abstract ID: 513

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Ectomycorrhizal (ECM) fungi play a crucial role in acquiring phosphorus (P) beyond the rhizosphere in nutrient-poor soil environments. However, our understanding of how ECM community structure and function influence the utilization of different P-containing substrates within forest soils remains limited. In this study, we investigated the impact of various P substrates, namely calcium orthophosphate (Ca-P), phosphate-saturated goethite (Fe-P), fluorapatite (Min-P), and wheat bran (Orgn-P), on the release of plant-available P using hyphal in-growth mesh bags. Our findings revealed that the different P substrates released similar amounts of plant-available P to the Pinaceae hosts. The relative abundance of P-preferred ECM fungal taxa, with a particular emphasis on inorganic forms such as Fe-P, Ca-P, and Min-P, demonstrates a strong correlation with both P acquisition exoenzyme activity and the reduction of Fe (III). Additionally, this correlation is notably associated with the long/medium-distance hyphal exploration types characteristic of those fungal taxa. These results highlight the strong preferences of ECM fungi for different P-containing substrates. The niche-specific associations between ECM fungi and P substrates provide new insights for management interventions aimed at alleviating widespread P deficiency in subtropical forests. Targeted fertilization strategies could be developed based on these findings.

High fluoride in drinking water sources in Kenya and their health implications: Challenges of establishing local solutions

Oral - Abstract ID: 206

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Kenya has a complex geology which includes the volcanic East African Rift Valley, the metamorphic Mozambique Mobile Belt and sediments of the coastal region with known high concentrations of potentially harmful elements. This diverse geology results in varying hydrogeochemistry across the county, some of which could have adverse human health implications. Due to the semi-aridity of most regions in Kenya, rainfall is unreliable leaving groundwater resources highly relied on. Evidence of fluoride concentrations ten-fold higher than recommended limits, and resultant health complications such as dental and skeletal fluorosis, have been reported in groundwater sources across Kenya as early as the 1980's. However, despite this known challenge in drinking water quality, there has not been established an efficient, reliable and user-friendly defluoridation system in the country. To overcome this challenge, this report highlights the occurrence of high fluoride groundwaters in Kenya, their health implications, and defluoridation status in Kenya and its challenges. Solutions will be proposed to solve these challenges and successful defluoridation methods used in other parts of the world will be suggested for establishment in the country. This review is the first step in establishing effective defluoridation techniques to be used in the country, and others with similar issues. Its significance comes with the fact that Kenya is trying to achieve her UN SDGs and is currently ranked 125th of 157 countries in achieving these goals. Among these goals include the provision of clean water and good health for the population. Therefore, Kenya needs to establish and use locally tailored technologies that help in the provision of clean drinking water to the population.

High Nitrate Concentrations with Low N2O Emission Fluxes in the Haihe Small Watershed

Oral - Abstract ID: 900

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Nitrous oxide (N2O) exhibits a greenhouse effect that is 300 times more potent than carbon dioxide, positioning streams and small rivers as significant emission hotspots. Despite this, the spatiotemporal dynamics and controlling mechanisms of N2O emissions within small watersheds are yet to be fully understood. This study investigates a small watershed of the Hai River, which originates from the Yan Mountains in China, by collecting water samples from a variety of sources including streams, rivers, reservoirs, groundwater, and reclaimed water, across a gradient from upstream to downstream areas. Through the application of the headspace equilibration method, we measured dissolved N2O concentrations, determined emission factors (EF5r) for different river classes, and quantified N2O emission fluxes. Moreover, we explored the origins of N2O using nitrogen and oxygen isotopic analyses of nitrate (NO3-). Our findings indicate that NO3- concentrations spanned from 0.064 to 14.159 ug N-1L-1, averaging at 4.473±3.493 ug N-1L-1—surpassing the national average and suggesting a pronounced enrichment of NO3- in these water bodies. Dissolved N2O levels ranged between 0.113 and 8.161 ug N-1L-1, with a mean of 0.800±0.645 ug N-1L-1, marginally below the national mean. N2O flux measurements across all sites varied from 0.023 to 7.276 ug m-2 h-1, identifying both wet and dry seasons as minor sources of N2O. The investigation revealed that carbon limitations restricting energy availability curtailed N2O emissions in the upstream sections, whereas emissions in the downstream were constrained by a scarcity of reactive nitrogen. It was established that upstream N2O discharges primarily originated from terrestrial nitrogen inputs, in contrast, downstream emissions were significantly influenced by domestic wastewater outputs. This study enhances our comprehension of N2O emission patterns and their underlying mechanisms within small watershed contexts, underscoring the critical need for targeted mitigation strategies.

High Resolution Characterization of Coal Combustion-Derived Metal-Containing Nanoparticles and Their Health Implications

Oral - Abstract ID: 527

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Precise determination of the elemental composition of metal-containing nanoparticles (MCNPs) emitted from coal combustion activities is crucial for assessing their health related risk. Here, based on single-particle ICP time-of-flight MS (spICP-TOF-MS) technique, elemental composition of individual MCNPs in coal combustion by-products (CCPs) collected from a typical coal-fired power plant (CFPP) were analyzed. Vast number of Ti-, Fe-, Zn-, and Pb-containing NPs were identified in CCPs and fly ash escaped through the stack (EFA) had the highest particle number concentrations. A majority (64–96%) of these MCNPs existed as multi-metals nanoparticles (mmNPs), with almost all Zn and Pb having mass fractions below 20% in individual particles, indicating their adsorption to MCNPs. Al, Si and Fe were the dominant components of MCNPs, and these Al-, Si-, and Fe-rich NPs were found associated with volatile toxic metals. This association increased with dust removal stages and reached the highest in EFA. Toxic potency of MCNPs was approximately one order of magnitude higher than that of PM2.5 emitted from CFPPs. Iron in Al-rich NPs and Fe-rich NPs emerged as top significant factors regulating intracellular oxidative stress, while trace metals (especially Pb) associated with MCNPs played the most important role in lung cell viability toxicity.

High spatial resolution estimates of major PM2.5 components and their associated health risks in Hong Kong using a coupled land use regression and health risk assessment approach

Oral - Abstract ID: 28

Dr. Zhiyuan Li [1]

1. *Sun Yat-sen University*

Few studies have focused on the spatial distribution of the typical components and source tracers of $PM_{2.5}$ and their associated health risks, despite the fact that the chemical components of $PM_{2.5}$ pose potentially significant and independent risks to human health. The main objective of this study was to evaluate the spatial distribution of major $PM_{2.5}$ components and their associated health risks in Hong Kong using a coupled land use regression and health risk assessment modeling approach. The established land use regression models of the major $PM_{2.5}$ components and source tracers achieved a relatively high statistical performance, with training and leave-one-out cross-validation R^2 values of 0.85–0.96 and 0.62–0.88, respectively. The high spatial resolution (500 m × 500 m) distribution patterns of the chemical components of $PM_{2.5}$ showed the heterogeneity of population exposure to different components and the related potential health risks, as evidenced by the weak spatial correlations between the mass of $PM_{2.5}$ and some components. Elemental carbon, nickel, arsenic, and chromium from $PM_{2.5}$ made major contributions to the total health risk and should therefore be reduced further. Our results will enable researchers to determine independent associations between exposure to the various components of $PM_{2.5}$ and health endpoints in epidemiological studies.

Highly Sensitive Visual Detection of Ammonia Nitrogen in Groundwater by a Multi-emission fluorescent Tb-MOF

Oral - Abstract ID: 560

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Ammonia nitrogen is one of the important chemical indicators reflecting the quality of the water environment. Especially in complex and variable low-quality groundwater environments, high-sensitive and selective ammonia nitrogen detection can provide technical support for studying its migration and in-situ remediation mechanism. The traditional on-site detection methods for ammonia nitrogen in groundwater are Nessler's reagent method and salicylic acid hypochlorite method. The former one requires the use of highly toxic substance mercury iodide and is susceptible to other components in groundwater, while the latter has a long detection time and strict requirements for sample pH. Therefore, the development of environmentally friendly, highly selective, and highly sensitive on-site rapid detection technology for ammonia nitrogen in groundwater with a wide pH range and multi-component coexistence is a key technical issue that urgently needs to be addressed in this field.

In this study, we screened a functional group(dialdehyde structure, OPA) that reacted specifically with ammonia nitrogen (NH_3 and NH_4^+), subsequently generating fluorescent characteristic substances, to prepare a fluorescent sensor with high specificity for ammonia nitrogen. A highly sensitive, selective, and visual detection technology for ammonia nitrogen based on functionalized Tb-MOF was constructed. This visual ammonia nitrogen detection technology based on the photocathode strategy has advantages such as strong selectivity, low detection limit (LOD=8.18×10^{-3} μM), short detection time (5 minutes), wide detection range (0-0.0021 M), as well as good visualization. The detection in actual groundwater samples proves that this material can be used for practical applications. Our research provides a new method for visual, rapid and on-site detection of ammonia nitrogen in groundwater.

House dust: Size dependence of the concentration of various elements

Oral - Abstract ID: 284

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Indoor air quality is of growing interest since people spend much more than half of their time indoors. There people are exposed to house dust in various ways. On the one hand, house dust gets easily re-suspended depending on the size of the dust particles and subsequently it can enter the respiratory system. On the other hand, re-suspended house dust being deposited again can be ingested when it contaminates food. In the various studies on metals in house dust and the assessment of the associated risk the upper size limit of the house dust investigated varies between 63 µm and 500 µm. If the concentrations of metals are different in coarse and fine particles, a different upper size limit applied in sample preparation can strongly influence the measured concentration. However, in literature only few data on the size dependence of the composition of house dust is available. In this study house dust was separated into six particle size fractions by sieving. The particle size of the size fractions was determined by laser diffraction and the samples were analyzed using a XRF spectrometer. For many elements like Ca, Mg, Al, Sr, Ba, Rb, P, S, V, Cu and Mo no distinct size dependence of the concentration was found. The concentration of some elements (Si, Ni and Ta) increased with the particle size. In contrast, the concentration of several elements (As, Sb, Sn, Pb, Tl, Zn) was significantly increased in the fine size fractions. The concentration ratio between minimum and maximum concentration was up to approximately 1 to 6. Therefore, in studies dealing with health risk assessment of house dust increased attention should be given to the size limits of the investigated house dust samples, since the measured concentration of relevant metals will depend on the applied size limit in sample preparation.

How does Asbestos cause cancer? Insight into mechanisms of cancer development, early detection, and new treatment options, from genetically engineered mouse models

Oral - Abstract ID: 517

Prof. Daniel Murphy [1]

1. *University of Glasgow*

Exposure to Asbestos is the number 1 cause of Mesothelioma, a lethal cancer arising on the pleural surfaces of the chest cavity and lungs. A legacy of Asbestos contaminated buildings continues to drive new cases of Mesothelioma in countries that have banned use of these materials, while several countries continue to use Asbestos for a range of industrial, commercial and domestic purposes. Asbestos is additionally linked to lung cancer. The biopersistence and fibre dimensions of Asbestos fibres provoke a state of chronic inflammation but how that inflammation contributes to cancer development is poorly understood. My lab investigates the interplay between a) combinations of mutations commonly found in human Mesothelioma and b) Asbestos-driven chronic inflammation, to garner new insight into how these cancers arise. Temporal and spatial (anatomic) control over mutation activation and defined injected/inhalation exposure to Asbestos enables us to investigate not just the late stages of terminal disease but the entire journey from first genetic lesion through to development of lethal cancer. Through molecular and cellular characterisation of developing tumours along with deep phenotypic investigation of the relevant micro- and macro-environment, we are uncovering clues 1) that may help stratify patients by level of risk of malignant progression, 2) yield insight into what drives cancer progression and sustains tumour cell proliferation in situ and 3) what vulnerabilities might be exploitable for therapeutic benefit.

How much health benefit would the updated Indoor Air Quality Standard of China bring?

Oral - Abstract ID: 638

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Importance of the work and objectives: Despite continuous improvement in air pollution, China's PM2.5 pollution remains relatively high and ranks the primary air pollutant. The issue of indoor PM2.5 pollution is more serious than atmospheric PM2.5 pollution, but it had been underestimated. The Indoor Air Quality Standard of China was updated in 2022, with the targeted daily average indoor PM2.5 concentration (50 μg/m3). This study is aim to determine how much health benefit could this new guideline bring to China.
Methodologies: We constrcuted three air quality scenarios related to this guideline and evaluate the health and economic burden attributable to the time-weighted average PM2.5 (TWPM) exposure under the three scenarios, using the method of Global Burden of Disease (GBD) study and the Willingness-to-pay (WTP) method.
Main results and conclusion: The annual mean TWPM concentration in 2020 under the Unchanged scenario, Indoor Air Policy scenario (IAP), and Indoor and Outdoor Air Policy (IOAP) scenario were estimated to be 22.4, 21.7 and 17.5 μg/m3 in China, respectively. The TWPM-related premature deaths and economic burden were estimated to be 1.22 million and 3.35 trillion RMB Yuan in the Unchanged scenario. A total of 30 thousand premature deaths and 8.74 billion RMB Yuan were estimated to be avoided in the IAP scenario; 180 thousand premature deaths and 58.58 billion RMB Yuan could be avoided in the IOAP scenario. The Indoor Air Quality Standard could bring considerable health benefits for China. but the TWPM-related disease burden in China remained high even if all the counties of China achieved the new standard. In comparison to simply improving indoor air quality, boosting both indoor and outdoor air quality improvement may achieve more significant health and economic benefits.

How to improve collaborative performance in carbon mitigation and air pollution control? A spatio-temporal study based on evidence from 284 cities in China

Oral - Abstract ID: 486

Dr. Yanming Sun [1]

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Being affected by air pollution and climate change, cities are critical areas for implementing related governance policies. Based on panel data of 284 Chinese cities from 2014 to 2021 as an example, this paper employs an SBM-DDF-GML model and a coordinated development model to construct an evaluation system for collaborative performance of carbon mitigation and air pollution control (CPCA). We further analyze the dynamic changes and spatial-temporal evolution of CPCA, and then evaluate the trends using a spatial-temporal geographically weighted regression (GTWR) model to explore the spatial heterogeneity of the factors that drive CPCA in Chinese cities. We find that the spatial concentration of CPCA has been decreasing from 2014 to 2021, with a trend of decentralized distribution. Industrial structure, energy structure, green technology, energy efficiency, environmental regulation, and government competition have important impacts on CPCA. The results of the study can provide policy references and empirical evidence for governments at all levels to collaborate in carbon mitigation and air pollution control.

Human activities aggravate nitrogen-deposition pollution to inland water over China

Oral - Abstract ID: 149

Prof. Yang Gao [1], ***Dr. Junjie Jia*** [1], ***Dr. Junjie Jia*** [1], ***Prof. Xuefa Wen*** [1], ***Prof. Guirui Yu*** [1]

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In the past three decades, China has built more than 87 000 dams with a storage capacity of≈6560 km^3 and the total surface area of inland water has increased by 6672 km^2. Leaching of N from fertilized soils to rivers is the main source of N pollution in China, but the exposure of a growing inland water area to direct atmospheric N deposition and N leaching caused by N deposition on the terrestrial ecosystem, together with increased N deposition and decreased N flow, also tends to raise N concentrations in most inland waters. The contribution of this previously ignored source of N deposition to freshwaters is estimated in this study, as well as mitigation strategies. The results show that the annual amounts of N depositions ranged from 4.9 to 16.6 kg ha^{-1} yr-1 in the 1990s to exceeding 20 kg ha^{-1} yr^{-1} in the 2010s over most of regions in China, so the total mass of ΔN (the net contribution of N deposition to the increase in N concentration) for lakes, rivers and reservoirs change from 122.26 Gg N yr^{-1} in the 1990s to 237.75 Gg N yr^{-1} in the 2010s. It is suggested that reducing the N deposition from various sources, shortening the water-retention time in dams and decreasing the degree of regulation for rivers are three main measures for preventing a continuous increase in the N-deposition pollution to inland water in China.

Human and environmental exposure to rare earth elements and other agents in the ion-adsorption type rare earth mining areas in the Ganzhou City, Southeast China

Oral - Abstract ID: 306

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Basic methods are used to exploit the ion-adsorption type rare earth mines (IATREMs)in the Ganzhou City of the southeast China, producing hazardous wastes that may pose risks of contamination by rare earth elements (REEs) and other agents. The objectives of this study were to quantify the concentrations of REEs, heavy metals, ions and assess their environmental and human health risks in IATREMs areas in the Ganzhou City of the southeast China. Thus, 120 samples of surface water, underground water, soils, mining wastes, human hair samples were collected in exploration sites and its nearby village, as well as in a natural forest and village downstream that were considered as reference areas. The concentrations of REEs and heavy metals were quantified using inductively coupled plasma mass spectrometry, and the results were used to estimate pollution indices and risks associated with the contaminants. All REEs and NH_4^+,NO_3^-,REEs,Pb, As, Cd showed higher concentrations in surface and grounded water samples in the mining areas, while REEs, Pb, As, Cd are lower concentrations in surface soils samples. All REEs, As, Al, Th, Rb, Mn concentrations showed higher concentrations in people who lived nearby mining area. The ecological risk indices varied from moderate to low in the most polluted sites, and risks to human health were low in all areas studied. The results of this study indicate that REEs mining has the potential to cause contamination, enrichment, and ecological risks by REEs, heavy metals and ions in the Ganzhou City. Preventive and control measures should be implemented to protect the environment from the negative impacts of these contaminants.

Human Internal Exposure to Contaminants of Emerging Concerns at Typical Industrial Sites in China

Oral - Abstract ID: 533

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Industrial activities represent a primary source of human exposure to contaminants of emerging concerns (CECs). In this study, serum and urine samples were collected from various industry areas, including coking, petrochemical, e-waste, and nonferrous metal factories. Per- and polyfluoroalkyl substances (PFAS), chlorinated paraffins (CPs), dechlorane plus (DPs), and p-phenylenediamine (PPDs) were analyzed using high-resolution mass spectrometry. A rigorous comparison was carried out between the exposed groups and their respective control groups. Our findings revealed significantly elevated concentrations of several CECs within the exposed groups compared to their control groups, which suggested potential occupational exposure to these contaminants. Moreover, non-target analysis was also employed to identify other potential CECs. This approach led to the identification of several previously unrecognized chemicals, including bis(trifluoromethane)sulfonimide. Furthermore, risk assessment associated with CECs exposure was conducted for different populations to provide insights into the health-based effects of both occupational exposure and non-occupational exposure to CECs, offering a comprehensive perspective on the potential risks involved.

Human Pathological Mineral Features

Oral - Abstract ID: 807

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Mineralization is one of several events that constitute the life process of the human body. Functional mineralization is a controlled process that occurs in a specific part of the human body and is completed strictly according to the specific composition, structure and degree. The minerals formed have a special high-level structure and assembly mode. Pathological mineralization, also known as abnormal mineralization, is an out-of-control process and often closely associated with disease. It occurs in places where it should not occur (ectopic mineralization). Pathological mineralization can occur in many parts of the human body, such as various organ stones, gout, cardiovascular system calcification, tumor calcification foci and so on. Among them, stones and tophi are easier to obtain samples that scholars have conducted in-depth researches on them for many years and have obtained a more systematic understanding. Calcification of the cardiovascular system is the main risk factor for the cardiovascular diseases, and calcification in tumor lesions is also considered to be closely related to the development and diagnosis of tumors. Therefore, the study of pathological mineralization may possibly provide guidance for the prevention and treatment of diseases. Human pathologic mineral is the product of the interaction between human body and the surrounding environment. It is the carrier to record the evolution of the human body and the external environment, which contains a lot of information reflecting the changes in the human and surrounding environments. This information is contained in the morphology, microstructure, chemical composition, physical and chemical properties, spectral characteristics, and distribution laws of minerals. Therefore, to find out the etiology and pathology of diseases related to mineralization, it requires in-depth study of the minerals formed in the lesions. This talk will mainly describe the characteristics of pathological minerals in several tumor mineralization foci and the cardiovascular system.

Hydrochemical characteristics and water quality evaluation of pore confined water in Qiongbei Basin,Hainan Island

Oral - Abstract ID: 895

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Pore confined groundwater was an important water source in Qiongbei Basin,Hainan Island. It have played an important role in solving the water consumption of urban and rural residents and supporting economic and social development. Studying the hydrochemical characteristics and water quality of this type of groundwater is of great significance to understand the impact of natural processes and human activities on groundwater environment. The pore confined groundwater in Qiongbei Basin of Hainan Island was taken as the research object,combined with the hydrogeological conditions and the methods of multivariate statistics,Piper diagram,Gibbs diagram,correlation analysis and ion ratio,this paper studied the hydrochemical characteristics and main control factors of groundwater in this area,and analyzed the groundwater quality and influencing factors. The results showed that pore confined groundwater in Qiongbei Basin of Hainan Island was mainly neutral water. Weak acid water was mainly distributed in the recharge runoff area of piedmont plain,and weak alkaline water was mainly distributed in the discharge area near the coastal zone at the northwest end of Qiongbei Basin. K^+,Na^+,Cl^-,SO_4^{2-} and NO_3^- were greatly affected by temporal and spatial scales and their distribution was unstable. The hydrochemical types were mainly HCO_3-Ca·Mg,HCO_3-Ca·Mg·Na. From the recharge area to the discharge area,the cations were changed from Ca^{2+} and Mg^{2+} to Na^+. The chemical characteristics of groundwater were mainly affected by the weathering and leaching of rocks,mainly the dissolution of silicate minerals,and the weathering and dissolution of evaporated salt rock and carbonate minerals also contributed to a certain extent. The groundwater quality in Qiongbei Basin of Hainan Island was mainly Class □ water,and the overall water quality was good. Class □ and □ water were mainly distributed in groundwater runoff area and discharge area,mainly in coastal discharge area. The main exceeding standard factors such as Al and Mn were related to geological background.

Identification of methane cycling pathways in Quaternary alluvial-lacustrine aquifers using multiple isotope and microbial indicators

Oral - Abstract ID: 182

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Groundwater rich in dissolved methane is often overlooked in the global or regional carbon cycle. Considering the knowledge gap in understanding the biogeochemical behavior of methane in shallow aquifers, particularly those in humid alluvial-lacustrine plains with high organic carbon content, we investigated methane sources and cycling pathways in groundwater systems at the central Yangtze River basins. Composition of multiple stable isotopes ($^{2}H/^{18}O$ in water, ^{13}C in dissolved inorganic carbon, $^{13}C/^{2}H$ in methane, and ^{13}C in carbon dioxide) was combined with the characteristics of microbes and dissolved organic matter (DOM) in the study. The results revealed significant concentrations of biogenic methane reaching up to 13.05 mg/L in anaerobic groundwater environments with abundant organic matter. Different pathways for methane cycling (methanogenic CO_2-reduction and acetate-fermentation, and methane oxidation) were identified. CO_2-reduction dominated acetate-fermentation in the two methanogenic pathways primarily associated with humic DOM, while methane oxidation was more closely associated with microbially derived DOM. The abundance of obligate CO_2-reduction microorganisms (Methanobacterium and Methanoregula) was higher in samples with substantial CO_2-reduction, as indicated by isotopic composition. The obligate acetate-fermentation microorganism (Methanosaeta) was more abundant in samples exhibiting evident acetate-fermentation. Additionally, a high abundance of *Candidatus* Methanoperedens was identified in samples with apparent methane oxidation. Comparing our findings with those in other areas, we found that various factors, such as groundwater temperature, DOM abundance and types, and hydrogeological conditions, may lead to differences in groundwater methane cycling. This study offered a new perspective and understanding of methane cycling in worldwide shallow alluvial-lacustrine aquifer systems without geothermal disturbance.

Identification of multi-element pollution hotspots and geochemical associations of PTE in urban dust (Yerevan, Armenia)

Oral - Abstract ID: 365

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Identification of pollution levels and sources of potentially toxic elements (PTE) in urban dust (UD) is crucial for better urban management and pollution prevention. This study aims to identify UD multi-element pollution hotspots in city of Yerevan through the combined application of Summary Pollution Index (Zc), Local Moran's I Index (LMI), CoDA and hierarchical clustering. UD sampling was conducted in the summers of 2022/2023. 299 UD samples were collected from the streets and residential yards of Yerevan and the contents of Cr, V, Ti, Mo, Cu, Zn, Co, Fe, Mn, Pb, and Ba were determined by X-ray fluorescence spectrometry. The assessment of Zc showed that moderately hazardous and hazardous levels of pollution dominated in the city territory, occupying its north and south, respectively. It should be noted that the south of the city is an old industrial district where many industrial plants operated and are still active (Mo production). Moreover, the extremely hazardous level of pollution was observed in the southwest near the remains of the old industrial units and metal scrap piles. The LMI showed that this area, characterized by the extremely hazardous and surrounded by hazardous levels of pollution, is spatially contiguous with the high-high cluster. Hierarchical clustering of the clr-transformed data set of the high-high cluster showed that PTE represents two groups: first: Fe, Co, Ti, Mn, V and Ba; second: Mo, Zn, Cu, Pb and Cr. The elements in the second cluster form a geochemical association of anthropogenic origin. This study showed that the combined use of Zc, LMI, CoDA and hierarchical clustering allows to identify statistically significant multi-element pollution hotspots in the urban area and to reveal geochemical associations of elements typical of high-high spatial cluster.

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Identification of possible sources for potentially toxic elements and polycyclic aromatic hydrocarbons and their spatially varying relationships in urban soils of Dublin, Ireland

Oral - Abstract ID: 174

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Potentially toxic elements (PTEs) and polycyclic aromatic hydrocarbons (PAHs) harm the ecosystem and human health, especially in urban areas. Identifying and understanding their potential sources and underlying interactions in urban soils are critical for informed management and risk assessment. This study investigated the potential sources and the spatially varying relationships between 9 PTEs and PAHs in the topsoil of Dublin by combining positive matrix factorisation (PMF) and geographically weighted regression (GWR). The PMF model allocated four possible sources based on species concentrations and uncertainties. The factor profiles indicated the associations with high-temperature combustion (PAHs), natural lithologic factors (As, Cd, Co, Cr, Ni), mineralisation and mining (Zn), as well as anthropogenic inputs (Cu, Hg, Pb), respectively. In addition, selected representative elements Cr, Zn, and Pb showed distinct spatial interactions with PAHs in the GWR model. Negative relationships between PAHs and Cr were observed in all samples, suggesting the control of Cr concentrations by natural factors. Negative relationships between PAHs and Zn in the eastern and north-eastern regions were related to mineralisation and anthropogenic Zn–Pb mining. In contrast, the surrounding regions exhibited a natural relationship between these two variables with positive coefficients. Increasing positive coefficients from west to east were observed between PAHs and Pb in the study area. This special pattern was consistent with prevailing south-westerly wind direction in Dublin, highlighting the predominant influences on PAHs and Pb concentrations from vehicle and coal combustion through atmospheric deposition. Our results provided a better understanding of geochemical features for PTEs and PAHs in the topsoil of Dublin, demonstrating the efficiency of combined approaches of receptor models and spatial analysis in environmental studies.

Ignorance is Not Bliss. The Need for Elucidating the Geographical Link between Chronic Diseases and Environmental Microbiomes

Oral - Abstract ID: 699

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There are several chronic diseases (e.g., stroke, Alzheimer disease) which display strong geographical variation in prevalence. While some of this variation can be explained by socio-economic contributions, there remains a significant amount of variation that is unaccounted for. In the case of both stroke and Alzheimer disease, there is a strong implication of nativity and early life - prolonged residence in select geographic regions (e.g., the Stroke Belt) - as significant risk markers. These diseases also elicit racial and ethnic disparities with higher risk and death rates carried by African-Americans. One hypothesis is that residence in these geographically constrained areas results in acute-exposure events, and that consideration should be given to an infectious agent as the possible culprit. Unfortunately, very little research has been conducted to elucidate which etiological agents may be present in these environments. In the case of strokes, we conducted a study to pinpoint environmental factors within the Stroke Belt of South Carolina to identify soil risk markers. We were able to identify several soil characteristics that strongly correlated with stroke rate. These properties related to wet soil conditions, as indicated by depth to water table, soil drainage class, and hydric soil rating. Additionally, soil pH positively correlated with increased stroke rates. All of these properties are known to have an impact on microbial population composition. Reductions in the cost of metagenomic sequencing has resulted in such approaches becoming widely affordable and accessible. The potential for developing a metagenomic map of the Stroke Belt is now within our grasp. This map can then be utilized to highlight potential links between microbial agents and increased risk rates for disease, as well as be provided as a resource for other environmental-, animal-, and human-health related research.

Immobilization of heavy metal(loid)s in contaminated soil using functionalized biochar

Oral - Abstract ID: 208

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Soil contamination by heavy metal(loid)s is a global environmental concern. Effective solutions are urgently needed to mitigate the negative impacts of heavy metal(loid)s on the environment and human health. Biochar has become an effective material for the remediation of contaminated soils. However, pristine biochar cannot always meet the desired remediation requirements. Therefore, a range of modification methods have been developed for tailoring the physicochemical properties of biochar to enhance its effectiveness in soil remediation. This talk presents the recent advances in the synthesis and application of functionalized biochar for the immobilization of heavy metal(loid)s in contaminated soils.

Keywords: Modified biochar; Heavy metal; Metalloids; Adsorption; Soil remediation

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Impact of virus on bacterial communities and nutrient cycles in paddy soils

Oral - Abstract ID: 902

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Soils harbor extremely abundant and diverse viruses, which are increasingly recognized as crucial in modulating host community dynamics and biogeochemical cycling of elements. However, empirical evidence detailing the impact of viruses on bacterial communities and nutrient cycles in soil environments remains scarce. Initially, we examined the successional patterns of T4-type bacteriophages within the *Myoviridae* family and bacterial communities across a 2000-year paddy soil chronosequence. Both the Mantel test and variation partitioning analysis revealed that bacteriophages play a significant role in shaping bacterial communities in soils. Subsequently, we carried out an extensive field survey to elucidate the patterns of T4-type bacteriophage-bacteria interactions in paddy soils across latitudinal gradients at a continental scale. Procrustes and bipartite network analyses indicated a monotonically decreasing pattern of virus–bacteria interactions along latitudinal gradients. The microcosm experiments further demonstrated that temperature, closely associated with climatic conditions, was the primary regulator of trophic associations along the latitudinal gradient. We also explored the potential function of viruses in nutrient cycling using metagenomic and viromic approaches. The identification of several viral-encoded auxiliary metabolic genes, such as *phoB* and *gdh*, linked to phosphorus and nitrogen cycling, and the observed associations between viruses and bacteria encoding these genes, underscore the viruses' potential role in the phosphorus and nitrogen cycles in paddy soils. Additionally, we highlighted the viral shunt by tracing the carbon flow from ^{13}C-labelled organics to bacteria and T4-type bacteriophage in paddy soil. Finally, the impact of viruses on nutrient cycles was further evidenced by the amendment of viral suspensions in paddy soil, which significantly altered the dissolved carbon and nitrogen pools, microbial biomass carbon, and emissions of methane and nitrous oxide. In conclusion, our findings provide empirical evidence of the significant impact of viruses on microbial communities and biogeochemical cycles in the soil environment.

Improvement of alfalfa resistance against Cd stress through rhizobia and arbuscular mycorrhiza fungi co-inoculation in Cd-contaminated soil

Oral - Abstract ID: 371

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Rhizobia and arbuscular mycorrhiza fungi (AMF) are important symbiotic microbes that are advantageous to plants growing in metal-contaminated soil. However, it remains unclear how inoculated microbes affect rhizosphere microbial communities or whether subsequent changes in rhizosphere microbiomes contribute to improving plant resistance under metal stress. This study investigated the effects of rhizobia and AMF inoculation on alfalfa resistance to Cd stress. Results showed that single rhizobia or AMF inoculation significantly improved alfalfa resistance to Cd stress, while their co-inoculation resulted in the greatest overall improvement. Improved resistance was reflected by the significant mitigation of Cd-induced lipid peroxidation and reactive oxygen species (ROS) stress caused by increases in antioxidant enzyme activities along with co-inoculation. Furthermore, co-inoculation significantly altered the rhizosphere microbial community structure by decreasing fungal community diversity and increasing bacterial community diversity. Results of partial least squares path modeling (PLS-PM) and variation partitioning analysis (VPA) showed that the rhizosphere bacterial community predominated over the fungal community with respected to improvements in resistance to Cd stress under the co-inoculation treatments. This improvement was specifically seen in the enrichment of certain key bacterial taxa (including *Proteobacteria*, *Actinobacteria*, *Acidobacteria*, and *Chloroflexi*) induced by the rhizobia and AMF co-inoculation, enhancing alfalfa' ability to uptake rhizosphere nutrients and reduce its release of photosynthetically-derived carbon (C) into soil. Our findings revealed that the co-inoculation of multiple symbiotic microbes can assist plants to effectively cope with Cd stress, providing a greater understanding of rhizosphere bacterial taxa in the microbe-induced phytomanagement.

Improving predictions and understanding of primary and ultimate biodegradation rates with machine learning models

Oral - Abstract ID: 452

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This study aimed to develop machine learning based quantitative structure biodegradability relationship (QSBR) models for predicting primary and ultimate biodegradation rates of organic chemicals, which are essential parameters for environmental risk assessment. For this purpose, experimental primary and ultimate biodegradation rates of high consistency were compiled for 173 organic compounds. A significant number of descriptors were calculated with a collection of quantum/computational chemistry software and tools to achieve comprehensive representation and interpretability. Following a pre-screening process, multiple QSBR models were developed for both primary and ultimate endpoints using three algorithms: extreme gradient boosting (XGBoost), support vector machine (SVM), and multiple linear regression (MLR). Furthermore, a unified QSBR model was constructed using the knowledge transfer technique and XGBoost. Results demonstrated that all QSBR models developed in this study had good performance. Particularly, SVM models exhibited high level of goodness of fit (coefficient of determination on the training set of 0.973 for primary and 0.980 for ultimate), robustness (leave-one-out cross-validated coefficient of 0.953 for primary and 0.967 for ultimate), and external predictive ability (external explained variance of 0.947 for primary and 0.958 for ultimate). The knowledge transfer technique enhanced model performance by learning from properties of two biodegradation endpoints. Williams plots were used to visualize the application domains of the models. Through SHapley Additive exPlanations (SHAP) analysis, this study identified key features affecting biodegradation rates. Notably, MDEO-12, APC2D1_C_O, and other features contributed to primary biodegradation, while AATS0v, AATS2v, and others inhibited it. For ultimate biodegradation, features like No. of Rotatable Bonds, APC2D1_C_O, and minHBa were contributors, while C1SP3, Halogen Ratio, GGI4, and others hindered the process. Also, the study quantified the contributions of each feature in predictions for individual chemicals. This research provides valuable tools for predicting both primary and ultimate biodegradation rates while offering insights into the mechanisms.

Influence of climate-induced organic matter decomposition on the arsenic behavior in soil environments

Oral - Abstract ID: 391

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The biological (e.g., microbial activity and community composition changes) and non-biological (e.g., photochemical reactions and freeze-thaw cycles) responses to climate change are known to influence soil environments. Particularly, warming factors such as temperature and moisture accelerate the decomposition and carbon loss of soil organic matter (SOM) leading to changes in composition (labile < recalcitrant). This study aims to evaluate the adsorption capacity of arsenate (As(V)) based on the physicochemical factors of soil organic matter (aggregates size, OM content, and composition) that could be altered by climate change. Our results demonstrate that higher As(V) adsorption was observed in micro-aggregates (<250 µm) with elevated concentrations of OM and iron. Decreased adsorption capacity was confirmed in soils where OM content was reduced through sodium hypochlorite (pH < 8) treatment. Limitations in adsorption sites and the decrease in iron concentration due to the loss of OM contributed to the decline of As(V) adsorption. Considering the composition of OM, higher lignin (recalcitrant) content corresponded to increased As(V) adsorption capacity, along with lower iron release. The behavior of As(V) in soils is primarily regulated by adsorption and co-precipitation with minerals rich in fine particle-sized iron oxides (Fe-(oxy)hydroxide). However, this study confirms that climate-induced SOM decomposition can impact directly As(V) behavior, the stabilization of As(V) and the interaction with minerals (e.g., As-Fe-OM ternary complex). Continuous warming can lead to decompose recalcitrant OM (lignin), and may render it more challenging for As(V) to persist in the soil environments. This study may contribute to a better understanding of the mechanistic interactions between OM and As(V) in soil-groundwater systems undergoing climate change.

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Influence of environmental pollution on life expectancy: A scoping review

Oral - Abstract ID: 265

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Importance of the work and objectives

A better understanding of indoor life expectancy and the environmental pollution affecting it can improve environmental quality management and enhance human well-being. This scoping review aims to evaluate the peer-reviewed published literature on environmental pollution and life expectancy under a scoping review framework.

Methodologies

PubMed, Scopus, and Web of Science databases were searched to execute the scoping review. Title and abstract screening, full-text review, and data collection were conducted. The scoping review is guided by Arksey and O'Malley framework in five stages.

Main results and conclusion

We present the characteristics of these studies regarding water, soil, and air pollution and life expectancy. The findings of this scoping review cover a variety of environmental pollution factors that might influence life expectancy, and several core research themes were identified. This scoping review highlights the current gaps in the existing literature, as well as the consensus across findings. Based on our findings, recommendations for future studies and practice are discussed, and the importance of environmental pollution control in promoting life expectancy is highlighted.

Insights into the Mechanism of Chromium(III) Transformation by Iron Hydroxide in the Atmosphere: A Study Using an Oxidation Flow Reactor

Oral - Abstract ID: 799

Ms. Yu-Yu Kung [1], *Prof. Yu-Ting Liu* [1], *Prof. Liang-Ching Hsu* [1]

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Air pollution poses significant threats to ecosystems and human health, particularly concerning the composition and aging of atmospheric particulate matter. Of particular concern are heavy metals, such as chromium (Cr), which exist in both Cr(III) and highly toxic Cr(VI) forms. Airborne transportation of heavy metals is increasingly recognized as a significant environmental pathway, with respiratory exposure posing greater health risks than ingestion. Long-term exposure to Cr(VI) can escalate disease and cancer risks. However, analyzing Cr(VI) in environmental samples is challenging due to species inter-conversion induced by sample matrices, extraction, and analysis methods. Hydroxyl radicals (HO·), ubiquitous in atmospheric reactions, can be generated effectively in an oxidation flow reactor (OFR), simulating long-term atmospheric oxidation environments. Studies employing 100 mM Na_2CO_3 as a Cr(VI) extraction agent demonstrate minimal species conversion and 88% Cr(VI) recovery. The iron hydroxide, Ferrihydrite (FH), adsorbs Cr(III) forming Cr-FH complexes. Under varying relative humidity (RH20%-70%) in the OFR, UV light (185/254 nm) drives the transformation of chromium species. Cr(VI) formation in Cr-FH decreases notably with increasing RH, while Cr(VI) in Cr without FH increases with RH, correlating with HO· trends. Iron significantly influences Cr reactions, with stronger oxidation observed at RH20%. Increased humidity attenuates UV light intensity, promoting photoreduction of Fe(III) to Fe(II) and HO· production. Cr adsorbed on ferrihydrite may interact with Fe(II) and HO·, leading to Cr(VI) reduction. Overall, atmospheric HO· oxidation drives Cr oxidation to Cr(VI), with particulate iron abundance significantly influencing Cr redox reactions under UV irradiation.

Integrating Geochemical and Magnetic Analysis for Estimating Risk-based Soil Screening Values: A Regional Study in Greece

Oral - Abstract ID: 509

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Exposure to naturally occurring and diffused anthropogenic background concentrations of Potentially Toxic Elements (PTEs) might be associated to human and ecosystem health risks. In such instances, rigorous geochemical evaluation is essential to estimate risk-based soil screening values.

Here we provide geochemical and magnetic susceptibility (MS) data from a regional soil dataset in Greece as a worked example, supporting risk assessors and managers with evidence to facilitate informed decisions for setting remedial goals. Top-soil (0-20 cm) samples were collected from 117 locations on a 5 km x 5 km grid within an area of about 2500 km^2 by following and appropriately adjusting the guidance of the recently published International Union of Geological Sciences Manual or Standard Methods for Establishing the Global Geochemical Reference Network. Dried and sieved (<2mm) soil samples were analysed by ICP-AES / ICP-MS following aqua regia dissolution. The study focused on the elements: As, Sb, Cd, Co, Cr, Cu, Pb, Ni, Tl, V, Zn, Mn, Fe. Volume-specific MS was measured at low (470 Hz) and high frequency (4700 Hz) using an MS3 Bartington Instrument, equipped with a dual frequency MS2B sensor. The combined results of multivariate statistical analysis of aqua regia data, MS data and spatial mapping confirmed the effects of weathering of mafic and ultramafic rocks and the presence of mineralised zones with high concentrations of specific elements. Samples of the highest concentrations were further evaluated by mineralogical analysis and leaching tests (modified BCR sequential extraction and dilute nitric acid leach).

It was found that in over 90% of the samples' concentrations are consistent with background. The results could be incorporated into site-specific risk-based cleanup levels within spatial domains of elevated PTE concentrations considering the background for setting realistic remedial goals.

Integration of Big Data and AI Techniques for Understanding Arsenic Behaviour in Mineralization Processes

Oral - Abstract ID: 119

Prof. Qiuming Cheng [1]

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Arsenic is a naturally occurring element that can be found in soil, water, and some minerals. It exists in two forms: organic and inorganic. Inorganic arsenic is more toxic and poses a greater risk to human health. Arsenic can be associated with various mineralization processes in the Earth's crust and is often associated with specific types of ore deposits. For example, gold deposits can contain arsenic-rich minerals, such as arsenopyrite, as accessory minerals. Copper and polymetallic deposits, such as porphyry copper deposits and skarn deposits, can also contain arsenic as a minor component. The presence of arsenic in these ore deposits can have implications for their economic viability and ore processing methods, as well as potential environmental considerations. The release of arsenic during mining and ore processing activities can pose environmental and health risks, requiring proper management and mitigation measures to protect human health and the environment. However, the behavior of arsenic (As) in mineralization processes is a complex phenomenon influenced by various geological factors. The integration of big data and artificial intelligence (AI) techniques offers promising avenues for understanding and predicting the behavior of As in mineralization processes. This abstract presents an overview of the application of a knowledge graph constructed based on literature publications in identifying the behavior of As in mineralization processes. Machine reading and machine learning techniques enable the extraction of As and relevant information from vast and diverse publications to identify patterns and correlations related to As behavior. These datasets can be processed to identify key factors influencing the mobilization, transport, and deposition of As during mineralization. Temporal analysis can reveal changes in As behavior over time, providing valuable insights into the evolution of mineralization processes. This knowledge can aid in the selection of appropriate ore processing methods that minimize As contamination risks.

Integrative Water Quality Challenges and Opportunities on an Urbanizing Planet

Oral - Abstract ID: 835

Prof. Bryan Brooks [1]

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By 2050, 70% of human populations will reside in urban areas with a majority living along or immediately upstream from coastlines. Such high population densities elevate local demand for water, energy, food and other resources, including chemicals, for which usage is then concentrated in cities and within the diverse waste streams released from urban centers. Environment and health implications of global megatrends, including water quality intersections with demographic transitions to cities, present challenges and unique opportunities to achieving the United Nations Sustainable Development Goals. For example, empirical safety information is unavailable for the majority of the >350,000 chemicals and chemical mixtures listed for global commerce. Further, aquaculture will play an important role to meet future food demand, but 80% of the global sewage production is not treated before it is released to the environment and subjected to potential reuse. Judicious resource recovery will become increasingly critical; 66% of the world population will live in water stressed regions by 2025. Water reuse is routinely occurring, where inland surface waters and base flows to bays and estuaries can be dominated by or dependent on reclaimed sewage, which includes diverse contaminants of historic and emerging concern. Herein, we have embraced a One Health approach during study of urbanizing systems. For example, comparative pharmacology and toxicology efforts are affording opportunities to identify susceptible organisms and systems to anthropogenic chemicals and natural toxins when targets (e.g., receptors, enzymes) and molecular initiation events leading to adverse outcomes are evolutionarily conserved among species. Clearly, urban water quality challenges represent an emerging environment and health frontier, which requires multidisciplinary engagement and systems perspectives such as One Health to define mechanisms, to develop interventions, and to implement sustainable management strategies that promote integrative water quality while reducing risks to public health and the environment.

Interaction characteristics and environmental effects of iron-enriched features in river-water/groundwater interactions

Oral - Abstract ID: 110

Prof. Hui Liu [1]

1. China University of Geosciences

Rivers serve as the link between land and marine ecosystems, and the river-water/groundwater interaction zone (hereafter referred to as the "interaction zone") is a vital interface connecting river systems with groundwater systems. The transformation of elements and substances within this zone is a crucial step in the global elemental and material cycling processes. River water and groundwater mix bi-directionally within the interaction zone, causing the boundary to constantly move and form unique physical, chemical, and biological dynamic gradients. This drives complex biogeochemical processes of element and substance cycling.

Iron is the most abundant redox-sensitive element on Earth and is highly responsive to changes in oxidation-reduction conditions. Dynamic dissolved oxygen gradients exist within the interaction zone, where iron undergoes frequent, intense, and complex changes in valence and speciation. The iron redox cycle is an essential pathway for surface energy flow. It plays a significant role in regulating the formation and transformation of sedimentary environment minerals, elemental cycling and degradation, and the sequestration of pollutants. This research will provide new insights into the coupled cycling of iron and contaminants at the river-water/groundwater interface in critical zones of the Earth and has essential scientific implications for understanding the biogeochemical cycling of iron and pollutants in small and large geological cycles.

Our research group has established an interaction zone monitoring site in the downstream section of the Han River. Through field sampling and analysis of pore water and sediment within the interaction zone, the morphological characteristics of iron enrichment, its influencing factors, and the mechanisms of its formation and removal of pollutants were revealed. The biological oxidation and reduction characteristics of iron were investigated through the quantitative analysis of microbial community structure and functional microbes. Additionally, several strains of versatile iron-oxidizing bacteria were isolated, revealing new pathways of coupled transformation between iron and pollutants.

Interaction mechanism of radiocesium on Beishan granite at a molecular scale

Oral - Abstract ID: 429

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As an important fission product in uranium nuclear fission, radioactive cesium (RCs) is one of the key nuclides in the disposal of high-level radioactive waste(HLW). The microscopic mechanism of interaction between Beishan granite and RCs is essential for the performance and safety evaluation of the HLW disposal. In this work, batch experiments, electron probe microanalysis (EPMA), X-ray absorption fine structure spectroscopy (EXAFS), and μ-X-ray fluorescence (μ-XRF) spectroscopy had been used in studying the interaction between clay minerals or granite and RCs under different conditions. EPMA and μ-XRF confirmed that biotite and albite/microcline were controlling the retardation of RCs in Beishan granite. EXAFS analysis showed that Cs(I) adsorbed on Beishan granite and albite/microcline mainly as the formation of outer-sphere complexes, while more inner-sphere complexes when adsorbed on biotite. Since the high content of albite/microcline (about 70%) in Beishan granite, the sorption of Cs(I) on albite/microcline cannot be negligible. The general adsorption mode (GAM) for Cs adsorption can quantitatively describe and predict the adsorption-desorption behaviors of Cs(I) on Beishan granite. Groundwater with higher salinity could inhibit the fixation of Cs(I) on Beishan granite to some extent. However, the frayed edge sites on Beishan granite were still effective for the trace RCs and were less affected by Beishan groundwater.

Interactions between polymeric materials and emerging contaminants and their implications

Oral - Abstract ID: 861

Prof. Jie Han [1]

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Polymers are usually considered inert materials. However, the authors found that some polymers are able to absorb organic compounds from aqueous solutions. Such phenomena were neglected largely in previous studies. This presentation will focus on the interactions between representative polymers and a variety of emerging contaminants in water. Absorption mechanisms and affecting factors on these interactions will be discussed in details. Additionally, case studies will be provided to underscore the utility of polymers' adsorptive attributes in the realm of organic compound recovery and elimination from aqueous systems, as well as their significance for the dynamics of contaminant transport and fate. Finally, the presentation will offer insights and future perspectives on the advancement of polymer adsorption technology within the contexts of water purification and quality assessment.

Intercropping promotes soil aggregates stability by regulating soil microbial activity, diversity and community structure

Oral - Abstract ID: 472

Prof. Xiaohong Wu [1], ***Ms. Wenqiong Jiang*** [1], ***Dr. Xinxing He*** [1], ***Prof. Jun Wang*** [1], ***Prof. Wende Yan*** [2], ***Prof. Fan Zhu*** [3], ***Mrs. Li Fu*** [1]

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Soil aggregate plays an important role in the stabilization of soil organic carbon (SOC), and microbial communities have a crucial influence on the formation and stability of soil aggregates. However, the interactions between soil aggregates and microbial communities in relation to intercropping are still poorly understood. For this, a field experiment was conducted within a fully controlled *Camellia oleifera* agroforestry system in the subtropical region of China. The fraction and stability of soil aggregates (<0.053, 0.053–0.25, 0.25–2, >2 mm) were analyzed in three different plantation soils: (i) C. *oleifera* mono-culture (CK); (ii) C. *oleifera–Trifolium repens* intercropping (CT); and (iii) C. *oleifera–Lolium perenne* intercropping (CL). Additionally, we invested soil nutrients, C,N,P-acquiring enzyme activities, as well as the diversity and composition of soil bacterial and fungal communities. The results showed that intercropping substantially increased the proportion of large macro-aggregate (>2 mm) fraction, the mean weight diameter (MWD) and geometric mean diameter (GMD), but decreased the soil erosiveness K value. Compared to CK, soil leucine aminopeptidase (LAP) activity was enhanced by 40% and 121% in CT, 98% and 92% in CL in the spring and summer tip growth stages, respectively. The diversity index of bacterial and fungal communities for the CT and CL were significantly higher than those of the CK, especially at the summer tip growth stage. Relationship analysis revealed significant correlations between soil aggregate characteristics, such as MWD and GMD, with the microbial diversity and LAP activity. The proportion of large macro-aggregate increased with the increasing of the relative abundances of *Verrucomicrobia* and *Ascomycota*. These relationships suggested that intercropping altered soil microbial activity, diversity and community structure, and ultimately facilitated the stability of soil aggregates in C. *oleifera* soils, which was ultimately benefit

Intermediate volatility compounds dominate secondary organic aerosol formation from biomass burning emissions

Oral - Abstract ID: 176

Prof. Kun Li [1]

1. *Shandong University*

Organic gases from biomass burning are a large source of secondary organic aerosol (SOA). Previous smog chamber studies found that the main SOA contributors in biomass burning emissions are volatile organic compounds (VOCs). Intermediate volatility organic compounds (IVOCs), thought to be efficient SOA precursors, are a considerable fraction of biomass emissions, but their contribution to SOA formation has not been directly observed. Here, by deploying a newly-developed oxidation flow reactor to study SOA formation from wood burning, we find that IVOCs can contribute ~70% of the formed SOA, i.e., >2 times more than VOCs. This previously missing SOA fraction is interpreted to be due to the high wall losses of semi-volatile oxidation products of IVOCs in smog chambers. The finding in this study reveals that SOA production from biomass burning is more than 3 times higher compared to previous studies, and highlights the urgent need for more research on the IVOCs from biomass burning and potentially other emission sources. The results provide insights into the multi-generation chemistry when biomass burning emissions are transported in the atmosphere.

Interpreting highly variable indoor PM2.5 using low-cost sensors

Oral - Abstract ID: 49

***Prof. Shen Guofeng* [1], *Mr. Men Yatai* [1], *Dr. Luo Zhihan* [1], *Dr. Liu Xinlei* [1], *Prof. Tao Shu* [1]**

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Household air pollution associated with solid fuel use is a long-standing public concern. The primary pollutant in household air pollution is $PM_{2.5}$, which exhibits substantial spatiotemporal variability. Understanding the key factors influencing these variations is crucial for improving air quality and safeguarding human health.
According to high temporal resolution data obtained from numerous low-cost sensors, it was determined that the average indoor $PM_{2.5}$ concentration in rural households during the winter was 120 μg/m^3, with a range of 16 to 400 μg/m^3. Outdoor $PM_{2.5}$ levels accounted for 19% of the daily indoor $PM_{2.5}$ fluctuations within households. Additionally, factors associated with energy use, such as outdoor temperature and the temperature difference between indoor and outdoor environments, directly or indirectly contributed to 26% of the temporal variations. When considering inter-household variation, it became evident that distinct internal sources had a significant impact, with energy-use-associated factors explaining 35% of the variation
According to result of random forest regression model, it was found that transitioning from solid fuels to clean coal or biomass particles could result in a 20% reduction in indoor $PM_{2.5}$. Further shifting to cleaner modern energy sources could lead to an additional 30% reduction in indoor $PM_{2.5}$, suggesting many significant benefits in promoting clean transitions in household heating activities.

Investigations of unstable reactive oxidants in the atmosphere

Oral - Abstract ID: 307

Prof. Shengrui Tong [1], ***Prof. Maofa Ge*** [1]

1. Institute of Chemistry, Chinese Academy of Sciences

There are various oxidants existed in the atmosphere, most of them are unstable, highly reactive and recyclable. Reactive oxidants are the central species in the atmosphere, and they have great impact on secondary particle formation, human health and climate change. Some reactive oxidants are very hard to capture which restrict the investigation of their reaction processes. Therefore, we constructed some methods to capture unstable reactive oxidants, such as HONO, Criegee Intermediates. HONO is one of the most import precursors of OH radical, and was hardly to be detected. A custom-built HONO analyzer was constructed and used in field observation in many areas. Formation mechanisms of HONO in the atmosphere were interpreted in conjunction with the simulations by box-model. Criegee intermediates (CIs) can be generated by the ozonolysis of alkenes, and few amounts can come from radical-radical reactions. CIs are found to be the important oxidants, and can react with many gases in the atmosphere. A Matrix-isolate Vacuum FTIR method was constructed to capture CIs during the reaction of O_3 with alkenes. Different kinds of Primary ozonides (POZs), CIs, and Secondary ozonides (SOZs) were detected, and the reaction processes were deduced.

Joint associations of short-term exposure to gaseous air pollutants with hospital admission of ischemic stroke

Oral - Abstract ID: 288

Dr. Tao Liu [1]

1. Jinan University

Background: Although numerous studies have estimated the associations of short-term exposure to particulate matter pollutants with incidence of ischemic stroke (IS), less studies focused on gaseous pollutants, and the joint associations of IS with gaseous pollution as a mixture remain unknown.

Methods: A time-stratified case-crossover study was employed to investigate 824,808 IS patients in 292 Chinese cities from 2015 to 2019. Mean concentrations of maximum eight-hour average for O_3 ($O_{3\text{-}8h}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and carbon monoxide (CO) on each of the case and control days across all monitoring stations in the city where the IS patients resided were assessed. Conditional logistic regression models were conducted to estimate the exposure-response associations.

Results: Results from single-pollutant models showed significant associations of hospital admission for IS with the 2-day moving average (Lag01-day) concentrations of $O_{3\text{-}8h}$ (excess risk (ER)=0.29% for each 10μg/m^3 increase), NO_2 (ER=1.15% for 10μg/m^3), SO_2 (ER=0.82% for 10μg/m^3) and CO (ER=3.47% for 1mg/m^3). The joint associations with all gaseous pollutants (for increase in each interquartile range [IQR]) estimated by the single- and multi-pollutant models were 7.33% and 4.28%, and the corresponding joint attributable fractions (AF) were 11.77% and 6.92%, respectively.

Conclusions: Short-term exposures to $O_{3\text{-}8h}$, NO_2, SO_2, and CO were significantly associated with increased risks of hospital admission for IS. The joint associations of gaseous air pollutants with IS might be overestimated using single-pollutant models.

Key Drivers of the Oxidative Potential of PM2.5 in Beijing

Oral - Abstract ID: 1010

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The air quality, characterized by mass concentrations of $PM_{2.5}$, SO_2, and NO_x etc., has improved significantly in China since 2013. However, respiratory disease infection rates, which are strongly associated with oxidative stress, have slightly increased despite a decrease in $PM_{2.5}$-based disease burden. Understanding driving factors for $PM_{2.5}$ oxidative potential (OP) is crucial for effective policy-making, especially regarding human health. Herein, we carried out long-term measurements of the OP^{DTT} in Beijing from 2018 to 2022, alongside comprehensive observations of the chemical composition of $PM_{2.5}$, trace gases, and meteorological parameters to understand the drivers of OP in Beijing in the context of air quality improvement. OP_v ranged from 0.03 to 0.98 $nmol \cdot min^{-1} \cdot m^{-3}$ (5-years mean values: 0.37 $nmol \cdot min^{-1} \cdot m^{-3}$). The annual OP_v decreased from 0.42 to 0.25 $nmol \cdot min^{-1} \cdot m^{-3}$ from 2018 to 2021 but notably increased to 0.42 $nmol \cdot min^{-1} \cdot m^{-3}$ in 2022. Dust, traffic, and biomass combustion were identified as main OP sources of $PM_{2.5}$ in Beijing. The complex interactions between dust particles, black carbon, and gaseous pollutants (nitrogen dioxide and sulfur dioxide) drives the OP evolution, in particular, leading to the abnormal rise of OP in 2022. Thus, BC and dust should be controlled preferentially from the perspective of oxidative potential in the future. A co-benefit of controlling BC and NO_x from vehicle exhaust emissions and biomass combustion is expected given their combined impact on OP.

Large-scale urban agglomeration's sprawl and interactive effect of social and ecological system: a case study from China

Oral - Abstract ID: 581

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Large-scale urban agglomeration has become the major urbanization form of China due to its strong social-economic cluster effect. However, the complex multi-spatial hierarchy of urban agglomeration not only caused unbalanced urban sprawl between different cities within the region, but also complicated the interactions between the regional social and ecological systems. In this study, we took two of the most important urban agglomerations of China (Beijing-Tianjin-Hebei and Yangtze River Delta urban agglomeration, BTH and YRD) as an example to explore the sprawl pattern of such large multi-hierarchy region and the interactive mechanism between regional social-ecological systems. The results showed: 1) scale effects were marked across large-scale urban agglomeration; 2) On regional scale (taking the large-scale urban agglomeration as a whole), the urban sprawl of the dual-core urban agglomeration (BTH) was faster than that of the polycentric one (RYD). On city scale (considering the difference of cities within urban agglomeration), the urban sprawl of core cities within the urban agglomeration was faster than that of non-core cities; 3) on regional scale, the sprawl of large-scale urban agglomeration obviously increased the total volume of surface runoff. For example, from 1980-2015, the total surface runoff across BTH increased 11.83%. On city scale, the hydrological effects between different cities were varied in a range of about 3.54%-24.42%; 4) by optimizing the sprawl pattern of large-scale urban agglomeration, the total volume of surface runoff across the whole urban agglomeration would be reduced 7.8 million cubic meters, while the surface runoff of difference cites was varied between -4.45% and 1.88%. Notably, the optimized sprawl pattern of large-scale urban agglomeration would obviously reduce the surface runoff in main urbanized areas, which are very important for reducing urban flood risk.

Lattice Engineered Nanoscale Fe0 for Environmental Remediation

Oral - Abstract ID: 567

Prof. Jiang Xu [1]

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Achieving rapid and highly selective chemical reductions using Fe0 nanomaterials for environmental remediation remains challenging. Constructing the crystalline Fe0 with controllable lattice strain and speciation provides a strategy to overcome the reactivity–selectivity–stability trade-offs. The altered morphology, elemental distribution, crystalline structure, and speciation will tune the physicochemical properties of materials, changing their reactivity and selectivity with water and target contaminants. Our recent work is trying to provide the most comprehensive understanding available for the chemical properties controlling the reactivity and selectivity of these lattice-engineered materials. This talk will advance the nFe0 research and application toward the rational design of more efficient environmental remediation materials, improving their delivery and effectiveness in the field.

Lead pollution-related health of children in China: disparity, challenge, and policy

Oral - Abstract ID: 92

Prof. Xiaoping Li [1], ***Dr. Jie Dong*** [1]

1. *Shaanxi Normal University*

Lead (Pb) is a neurotoxic metal, and no level of lead exposure is safe for children. China has still experienced problems on child lead poisoning even though the Chinese government has phased out leaded gasoline since 2000. The underlying problem affecting the lead pollution-related health of children in China remains to be comprehensively investigated. It is found that although the significant decline of BLLs, as the Geometric Mean (GM), from 91.40 μg/LGM in 2001 to 37.52 μg/LGM in 2018 is observed, the average BLLs of children are still above 50 μg/L or more [average 59.70 (60.50-65.02, 95%CI) μg/LGM] after phasing out leaded gasoline since 2000 in China. Lead exposure causes 29.67 MID per 1,000 children with a loss of 98.23 (59.40-146.21, 95%CI) DALYs per 1000 in China, which is greater than the levels reported from the Western Pacific Region and other low- and middle-income countries. Although the disparities in BLLs in China are strongly influenced by unequal distributions of potential multi-lead related sources (soil lead, PM2.5 lead, dust lead), unbalance development of local industrialization and economies, as well as incorrect health care for younger children, the notable emissions from coal combustion (CC) and non-ferrous metals (NMS) exploitation dominate the crucial sources of low-level lead exposure to children after phasing out leaded gasoline in China currently. Faced with the unequal and disparate distribution of BLLs in China, the big bottleneck is to decrease the BLLs exertions of 36-45 μg/L in the next few decades. The Chinese government needs to make more efforts on developing more strict guidelines, implementing more policy strategies on prevention and management of blood Pb poisoning, and monitoring the nationwide changes in children's BLLs continuously.

Levels, drivers and potential sources of heavy metal in riparian soils of the inflow rivers of Baiyangdian wetland

Oral - Abstract ID: 943

Prof. Lu Sun [1]

1. *China Geological Environment Monitoring Institute*

Abstract: Riparian soils are important sink for heavy metals originating from river waters or uplands, and thus have an important impact on the metal pollution within alluvial floodplains. Assessment of heavy metals pollution and source in riparian soils is of great concern for watershed management. Baiyangdian wetland is the largest fresh-water resource in northern China and plays an important role in the water supply, agriculture and aquaculture, climate regulation, and flood control of the region. The concentrations and spatial distribution of heavy metals in riparian soils of its inflow rivers were assessed. Environmental drivers and the likely sources of heavy metals in riparian soils were evaluated. The results showed that the weathering process and soil properties significantly affect heavy metal accumulation in soils. Land uses had a dramatic effect on the soil properties and contents of heavy metals in surface soils of riparian zones. The high mobility and bioavailability of Cd combined with moderate pollution level would pose a great threat in the regions.

Long-term outdoor radon-222 dose rate monitoring in Canada

Oral - Abstract ID: 416

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1. *Radiation Protection Bureau of Health Canada*

Radon (^{222}Rn) has long been known for its potential lung cancer risks. Since 2007, more Canadian homes have been tested for radon following the revised Canadian radon guideline. Based on community and nationwide radon surveys, radon distribution in Canadian homes has been characterized with the population-weighted arithmetic mean concentration of 82 Bq/m^3. The corresponding mean annual internal dose is 2.1 mSv, equivalent to an internal dose rate of 300 nSv/h.

While indoor radon is better characterized in Canadian homes, direct measurements and characterizations of outdoor radon are lacking. This study filled this gap by analyzing the outdoor Radon Dose Rate (RnDR) data from Health Canada's Fixed Point Surveillance network at two Arctic stations (Resolute 74.71° N, 94.97° W in Nunavut, and Yellowknife 62.48° N, 114.47° W in Northwest Territories). These data were collected from sodium iodide spectrometers and were derived based on spectral analysis.

The results showed that the RnDRs at both stations exhibit a clear seasonality, with higher dose rate in summer and lower in winter. In a year cycle, the monthly averaged RnDRs have means ranging from 5.7 nGy/h to 9.2 nGy/h in Yellowknife and from 2.0 nGy/h to 4.0 nGy/h in Resolute. This leads to annual effective doses of 20-40 μSv due to external exposure outdoors. Based on indoor radon surveys, Northwest Territories homes have a mean radon concentration of 69 Bq/m^3 and Nunavut homes of 10 Bq/m^3, corresponding to an annual effective dose of 1.7 mSv for Yellowknife and 0.25 mSv for Resolute. Compared to indoor radon exposure, exposure to outdoor radon contributes very little to the total radon exposure for the public. Furthermore, this study's RnDR data can serve as a historical baseline for assessing any future increases in outdoor ^{222}Rn levels related to climate change.

Long-term Ozone Exposure and COPD Assessment Test (CAT) Score: Findings from the China Pulmonary Health Study

Oral - Abstract ID: 455

Ms. Xueyan Han [1]***, Mr. Zhaoyang Pan*** [1]***, Dr. Ke Huang*** [2]***, Prof. Ting Yang*** [2]***, Prof. Tianjia Guan*** [1]

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Importance of the work and objectives: Despite understanding on the impairment effect of ozone on lung function, the association between ozone exposure and chronic respiratory symptoms remains unknown. This study aims to explore the association between long-term ozone exposure and chronic obstructive pulmonary diseases (COPD) Assessment Test (CAT) score, which measures the presentation and severity of cough, sputum production, chest tightness, exertional dyspnea and the impact of respiratory symptoms on daily life.

Methodologies: We extracted individuals with CAT score from the China Pulmonary Health study, which was a cross-sectional survey conducted from 2012-2015. We used both multivariable linear (CAT score after logarithm transformation as outcome variable) and logistic regression (CAT score > 10 (mild to severe impact) as cutoff) models to explore the association between long-term ozone exposure and CAT score, adjusting for demographic factors, individual risk factors such as smoking and biomass fuel use, survey season, lung function indicators, and longitudinal trends.

Main results and conclusion: We included 14275 participants (male: 7499 (52.5%)) with mean age of 55.2 ± 12.5 years. 73.5% of participants did not have COPD. The median CAT score was 3.0 (interquartile range (IQR): 0.0-7.0) and the median lag 1-year O_3 exposure was 101 μg/m^3 (IQR: 95.4-110.0 μg/m^3). Per 10 μg/m^3 increase in long-term ozone exposure was associated with a 6.2 (95% confidence interval (CI): 3.0-9.4, P<0.001) percent change in CAT score, and an increased risk of having CAT score > 10 (odds ratio: 1.1, 95% CI: 0.95-1.2, P=0.316). The association was robust after adjusting for $PM_{2.5}$ concentration.

In conclusion, this study we quantified the association between long-term exposure of ozone, and the severity and impact of respiratory symptoms, and such association was independent of $PM_{2.5}$. It provided further evidence on the magnitude and mechanism of the detrimental effect of ozone on the respiratory system.

Long-term soil degradation and remediation needs in the historical Outokumpu Cu–Co–Zn mining area, Finland

Oral - Abstract ID: 111

Mrs. Soili Solismaa [1], ***Mr. Juho Kupila*** [1], ***Dr. Kirsti Loukola-Ruskeeniemi*** [1], ***Dr. Jari Mäkinen*** [1], ***Mr. Jussi Reinikainen*** [2], ***Mrs. Hanna Tolvanen*** [3], ***Mr. Kimmo Järvinen*** [3], ***Mr. Jarkko Karvonen*** [4]

1. Geological Survey of Finland, 2. Finnish Environment Institute, 3. Ramboll Finland Oy, 4. Outokumpu town

In the summer of 2023, the European Parliament and Council proposed a soil monitoring law, comparable to the earlier regulations established to protect air and water. The proposal mandates member states to address soil contamination. The EU project ‘Information-based strategies for land remediation’ (ISLANDR) will provide data, tools and methods to support the initiative.

One of the ISLANDR test sites is the mining area at Outokumpu in Finland. Soils and surface waters were contaminated by the mining and metallurgical industry in the region between 1913 and 1989. Extractive wastes rich in sulphur, nickel, copper, zinc, cobalt, chromium and other ‘potentially toxic elements’ (PTEs) were stored according to regulations, which during those days were not as advanced as today. These wastes were also used for construction purposes, causing additional acidity and PTE loading to the environment. Locally, elevated concentrations of PTEs have been observed in soil, groundwater and surface waters. For example, soil samples from 19 excavations and 61 drillings contained up to 7900 mg/kg Cu (Ramboll, 2022, unpubl. report). Mining-related environmental contamination can cause the corrosion of underground municipal infrastructure, increase the PTE load among residents and impact the ecosystem through soil and water contamination.

Recommendations for regulation and remediation methods will be compiled in the study. Financial challenges, proposed solutions to improve the environmental status of the region, and opportunities for reusing or decontaminating degraded soils will be discussed. Lessons learned in the historical Freiberg mining area in Germany will be utilized (Loukola-Ruskeeniemi et al., 2022: *J. Haz. Mat.* 424, 127677).

Various stakeholders will be engaged to ensure the consideration of socio-economic factors. The results from Outokumpu will be used to develop a risk management procedure that can be applied to comparable brownfield mining areas in Europe and beyond.

Long-term trends of global, regional, and national NO2 attributed mortality burdens: a health impact assessment study from multiple global datasets

Oral - Abstract ID: 418

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Studies quantifying the nitrogen dioxide (NO_2)-associated disease burdens were rare. We aimed to estimate the NO_2 attributable mortality burdens related with cardiovascular disease (CVD) and respiratory disease (RD) at global, regional, and national level from 1990 to 2021 following the counterfactual analytic framework adopted by Global Burden Disease (GBD) study. We adopted multiple high-resolution global NO_2 concentrations datasets established through land use regression model, chemical reanalysis, and global chemistry transport model across the year from 1990 to 2021. We combined these concentration datasets together with population and baseline mortalities rates derived from the latest GBD 2019 study. Both linear and super-linear shapes for the concentration response function derived from a recent meta-analysis were discussed to estimate the uncertainties range related with the NO_2 mortality burden. Threshold values below which no risk of health were related with NO_2 were also discussed. We estimate that annual global NO_2 concentrations of all three datasets (1.2 ~ 1.6 ppb) were lower than AQG suggested by WHO. The global excess deaths associated with long-term exposure to NO_2 from CVD and RD in 1990~2021 were 129 (95% Cl: 85~177) ~727 (95% Cl: 415~1000) thousand and 1395% (95% Cl: 5~13) ~ 97 (95% Cl: 70~150) thousand, respectively.

Our study performed first-of-the-kind comprehensive analysis of the long-term trends of ambient NO_2-attributed mortality burdens at global scale. Accuracies in performing such estimations were also discussed by considering the different factors, ranging from the sournces of the concentration datasets, the shapes of the concentration response function, and the threshold values. Despite all these uncertainties, we conclude that reductions in ambient NO_2 concentration could bring substantial benefits in improving public health walfares.

Loss of functional diversity after Spartina alterniflora invasion reduces carbon sequestration and nitrogen removal in mangrove sediments

Oral - Abstract ID: 739

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Mangrove ecosystems play an important role in carbon (C) sequestration and nitrogen (N) removal. Although *Spartina alterniflora* has successively invaded native mangrove habitats during the preceding two decades, the effects of this invasion on the microbial functional potential involved in nutrient cycling remain unclear. In this study, metagenomic sequencing was used to investigate microbial C and N cycling in sediments derived from *S. alterniflora* and three native mangrove species. Greater differences in the functional diversity of C and N cycling-related genes were observed between *S. alterniflora* and mangrove sediments than between different mangrove sediments. Functional diversity was lower in *S. alterniflora* sediments than in native mangrove sediments. The growth of Thaumarchaeota and Proteobacteria, was enhanced due to their resilience to diversity loss, while the growth of oligotrophs, such as Chloroflexi and Firmicutes, was inhibited in *S. alterniflora* sediments. The abundance of genes involved in C fixation and methane (CH_4) production was lower in *S. alterniflora* sediments than that in mangroves. However, *S. alterniflora* significantly increased the gene abundance of *pmo* that controlled the process of CH_4 to carbon dioxide. Additionally, genes involved in nitrification were enriched, whereas genes involved in N reduction processes, such as denitrification and dissimilatory nitrate reduction to ammonium, N immobilization, and N mineralization, was depleted in *S. alterniflora* sediments compared to mangrove sediments. Partial least squares regression models demonstrated that the decrease in soil organic C and increase in pH in *S. alterniflora* sediments induced the loss of microbial functional diversity, which was the main driver of changes in the abundances of genes involved in C and N cycling. Overall, our findings indicate that *S. alterniflora* invasion modifies the microbial functional profile of nutrient cycling in native mangrove ecosystems and weakens the capacity of mangroves to sequester carbon and remove nitrogen.

Loss of Microbial Diversity Increases the Risk of Arsenic Release and Methane Emissions in Paddy Soils

Oral - Abstract ID: 249

***Ms. Ouyuan Jiang* [1], *Prof. Xianjin Tang* [1]**

1. *Zhejiang University*

Loss of microbial diversity is vital to the transformation of pollutants and greenhouse gas emissions in paddy soils. However, the impact on anaerobic methane (CH_4) oxidation and arsenic (As) conversion under flooded conditions remains unclear. In this study, we reinoculated microbial suspensions into As-contaminated paddy soils using a dilution-to-extinction approach to manipulate microbial diversity loss. The results revealed that the porewater As concentration in the dilution groups was 1.77-8.17 times greater than in the undiluted groups. Besides, the 10^{-4} and 10^{-6} dilution led to the highest CH_4 emissions (1552.19 μM and 1643.65 μM) compared to undiluted groups (472.69 μM). The loss of diversity promoted the reductive dissolution of As-bearing iron minerals, increasing the Fe (II) concentration, which further enhanced the release of As (R = 0.9, p < 0.001) and dissolved organic carbon (DOC) (R = 0.91, p < 0.001) in porewater. However, no anaerobic CH_4 oxidation was observed in 10^{-4} dilution groups and above, suggesting the loss of diversity inhibited the ability of paddy soils to reduce CH_4 emissions naturally. The decline of microbial diversity also increased the relative abundances of methanogens (i.e., *Methanobacterium* and *Methanomassiliicoccus*) and Fe (III)-/As (V)- reducing bacteria (i.e., *Bacillus*, *Clostridium_sensu_stricto_10*, and *Geobacter*). Simultaneously, it decreased the abundance of methanotrophs (i.e., *Methylocystis*). Quantitative PCR analysis confirmed that the related functional genes (i.e., *mcrA* and *FeRB*) were enhanced under diversity loss. These findings suggest that microbial biodiversity is critical and directly linked to ecosystem functional processes, highlighting the detrimental effects of biodiversity loss in As-contaminated paddies.

Magnetic response and bioaccessibility of heavy metal pollution in outdoor dustfall in Shanghai, China

Oral - Abstract ID: 649

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Dustfall plays a crucial role as sinks for heavy metals originating from anthropogenic and natural emissions, and heavy metal contamination in dustfall poses significant risks to air quality, climate, ecosystems, and human health. This study focuses on outdoor dustfall collected from different functional areas within 16 administrative districts of Shanghai. Traditional chemical analysis, physiological extraction tests (PBET), and environmental magnetism methods were employed to assess heavy metal contamination. The study aims to explore the correlations between heavy metals and magnetism using enrichment factor (EF) and cluster analysis (CA) techniques. Additionally, the relationship between magnetic parameters and the bioaccessibility fraction of heavy metals in various dustfall samples was investigated. The results show that the heavy metal elements have different degrees of contamination and enrichment in outdoor dustfall, and the distribution of their contents shows the following trend: Zn>Sn>Pb>Cu>Fe>Ni>Cr>Sr>Mn. χlf and SIRM are mostly positively correlated with the heavy metals, indicating higher concentrations when samples contain increased amounts of magnetic minerals. Moreover, χ_{lf}, SIRM and χ_{ARM} can well reflect the characteristics of dustfall pollution, indicating a certain degree of enrichment of coarse multi-domain and pseudo-single-domain particles, predominantly originating from anthropogenic pollution. The spatial trends of χ_{lf} and PM10 concentrations in precipitation align closely, establishing χ_{lf}, SIRM and χ_{ARM} as air pollution indices for evaluating heavy metal pollution in dustfall. Additionally, the overall trend in gastric bioaccessibility is as follows: Zn>Pb>Mn>Cd>Cu. Notably, the bioavailability of heavy metals decreases significantly from the gastric to the intestinal phase due to the increase in pH of digestive juices. The results aim to contribute valuable information for the development of effective air pollution control measures in Shanghai, with implications for other rapidly urbanizing regions globally.

Mapping Distribution of Geogenic Contaminated Groundwater Using Machine Learning Methods

Oral - Abstract ID: 85

Prof. Yanxin Wang [1]

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The worldwide occurrence of geogenic contaminated groundwaters (GCGs), such as high-arsenic, high-fluoride, and high-iodine groundwater, poses a significant global public health threat. Mapping GCG distribution is fundamental for mitigating associated health risks. Conventional hydrogeochemical mapping methods are often time-consuming and resource-intensive, necessitating alternative approaches to complement existing strategies. This study employs machine learning methods, specifically artificial neural networks, to leverage environmental variables (climate, topography, geology, soil properties, etc.) for prediction of the spatial distribution of GCGs. Our models not only globally predict the occurrence of high arsenic groundwater, but also generate high-precision results of delineating areas with high fluorine/iodine groundwater and identifying populations at risk in China. The findings reveal approximately 89 million and 30 million people in China are at risk of exposing to high-fluoride and high-iodine groundwater, respectively. To enhance the efficiency and cost-effectiveness of GCG prediction, we developed a deep learning method, siamese network-based transfer learning, requiring less training data. This method outperforms the widely used random forest model, overcoming challenges associated with imbalanced data categories, and significantly improves prediction accuracy for both GCGs and non-GCGs. In regions with limited groundwater quality data and inadequate risk information, our approach acts as a robust safeguard against GCG exposure threats. This work thus contributes to advancing our understanding of the mechanisms controlling GCGs occurrence and provides a useful tool for proactive public health interventions at global and national scales.

Keywords: machine learning, geogenic contaminated groundwater, spatial distribution, prediction

Mass loads of quaternary ammonium compounds associated with COVID-19 stringency indicators in Beijing: a sewage sludge-based longitudinal study

Oral - Abstract ID: 273

Prof. Yifei Hu [1]

1. *Capital Medical University*

Amidst global responses to the COVID-19 pandemic, diverse containment measures were implemented and quaternary ammonium compounds (QAC) were widely used disinfectant across various settings. Stringency could be linked to increased utilization of QAC. This study assessed the population normalized mass loads (PNML) of QAC including alkyltrimethylammonium chloride (ATMAC), benzylalkyldimethylammonium chloride (BAC), and dialkyldimethylammonium chloride (DADMAC), analysed their temporal trends and their relations with containment policies. We collected daily sludge specimens from five wastewater treatment plants in Beijing from July 2020 to May 2022. Using LCMS, we determined QAC concentrations and backward estimated their PNML. We used COVID-19 stringency index and its indicators as the measure of containment policies. Among the QAC categories, ΣBAC had a median PNML of 0.47 mg/person/day (IQR: 0.09 to 0.64), ΣDADMAC had 1.17 mg/person/day (IQR: 0.42 to 2.11), and ΣATMAC had 3.73 mg/person/day (IQR: 1.17 to 5.59). The total ΣQAC median PNML was 5.42 mg/person/day (IQR: 1.66 to 8.20). The PNML of QAC appeared to have a general increasing trend over time and were significantly different across seasons with winter season with highest median PNML. PNML increased on average by 0.01 mg/day (95% CI: 0.01, 0.02) for ΣBAC, 0.04 mg/day (95% CI: 0.03, 0.06) for ΣDADMAC, 0.11 mg/day (95% CI: 0.07, 0.15) for ΣATMAC, and 0.16 mg/day (95% CI: 0.10, 0.22) for ΣQAC per unit increase in stringency index score. Notably, higher stringency levels in public event cancellations, workplace closures, internal movement restrictions, and public gathering restriction were positively associated with higher QAC PNML levels. Our study found an overall increasing trend in QAC PNML in Beijing during the pandemic, with significant variation across seasons and positive association between stringency measures and QAC PNML. Further research is needed to explore the appropriate application of these compounds, particularly during periods of public health emergencies.

Maximizing the Health Benefits of Air Pollution Control and Climate Change Mitigation

Oral - Abstract ID: 98

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Global Burden of Disease estimates each year air pollution contributes to 7 million premature deaths. Air pollution is recently found intensified by climate change. After World Health Organization (WHO) released its Global Air Quality Guidelines (AQGs) in 2005, in 2012 for the 1st time, China introduced $PM_{2.5}$ into its National Ambient Air Quality Standards (NAAQSs), following the interim target 1 of the WHO AQGs for $PM_{2.5}$. This helped China to launch its National Action Plan on Air Pollution Prevention and Control 2013-2017, with comprehensive measures ranging from capacity building, emission reduction measures and technologies, as well as legislative and economic measures. Air pollution has been drastically reduced in China from its level in 2013 to 2021. The health benefit from this reduction is estimated to be about 200K reduction in mortality each year.

In the meantime, more evidences about the health effects of climate change are emerging. Global warming is leading to more extreme weather (wildfires, heatwaves, storms, droughts). Number of heatwave days has significantly increased in the last 10 years compared to 1986-2005. Heat-related deaths in people older than 65 years reached a record high of an estimated 345 000 deaths in 2019. Annual population-weighted mean increased in the number of days with very high and extremely high risk of wildfire from 2001–04 to 2017–20 for each country or territory. Wildfires cause health risks such as reduced birth weight and stillbirths in newborns. It is also found that air pollution and high temperature have synergistic effects on human health. While carbon neutrality policies provide a great opportunity to reduce air pollution, international actions are needed to coordinate air pollution control and climate change policies to maximize the co-health benefits.

Mechanistic and modeling insights into the sequestration of cadmium and fulvic acid during Fe(II)-induced ferrihydrite transformation

Oral - Abstract ID: 77

Dr. Shiwen Hu [1], ***Prof. Chongxuan Liu*** [2], ***Prof. Zhenqing Shi*** [3], ***Prof. Fangbai Li*** [1], ***Prof. Tongxu Liu*** [1]

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Owing to the dual demands for pollution control and carbon (C) fixation in soils, Fe(II)-induced phase transformation may be a credible strategy to simultaneously immobilize heavy metals or organic matter (OM), but the underlying mechanisms remain unclear. Here, the synchronous sequestration mechanism of cadmium (Cd) and fulvic acid (FA) during Fe(II)-induced ferrihydrite transformation were examined. Mineral quantitative results uncovered that increasing Fe(II) concentration favored the transformation of lepidocrocite and goethite to magnetite, and ferrihydrite transformation rate decreased with decreasing Fe(II) addition. EDS mapping and line scans showed that Cd was dominantly adsorbed on the surfaces of lepidocrocite and goethite. Meanwhile, FA were adsorbed on magnetite aggregates and goethite surfaces, and incomplete structure of lepidocrocite provide spaces for immobilizing C. Newly-formed iron (Fe) minerals may immobilize Cd through surface binding, structural substitution, and physical encapsulation. The OM bound to the newly-formed Fe minerals was rich in aromatic and carboxyl functional groups, which was beneficial for binding Cd, whereas the presence of Cd promoted the generation of nano pore spaces or defects and consequently enhanced FA sequestration. Thus, Cd immobilization and FA sequestration can be simultaneously achieved during phase transformation. A model for Cd species quantification during phase transformation based on mechanistic insights was constructed. The developed model uncovered that adsorbed Cd was dominantly regulated by organic matter and ferrihydrite, and direct complexation of Cd by OM had a strong influence on the continuous variation in Cd at lower Fe(II) addition. The findings conduce to an in-depth knowledge of various nanoscale mechanisms accounting for the fate of Cd and FA coupled with mineral transformation in soils. The results of this study also provide a tool for quantifying the dynamic behavior of heavy metals in multi-reactant systems.

Medical Geology - Integrating Environmental Science, Public Health and Earth Science

Oral - Abstract ID: 146

Prof. Jose Centeno [1]

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Medical Geology is defined as the study of the impacts of geologic materials and geologic processes on animal and human health. Over the past 20 years Medical Geology has developed into a mature discipline with numerous adherents. Several international and national associations emerged devoted fully or partially to this new scientific discipline. Numerous books on the subject have appeared in this time, as well as dozens of short courses, workshops, lectures, journals, and countless journal articles. International, national and local conferences have been devoted to this emergent area. This presentation will emphasize the global impact of this discipline with particular attention to its origin, its recent advances and its future.

Medical Geology: 20 Years of Progress

Oral - Abstract ID: 50

Dr. Robert Finkelman [1]***, Prof. Jose Centeno*** [2]***, Dr. Olle Selinus*** [3]

1. *University of Texas at Dallas,* ***2.*** *University of Puerto Rico at Mayaguez,* ***3.*** *Linneaus University, Kalmar*

The International Medical Geology Association (IMGA) was founded exactly 20 years ago, an instant in geologic time. Nevertheless, much has been accomplished in the intervening 20 years. Prior to the formation of the IMGA there were two books published on the impacts of the natural environment on animal and human health. Since the formation of the IMGA at least 40 Medical Geology books have been published in at least six languages. Prior to 2004 there was one international organization focused on this issue (SEGH) today there are four including the IMGA, SEGH, GSA Geology and Health Division, AGU GeoHealth Section. There is AGU's GeoHealth journal and the USGS's GeoHealth Newsletter. In the past 20 years scores of conferences and workshops on Medical Geology were held in more than 50 countries, attended by thousands. This includes the International MedGeo Conferences that just celebrated its 10^{th} biannual meeting. There has been numerous local and regional conferences and a growing series of student oriented continent-wide Medical Geology conferences. Thousands of articles dealing with a range of Medical Geology issues have appeared in hundreds of journals in numerous countries. Curriculum development and academic research programs on Medical Geology have been developed at several universities. Even the UNs Year of Planet Earth recognized Medical Geology as one of 10 key topics. There have been videos, webinars, a publication for children, a developing Medical Geology research center and more. Recently several government funded projects as well as the U.S. National Academy of Sciences have focused on Medical Geology issues. Despite the significant progress that this discipline has made in a relatively short time there is still much more that needs to be done to broaden the recognition of this discipline. With the many bright, young people entering the field, the future of Medical Geology looks bright.

Mercury emission in small scale gold panning and health effects: South Africa Case description

Oral - Abstract ID: 631

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The upsurge in independent small-scale gold mining activities in South Africa provides employment and generates wealth; but economic gains are often countermanded by health degradation and destruction of vital industries such as farming and fishing. Increasing health problems due to the use of mercury to amalgamate the gold are still being reported. Significant quantities of mercury are being used for each ton of gold processed, despite the continued introduction of more efficient mining techniques.

Our systematic review based on the PRISMA Protocol, backed by documented medical registry data, does show that occupational mercury exposure still produces signs and symptoms related to neuro-psychological disorders, such as ataxia, tremor or memory problems, though many other reported symptoms such as hair loss or pain remain largely unspecific. The absence of environmental concern or the lack of enforcement of regulations also persists in many instances.

Geochemical surveys prior to operation and close monitoring to quantify emissions during various stages of the gold mining process, coupled with good planning and working procedures can minimise contamination, while remediation schemes can also be devised and monitored by the application of sound geochemical techniques for identifying primary sources of mercury release, its mechanism of transport and other toxicokinetic variables. Strengthening efforts by national governments at formalising this industry will ensure rapid realisation of these proposals.

Mercury pollution remediation in paddy fields by biochar supplement and its mechanisms

Oral - Abstract ID: 312

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Abstract

This study aimed to assess the efficacy of utilizing cheap and easily obtainable biochar for remediating mercury (Hg) contaminated paddy soil and explore the mechanisms reduces methylmercury (MeHg) levels in rice grain. A grain production base located in eastern Guizhou Province was chosen as the research site for field restoration demonstrations and laboratory simulate adsorption experiments were also conducted. The biochar achieved adsorption equilibrium with Hg^{2+} within 30 min (qe=6.44 mg/g), with the highest adsorption capacity observed at pH=4, reaching a maximum of 9.75 mg/g. The field experiments showed that the total Hg (THg) in rice grain from the treatment group reached national limit, with a 21.0% reduction of MeHg content in rice grain compared with control group. Comparatively, the ratio of available Hg to THg in soil decreased by 51.4% and the ratio of rice THg to soil THg dropped by 32% in the treatment group compared with the control group. Furthermore, the addition of biochar led to a 10.2% increase in rice grain yield. TEM analysis revealed biochar's ability to adsorb Hg in soil, while FTIR indicated that functional groups such as hydroxyl, carboxyl, amide, and sulfur-containing groups on the surface of biochar formed complexes and precipitates with Hg. The integration of field remediation experimental results with explanations of the adsorption mechanism has fostered a deeper understanding of mercury adsorption in the soil-rice system, and endorsed the use of biochar amendments as a referable approach for managing mercury-contaminated soils.

Keywords: mercury ；biochar；remediation；

Microbial inoculants for soil and environmental health: Panacea or placebo?

Oral - Abstract ID: 672

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The influence of microbial inoculants on soil health has recently garnered significant attention in agricultural and environmental research. These microbial inoculants, either as single microbial species, or consortia of plant growth promoting bacteria, are touted for their potential to enhance soil properties, improve plant and soil health, and promote sustainable agriculture. However, these inoculants must compete with established microbial flora that have adapted and evolved with the soils they inhabit, meaning any interlocutors must either find a niche for them to inhabit for long-term propagation or work directly with plants within the short season they have for interactions. While there are a number of microbial inoculant success stories in the modern age, there are also a number of studies that demonstrate that microbial inoculants can “over promise and under deliver”. In this talk we will discuss three undergoing research studies, two in agricultural settings, and another in the revegetation of a remediated mining site, that have incorporated microbial inoculants to an effort to improve soil health and increase plant yield. In the two agricultural cases, product claims for the microbial inoculants have a mixed track record, with slightly over half of the products accurately representing their microbial contents. Responses to microbial inoculant application are likewise complex, though less complicated systems appear to have a better incorporation rate. Finally, a discussion on the potential impacts of agricultural microbial inoculant products for human health will be discussed, either as it pertains to reliance on what can be classified as possible opportunistic pathogens as microbial inoculants, or introduced as contaminants introduced during production.

Microbial pathways in the coupling of iron, sulfur, and phosphorus cycles at the sediment–water interface of a river system: An in situ study involving the DGT technique

Oral - Abstract ID: 704

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It is imperative to solve the problem of endogenous phosphorus (P) release from sediments in the governance of natural water bodies. Deciphering P migration and transformation patterns that are coupled to iron (Fe) and sulfur (S) cycling at the sediment–water interface (SWI) is the key to understanding the mechanisms underlying endogenous P release. In the present study, we deployed diffusive gradients in thin films (DGT) probes in situ at the SWI in Fuyang River, Hebei Province, China. When the probes were retrieved, the surrounding sediments were synchronously sampled. We analyzed the longitudinal spatiotemporal distribution of Fe, S, and P at the SWI. We also explored how functional bacterial community diversity was associated with the coupling reactions of Fe, S, and P as well as endogenous P release from sediments at the functional gene level. The results showed that labile Fe, S, and P occurred at low concentrations in sediments 0–2 cm below the SWI, while they were enriched in sediments at depths of 4–8 cm. The longitudinal distribution of different labile elements exhibited greater differences between October and February than regional differences, with higher concentrations at downstream locations than upstreamlocations. In February, Fe/Albound P and sulfide (S2−) concentrations increased in sediments compared with those inOctober owing to an increase in the relative abundances of dominant genera among P-mineralizing bacteria and sulfate-reducing bacteria. As a result, Fe in Fe-bound P precipitated as FeS2, which induced P remobilization and release into the overlying water. The spatiotemporal distribution patterns of functional genes related to P (phoD and ppk) and S (aprA) transformation were consistent with those of labile P and S, which strongly suggests that microorganisms played a role in driving and regulating the coupled cycling of P and S at the SWI.

Microplastics and Polycyclic Aromatic Hydrocarbons in Ports Worldwide: Concentrations and Associated Risks

Oral - Abstract ID: 653

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Coastal pollution is a pervasive environmental crisis arising from the intense demand and use of resources, endangering species and ecosystems worldwide. While microplastics (MPs) and polycyclic aromatic hydrocarbons (PAHs) have been extensively studied in various ecosystems, they have received scant attention in port environments. This review selected published articles conducted in ports worldwide between 2010 and 2023 to determine the concentration, accumulation characteristics, and driving factors of MPs and PAHs, and the associated ecological and health risks were evaluated. A total of 168 studies were conducted in 218 ports, examining water, sediment, and biota across all continents. The average concentrations of MPs in water, sediment, and biota were approximately 768.79 ± 1197.88 items/m^3, 245.81 ± 229.90 items/kg, and 12.83 ± 10.69 items/individual and in ports worldwide, respectively. Similarly, the average PAH concentrations were 175.63 ± 178.37 ng/L, 1592.65 ± 1836.5 µg/kg, and 268.47 ± 235.84 µg/kg in water, sediment, and biota of ports worldwide, respectively. Asia exhibited the highest concentration of MPs in ports across all media. PAHs were highest in water and biota from Asian ports, while sediments from African ports were the most polluted. Port semi-enclosed structures and the presence of rivers are key drivers of MP and PAH accumulation. MP and PAH pollution in ports poses potential ecological and health risks. Among the studied ports, 29.1% had MP numbers in sediment greater than the predicted no-effect concentration (PNEC). In comparison, the risk quotient of PAHs in sediments indicated that medium and high risks had a probability of 44%. The presence of MP and PAHs in biota, along with the capability of MPs to adsorb other contaminants pose a serious threat to human health.

Microscopic Mechanisms of Ferrous Ion Oxidation Facilitated by Cyanidiophyceae in Acidic and Anaerobic Environments

Oral - Abstract ID: 763

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1. National Chung Hsing University

Cyanidiophyceae, an extremophilic microorganism, thrive in extreme environments (10–56 °C; pH 0.5–7.0) rich in concentrated metals, making them valuable for metal remediation. Of particular significance is the potential of their genes, which are inherited from extremophilic prokaryotes, to oxidize ferrous iron under anaerobic conditions. This unique genetic feature enables the development of stable biocomposites with iron, resulting in an boosted capacity for heavy metal sorption and the dispersion of iron nanoparticles. Iron assumes a pivotal role, predominantly existing in the form of iron hydroxides which served as substrates for the attachment of contaminated metals. However, iron hydroxides undergo reduction, transitioning into a soluble divalent form in anaerobic and acidic conditions, leading to the release of previously adsorbed contaminants and thereby influencing the environment. **Therefore, we aimed to investigate the molecular mechanisms and capacity of extremophilic Cyanidiophyceae to stabilize ferrous ions under acidic and anaerobic environments.** We employed synchrotron-based techniques, such as transmission X-ray 3D microscopy, iron K-edge X-ray absorption spectroscopy, and SR-Fourier transform infrared spectroscopy, to elucidate the molecular mechanisms. In this study, we have identified three mechanisms through which Cyanidiophyceae facilitate the oxidation of ferrous iron to form iron hydroxides: a defense mechanism involving polysaccharides, disruption of protein structures via thiol-iron chelation, and the creation of inorganic iron precipitates in the form of ferrihydrite on the cell surface. These results underscore the ability of Cyanidiophyceae to facilitate the formation of iron hydroxides in anaerobic conditions, offering potential benefits in terms of effective heavy metal removal and reduced requirements for coagulants and sludge production during wastewater treatment. This study lays the groundwork for the versatile use of Cyanidiophyceae across diverse environmental settings to enhance the bioremediation of heavy metals.

Migration and health risk assessment of polycyclic aromatic hydrocarbons in karst underground river systems in southern China

Oral - Abstract ID: 894

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Due to the special geological structure of karst area, polycyclic aromatic hydrocarbons (PAHs) easily enter underground river, which seriously affects drinking water safety. Therefore, this study selected the Qingshuiquan underground river in Nanning, China as a representative to carry out the migration rule and health risk assessment of PAHs in the underground river system. The results showed that PAHs migrated from upstream to downstream, and the concentration of PAHs and the proportion of high loop increased. In the vertical direction, the migration path of air, soil, karst spring and underground river pipeline is formed. With the increase of rainfall intensity, the migration capacity of PAHs becomes stronger and more obvious above moderate rainfall. DOC and SPM are the controlling factors of PAHs in water body. With the increase of ring number and TOC, PAHs spread from groundwater to sediment. TOC and grain size are the factors controlling PAHs distribution. The grid-based multi-media fugacity model was established to improve the simulation accuracy and reveal the health risk of PAHs: with the deterioration of the environment, the carcinogenic risk of adults changed from mild to moderate, and the carcinogenic risk of children changed from no to mild, and the risk of oral ingestion exposure was greater than that of skin contact exposure. The research results provide scientific basis for karst water pollution control.

Migration and transformation characteristics of chromium (Cr) in different soil-paddy system

Oral - Abstract ID: 701

Dr. Huimin Cao [1], ***Prof. Juan Liu*** [2], ***Ms. Wenhuan Yuan*** [2], ***Ms. Qi'en Ouyang*** [2], ***Mr. Zihuang Du*** [1]

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Rice is a crucial component of agricultural production in China, yet it has been found to accumulate and transport chromium (Cr) from contaminated soils to its edible parts, engendering potential health risks. Understanding Cr's behavior in the soil-rice system is essential for precise risk assessment and the development of effective management strategies. Previous studies have examined various aspects of Cr pollution, including the processes of Cr uptake and storage in rice plants, the consequences of Cr contamination on rice growth and yield, and remediation methods for Cr-polluted soils. Our investigation delves into the influence of soil characteristics such as pH, the concentration of other heavy metals, and redox conditions on Cr transformation and availability in soil and rice. The findings indicate that a consistent decline in soil pH during the rice cultivation period enhances Cr mobilization and reduction, culminating in increased Cr accumulation in rice roots. Furthermore, high arsenic levels catalyze Cr conversion in the soil into a form that plants can absorb more readily, amplifying Cr bioavailability. This research provides not only a theoretical foundation for controlling Cr pollution in paddy soils but also practical insights into improving environmental quality and the safety management of agricultural produce.

Molecular characterization of organic aerosol in PM2.5 and its effect on viral infection

Oral - Abstract ID: 323

Prof. Xinhui Bi [1]

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Exposure to organic aerosol (OA) is expected to enhance respiratory virus infection. However, the key molecules that affect viral infection is not well understood due to the chemical complexity of OA. In this study, A549 cells were exposed to water-soluble humic-like substances (HULIS) and subsequent methanol-soluble organic matter (MSOM) of $PM_{2.5}$ collected in urban Guangzhou, and then were infected by SARS-CoV-2 pseudovirus. Both HULIS and MSOM led to an up-regulation of viral infection of A549 cells in a concentration-dependent way (p <0.001), with an enhanced up-regulation in MSOM. Meanwhile, the molecular composition of HULIS and MSOM were detected by Fourier-transform ion cyclotron resonance mass spectrometry. Partial least squares (PLS) analysis illustrated that the aromaticity, carbon number, unsaturation, and the fraction of oxy-aromatic compounds determined the up-regulation of viral infection in HULIS, while carbon number and lipid compounds caused the up-regulation in MSOM. The key molecules resulting in the up-regulated infection were CHO and CHON with potential oxy-aromatic and nitro-aromatic structures in HULIS, and CHO with aliphatic and olefin structures in MSOM. The results highlighted the distinct impacts of organic components with different molecular characteristics on the viral infection and would ultimately improve our understanding of the health effects of organic aerosols.

Molecular Insights on the Impacts of Fe-Organic Matter Associations on Iodine Mobilization in alluvial-lacustrine aquifers

Oral - Abstract ID: 476

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The biogeochemistry processes of iodine are typically coupled with organic matter (OM) and dynamic Fe minerals transformation. However, the impacts of Fe-OM associations on the cycling of iodine remain poorly understood. We used Fourier transform ion cyclotron resonance mass spectrometry to characterize the molecular characteristics of both dissolved organic matter (DOM) in groundwater and water-soluble organic matter (WSOM) in aquifer sediments being depth-matched with groundwater from monitoring wells in typical iodine-affected aquifers. The results show that WSOM in high-iodine sediments contains more high molecular weight (HMW) organic compounds with higher aromaticity and unsaturation. The association between iodine and WSOM is highly consistent with that between amorphous Fe_{ox1} and WSOM, but is contrary to that between crystalline iron oxides (Fe_{ox2}) and WSOM. The complexation of HMW organic compounds of WSOM to iodine-bearing amorphous Fe_{ox1} plays an important role in iodine mobilization, which could inhibit the amorphous Fe_{ox1} transformation to crystalline Fe_{ox2}. Based on batch adsorption experiments in combination with solid-phase characterization, the Fe-OM associations with a higher C/Fe ratio exhibited greater capacity for immobilizing iodine (~60-80% for iodate) in the solids, which was related to the higher affinity of iodine to OM and the significantly decreased extent of Fe minerals transformation with increasing C/Fe ratios as revealed by X-ray diffraction. This research provides new insights into the iodine cycling controlled by association between Fe and OM at the molecular level.

Molecular-scale probing of Fe oxyhydroxides-DOM interactions and their implications for the immobilization of heavy metal

Oral - Abstract ID: 229

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Dissolved organic matter (DOM) is a crucial carbon source in soil, impacting pollutant transformation and global carbon cycling through interactions with soil minerals, while a molecular-scale comprehension of these processes remains elusive. Applying molecular-scale methods, our research reveals that DOM exhibit molecular fractionation when adsorbing onto Fe oxyhydroxides, owing to the DOM's intricate structure. Environmental factors, such as the presence of phosphate, influence this process. The transformation or aging of poorly crystalline Fe oxyhydroxides, induced by Fe(II) or high temperature, can result in the occlusion or release of adsorbed DOM. Meanwhile, the interfacial electron transfer (ET) between DOM-oxyhydroxides is also investigated, and this can lead to the reductive of Fe minerals and the transformation of DOM.

These DOM-Fe oxyhydroxide interactions significantly impact the fate of heavy metals. Adsorptive fractionation of DOM on ferrihydrite enhances the immobilization of cadmium (Cd) while inhibiting arsenic (As) immobilization due to changes in binding strength and manner with Fe minerals mediated by DOM. Moreover, the ET between DOM and Fe oxyhydroxide influences heavy metal (As) reallocation; under anoxic conditions, reductive dissolution of highly crystalline Fe oxyhydroxides enhances As(V) immobilization, whereas As(III) is unaffected. In oxic conditions, Fe(II) generated during the ET process promotes reactive oxygen species production, leading to As(III) oxidation and immobilization on Fe oxyhydroxides. To gain deeper insights into these processes, we applied AFM-based dynamic force spectroscopy, which can modify heavy metals (As/Cd), DOM, and Fe oxyhydroxides on AFM tips, enabling the measurement and quantification of binding strength, binding manner, and ET processes in heavy metal-DOM-Fe oxyhydroxides systems. These findings offer novel insights into Fe oxyhydroxides-DOM interactions and implications for heavy metal immobilization.

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Monitoring the level of heavy metal contamination in sediments from San Antonio stream, Salto, Uruguay with Medical Geology applications.

Oral - Abstract ID: 177

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Salto city is located in the so-called horticultural belt, one of the most important areas of Uruguay for horticultural production. This area specializes in early or counter-season production. Silveira et al., (2020) describe 236 farms located in this area. These production systems are characterized by high-intensity use of soil and water resources. San Antonio Stream and Salto-Arapey Aquifer are the most important source of water for irrigation, livestock and human consumption in the región.

The municipal landfill and mechanical workshops are located in San Antonio basin, where solid waste and untreated wastewater effluent are deposited. Alvareda et al., 2019, has shown the presence of Arsenic (1.0 – 5.0 ug/L), Total Phosphorus (20.0 – 178.5 ug/L), Total Nitrogen (0.2 – 1.8 mg/L), Zinc (15.4 - 396.0 ug/L), Cr (3.1 ug/L one well) and physicochemical and microbiological parameters in San Antonio surface water. These results evidenced pollution. Da Rocha et al. unpublished results detected Lead (4.5-6.3 mg/kg) and Zinc (16.0-73.0 mg/kg) in sediments of San Antonio Stream near the intensive horticultural crops area.

For these reasons, the objective of this work is to analyze the sediments of the San Antonio Stream and identify a possible long-term accumulation of heavy metals. For this purpose 3 sites over San Antonio Stream with a monthly sampling frequency and a total of 30 sediments collected samples were selected. Samples were treated by EPA 3050B method and elements (Lead and Zinc) were analyzed by Perkin Elmer 900F Flame Atomic Absorption Spectrometer APHA-3500 with validated methodology. At this stage, the analyzes of the elements to be determined are being processed and the preliminary results will be presented. These results could contribute for the first time to this area of Uruguay to identify geochemical anomalies in sediments with some adverse impact on human and animal health and environmental problems.

Multi-Dimensional Characterization of Ambient Nanoparticles in the Human Body

Oral - Abstract ID: 104

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Characterization at nanoscale plays a crucial role in in-depth understanding the nature and processes of environmental nanoparticles (NPs). Unfortunately, current techniques suffer from many limitations, such as lack of accurate molecular information, inability to real-time monitor intermediates, and vulnerability to sample matrix interference. To probe NPs in the human body, we developed some MS-based techniques to analyze and characterize NPs. Specifically, we developed a chemical multi-fingerprinting platform (integrating elemental fingerprinting, high-resolution structural fingerprinting, and natural isotopic fingerprinting) for particle characterization and source tracing. We found that exogenous NPs are widely present in the human blood samples with extreme diversity in chemical species, concentration, and morphology. Furthermore, we have also developed detection platforms for airborne magnetic NPs and soot particles in complex media based on different MS techniques. These methods greatly rich the toolbox of nanotoxicological research and nanomaterial risk assessment.

Multi-medium migration and accumulation simulation of PFASs in Shanghai mega city river channels based on Storm Water Management Model and IV Fugacity model

Oral - Abstract ID: 313

Dr. Ye Li [1], ***Mr. Tianhao He*** [1], ***Ms. Fangfang Ding*** [1], ***Prof. Min Liu*** [1]

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PFASs (perfluoroalkyl and polyfluoroalkyl substances) can be readily released into the aquatic environment through multiple pathways, causing pollution and human health risk. However, the mechanisms of multi-media migration and circulation of PFASs in urban river network remain unclear. On the basis of field measurements, model simulation is an effective method for comprehensive understanding the pollutants' environmental behaviors in the city river channels. Shanghai is a high-developed megacity with intense human activities. Rapid urbanization of the city has dramatically altered the transport behaviors of pollutants in the environment. To comprehensive understanding the characteristics of PFASs in typical urban river network, the behaviors and mechanisms are needed to be addressed urgently. In this study, we use an emission estimating method to calculation the emissions of PFOA (perfluorooctane sulfonic) and PFOS (perfluorooctane acid) into Shanghai surface water from different pathways. Then, the four-order fugacity chemical migration and fate model coupled with the SWMM (Storm Water Management Model) model was used to evaluate the migration accumulation status of regional and municipal rivers in Shanghai. The accuracy of model simulation was verified by comparing the predicted concentrations and monitoring data, verifying the reliability of the emissions as well. The simulation results show that the main sink and transport medium for compounds are aquatic compartments. The distributions of PFASs in this urban river network was shown, indicating the dynamic behavior of pollutants in urban river networks. The health risks assessment of PFASs to urban communities show that urban residents have non-negligible health risks. Our methods and results provide technical and theoretical support for policy formulation.

Multi-omics Analysis for Mechanistic Understanding of Microbial-mediated Synthesis of Silver Nanoparticles

Oral - Abstract ID: 728

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Silver ions (Ag (I)), as a highly toxic heavy metal with their widespread applications, presents substantial hazards to both the ecosystem and human well-being. Employing microorganisms to bioreduce Ag (I) and subsequently synthesize Ag nanoparticles (Ag NPs) offers a promising strategy owing to its low-cost, gentle-process, and eco-friendly characteristics. Nevertheless, comprehending the intricate molecular mechanisms involved in the bacterial-mediated reduction of Ag (I) remains a formidable challenge. In this study, *Pantoea sp.* IMH was examined for its bioreduction capabilities of Ag (I) to Ag NPs, and the molecular mechanism of Ag (I) at various concentrations (50, 100, 200, and 500 μM) was investigated by the integration of transcriptome and proteome analyses. Multiple complementary characterizations confirmed that incubation of the strain IMH with different concentrations of Ag (I) led to the formation of Ag NPs with varying morphology and distributions. The results indicated that copper resistance metabolism participated in Ag (I) resistance within the range of 50 to 500 μM. Meanwhile, central carbon metabolism, including glycolysis, pentose metabolism, and fructose and mannose metabolism, were found to regulate the reduction of Ag (I) and the formation of Ag NPs at lower concentrations Ag (I). Furthermore, it was observed that at higher concentrations of Ag (I), the strain IMH activated nitrogen metabolism as well as other metal resistance metabolism pathways, such as arsenic detoxification metabolism, glutathione metabolism, and ATP-binding cassette transporters. The aforementioned pathways played a central role in the bioreduction of Ag (I) and the biosynthesis of Ag NPs. In general, the strain IMH exhibited two distinct approaches with the objective of mitigating the toxicity of Ag (I) and promoting the synthesis of Ag NPs. This study is anticipated to contribute innovative insights into the mechanisms underlying heavy metal resistance and the production of biogenic nanoparticles in bacteria.

Multi-site Ozone Mid- and Long-term Prediction Based on Temporal Convolutional Graph Neural Network

Oral - Abstract ID: 1003

Prof. Song Gao [1]

1. *Shanghai University*

With the rapid development of the economy and industry, ozone has become one of the major air pollutants, and it poses serious hazards to human health, ecosystems and crops. Predicting ozone concentration is crucial for taking effective measures to reduce the air pollution and improve the air quality. However, the ways to predict ozone are mainly based on short-term predictions within 24 hours at a small number of stations, and the medium- and long-term prediction methods need to be further improved. In this paper, we propose a novel temporal convolutional graph neural network (TCGNN), which is based on graph neural network and temporal convolutional neural network, and combined with the temporal attention mechanism to accurately predict the ozone of the study area in the next 72 hours. In addition to monitoring ozone data, we construct relevant pollutant and meteorological data as features in the dataset. The experimental results show that the TCGNN model achieves higher prediction accuracy than other baseline models for different time steps, with the RMSE, MAE, and R2 of TCGNN being 12.30, 9.74, and 0.71, respectively, for the 72-hour prediction, and the model generally outperforms the other two state-of-the-art models at all stations in Hangzhou Bay. This study aims to assist government departments in taking preventive and control measures by enabling them to implement sound strategies in advance to reduce the emission of precursors and curb ozone generation.

Multifaceted Health Effects of Chronic Exposure to Drinking Water Arsenic in Bangladesh

Oral - Abstract ID: 561

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In 2012, we have estimated an excess mortality rate of 1 in every 18 adult deaths in Bangladesh due to chronic exposure to drinking water arsenic (As). In an interim report released in 2013 by the Committee on Inorganic Arsenic of the National Research Council, three tiers of health end points of concern for inorganic arsenic have been described. Tier 1 includes lung, skin, and bladder cancer, ischemic heart disease and skin lesions. Tier 2 has prostate and renal cancer, diabetes, nonmalignant respiratory disease, pregnancy outcomes (infant morbidity), neurodevelopmental toxicity, and immune effects. Tier 3 is for liver and pancreatic cancer, renal disease, hypertension, stroke and other pregnancy outcomes (fetal loss, stillbirth, and neonatal mortality).

Here, we provide an update on the multifaceted health effects beyond the exposed population and excess mortality estimate. Relying on our published machine learning models that predicted probability of encountering groundwater with < 10 μg/L, 10-49

μg/L, 50-149 μg/L and > 150 μg/L of As in drinking water in Bangladesh, a more spatially representative distribution is first generated. Second, population data with demographic information are combined to assess chronic exposure. A convolutional neural network approach based on satellite imagery is used to identify the spatial distribution of the population, aiming to improve the accuracy of the density estimation. Finally, Tier 1 and selected Tier 2 adverse health outcomes are assessed. A pooled association between the relative risk of each disease and the concentration of arsenic in drinking water is determined using both linear and non-linear models, then used to calculate the corresponding health effect. Because exposure varies widely in the 64 districts of Bangladesh, the expected health outcomes presented spatially should inform the need to care for those sickened by chronic arsenic poisoning in Bangladesh.

Multifunctional Biomolecular Corona-Enabled Nanoremediation

Oral - Abstract ID: 122

Dr. Jie Hou [1], ***Prof. Daohui Lin*** [1]

1. Zhejiang University

Trade-off between reactivity and selectivity is a fundamental challenge in developing environmentally functional nanomaterials such as nano zero-valent iron (nZVI). Biomolecular corona composed of proteins and metabolites is the basic form of indigenous biota-mediated nanomaterials modification in nature, which can offer potential win-win strategies for nZVI functionalization. Here, we simulated an aquatic environment contaminated with florfenicol (FF) and integrated pollution-tolerant aqueous worms (Tubifex tubifex) with nZVI to form complex living materials. The synergistic removal properties, biomolecular corona composition, and interfacial interaction mechanisms of the nZVI-worm complex were investigated. It was found that the nano-bio interface served as the hot zone for pollutant enrichment and reductive degradation. Neither aged nZVI nor worms effectively degraded FF in water alone, while nZVI-worm complex concentrated substantial quantities of FF and its degradation products at the interface. Multi-omics analyses indicated the presence of structural proteins and functional proteins on the outer and inner sides of the worm epidermis, respectively. Upon exposure to nZVI-FF, functional proteins such as glycolysis formed large vesicles and assembled as a protein corona on the nZVI surface. These functional proteins further synthesized metabolites such as organic acids and amines, with their secretion showing an FF-dependent pattern. Further verifications showed that lactic acid and urea could bind FF via hydrogen bonding, significantly enhancing the solubility of FF and facilitating its concentration at the heterogeneous interface, thereby improving nZVI-FF interactions. Additionally, succinic acid and lactic acid could corrode the passivation layer of nZVI and promote electron transfer between nZVI and contaminants through surface conjugation, which showed more electronically efficient than corrosion induced by hydrochloric acid. In conclusion, nature endows organisms with the capacity to modulate the structure-properties of nanomaterials via biomolecular corona. Recognizing the multiple functions of biomolecular corona may provide short-cuts for solving emerging pollutions.

Multiple stable isotopic approaches for tracing nitrate contamination sources: Implications for nitrogen management in complex watersheds

Oral - Abstract ID: 263

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Nitrate (NO_3^-) contamination of surface water is a global environmental problem that has serious consequences for watershed ecosystems and endangers human health. It is crucial to identify influences of different sources of NO_3^-, especially the incoming water from upper reaches. A combination of hydrochemistry and multi-isotope tracers ($\delta^{11}B$, $\delta^{15}N$-NO_3^-, and $\delta^{18}O$-NO_3^-) were used to determine NO_3^- sources and their transformation the North Jiulong River (NJLR), Southeast China. The findings revealed that NO_3^-, which accounted for an average of 87.1% of dissolved inorganic nitrogen (DIN), was the main chemical form of nitrogen species. The integration of dual stable isotopes of NO_3^-, $\delta^{11}B$, and hydrochemistry showed that NO_3^- was primarily contributed by sewage, soil nitrogen (SN), and ammonium (NH_4^+) via precipitation or fertilizers. The contributions from the sewage and soil nitrate source were almost equivalent and much higher than those from other sources in the NJLR watershed. The contributions from diverse sources varied seasonally and spatially. Manure and sewage (M&S) were the leading sources in the summer and autumn, accounting for 60.9 ± 8.5% and 47.3 ± 7.9%, respectively. However, NO_3^- fertilizers were the predominant source in the spring and winter. The NO_3^- inflow from upper reaches was proposed as an additional end-member to identify its contribution in the midstream and downstream in this study. The contributions of NO_3^- from the upper reaches were significant sources in the midstream and downstream, accounting for 27.2 ± 17.8% and 42.9 ± 21.9%, respectively. The obvious decline in local NO_3^-contribution shares from midstream to downstream implied structural changes in pollutant sources and regional environmental responsibility. Therefore, tracing nitrate sources and quantifying their contributions is critical for clarifying environmental responsibilities for precise local nitrogen management in watersheds.

Nano-enabled remediation of oil, metals and harmful algal blooms

Oral - Abstract ID: 662

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Oil spills, metal waste discharges and harmful algal blooms are a continuing problem to the environment. Currently there are few viable, scalable and cost effective solutions to these problems. Nanotechnology potentially offers new approaches. Here we discuss one such approach, where magnetic, polymer-coated, magnetic nanoparticles are used effectively for the removal of all these pollutant types. Data on, and mechanisms of, removal are presented and discussed, Next steps and challenges to practical technology deployment, such as scaling, regulatory barriers and commercialization are also discussed.

Nanobiotechnology-based Strategies for Enhanced Crop Stress Resilience

Oral - Abstract ID: 115

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Low use and delivery efficiency of conventional agrichemicals is a significant impediment to maintaining global food security, particularly given that a 60-70% increase in food production is needed by 2050 to support the projected population. Further confounding these efforts is climate change, which may force cultivation of crops under more marginal and stress-inducing conditions. Thus, novel and sustainable strategies for enhancing food production are needed. Nanobiotechnology approaches to engineer crops with enhanced stress tolerance may be a safe and sustainable strategy to increase crop yield. Under stress conditions, cellular redox homeostasis is disturbed, resulting in the over-accumulation of reactive oxygen species (ROS) that damage biomolecules (lipids, proteins, and DNA) and inhibit crop growth and yield. However, delivering ROS-scavenging nanomaterials (NMs) at the appropriate time and place can alleviate abiotic stress. Importantly, ROS-production in living cells carries both costs and benefits. When present below a threshold level, ROS can mediate redox signaling and defense pathways that foster plant acclimatization against stress. We find that many NMs are ROS-triggering, such as nanoscale Cu, Fe, S, and CuS, but these materials have the potential to be judiciously applied to crop species to stimulate defense systems, prime stress responses, and subsequently increase the biotic and abiotic stress resistance of crops. This knowledge can be used to engineer climate-resilient crops. It is also clear that the ability to effectively tune nanoscale material structure and composition will be critical to maximizing positive impacts, including significantly reduced amounts of agrichemical use while simultaneously enhancing yield.

Natural restoration of heavy metal pollution from mining area in Karst region, China

Oral - Abstract ID: 361

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Mining activities are one of the main reasons of ecosystem degradation, soil and water pollution, crop quality decline. Particularly, soil and water acidification are serious in areas affected by multi-metal sulfide ores mining etc. Crops with high heavy metals are produced, and ecological events occur frequently in these areas. Karst region in China is an important zone of multi-metals sulfide deposits. How to use and assess carbonate rocks to carry out natural restoration of pollution caused by mining activities has important economic and ecological significance. In this study, the distribution and occurrence of heavy metals in water, soil and rice grains in a large lead-zinc sulfide mine with carbonate as its surrounding rock was investigated, and the effects of natural buffering and weathering of carbonate rocks on the migration, transformation and ecological risk of heavy metals released from sulfide mining were revealed. In the areas of ore mining and waste rock stacking, the Cd concentration of all soil samples exceeded its intervention value, Cd concentrations of 50% rice grains samples exceeded its safety standard. A large amount of Acid Mine Drainage (AMD) rich in heavy metals flows downstream. Cd in river water rapidly drops after AMD flowing through carbonate rocks. The pH of the water is significantly increased along the river. Cd precipitates with the occurrence of carbonate minerals, iron and manganese oxides and sulfate minerals in the river. In the lower reaches of the river, the Cd concentration of 15% soil samples exceeded its intervention value, Cd concentrations of 4% rice grains samples slightly exceeded its safety standard. Iron - manganese oxides, carbonate minerals inhibited the translocation of heavy metal Cd in soil by rice grains. It was suggested that carbonate acid neutralization was the most important process to achieve natural restoration of pollution caused by mining activities.

New pollutants study in China: History & future perspective

Oral - Abstract ID: 537

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The governance of new pollutants has become the primary policy for environmental protection in China. New pollutant is an emerging scientific term, in analogy to contaminants of emerging concern, which refers to any synthetic or naturally occurring chemical or micro-organism that can cause significant known, or suspected, toxic effects and health hazards when deposited in the environment. Typical representatives include persistent organic pollutants, environmental endocrine disruptors, and antibiotics.

International scientific research on New Pollutants has been developing rapidly in the 2000s, and there is a lineage with the researches on traditional environment pollutants, uniting the efforts of Chinese scholars for decades. For example, the researches on screening and control for environmental endocrine disruptors were funded by the National 863 Program since 1999. A prospective exploration of the pollution characteristics, interfacial behavior, and health effects of emerging pollutants (i.e., PBDEs, PFAS and SCCP) has been realized with the financial support of the National 973 Program during 2003-2018.

Compared to traditional pollutants, New Pollutants are characterized by continuity and uniqueness. Persistence (P) and toxicity (T) will remain the main basis for identifying compounds as New Pollutants. High-throughput and multifunctional systems such as the Integrated Toxicology Analyzer (ITA) and the Stem Cell Toxicology Platform are expected to play an important role in the future.

Nitrogen-containing organic aerosol: Speciation and formation

Oral - Abstract ID: 269

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Nitrogen-containing organic compounds (NOC) are a group of key species in organic aerosols (OA), which affect atmospheric physicochemical properties and climate. The species and formation processes of NOC, however, are still not well understood. In this study, we report the optical properties, chemical composition, and formation processes of NOC (including nitroaromatics, N-heterocyclic compounds, and organic nitrates) in urban fine particles. Nitroaromatics are the main light-absorbing NOC quantified in urban $PM_{2.5}$, and the seasonal variations of their chemical composition, sources and contribution to light absorption of OA are discussed. Nitrate-mediated photooxidation of nitroaromatics (including 4-nitrocatechol, 3-nitrosalicylic acid and 3,4-dinitrophenol) in aqueous phase under different pH and temperature conditions are also studied. The dynamic changes in light absorption of nitroaromatics during photolysis are measured, and the photolysis rates and products of nitroaromatics are further characterized. The photolysis rate of nitroaromatics generally increases with the increase of temperature. The photooxidation of nitroaromatics starts with the addition of -OH or/and -NO (-NO_2) groups to aromatic ring, followed by further ring-opening of aromatic ring with the formation of smaller, highly oxygenated molecules. Besides, the nighttime formation processes of secondary organic nitrates are investigated based on size-resolved aerosols measured in urban $PM_{2.5}$ with a soot particle long-time-of-flight aerosol mass spectrometer. Aqueous processing plays an important role in the nighttime formation of particulate secondary organic nitrates in large size particles, especially in fog-rain days. N-heterocyclic compounds from aqueous reaction of dicarbonyls with amines and ammonium under different pH are also studied. 155 newly N-heterocyclic compounds are identified and mainly involve four formation pathways.

Nonnegligible organic pollution released from common artisanal clusters of nonferrous mining area

Oral - Abstract ID: 919

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Heavy metal pollution caused by mining activities has raised wide concern. However, excess beneficiation reagents accompanied by the flotation process and persistent organic pollutants produced during smelting may remain in tailings and slags, which would also lead to ecological risk and be always ignored. An abandoned artisanal cluster (containing the beneficiation of lead-zinc ore and mercury smelter) in Tongren, Guizhou province of China, was investigated. The content of heavy metals, xanthate, and polycyclic aromatic hydrocarbons (PAHs) of the slags, construction waste, tailings and surface soil were analyzed among 51 samples. Environmentally persistent free radicals (EPFRs), which may derive from the smelting process, were ascertained by electron paramagnetic resonance spectroscopy (EPR) and the reactive oxygen species (ROS) induced by EPFRs were also detected. Results showed that the surface area was mainly polluted by Hg and Cd (with the mid-value of 7.17 and 5.92 mg/kg, respectively) due to the long-term leaching of mercury smelting slags and lead-zinc ore tailings. Interestingly, xanthate parents still existed with a concentration from 0.96 to 75.83 μg/kg, and the butyl xanthate was the key pollutant that originated from the flotation process. Although slight pollution of PAHs (27.8-410.3 μg/kg) was found, considerable EPFRs ($4.11\text{-}75.58\times10^{16}$ spins/g) than that of previous studies in some industrial areas were identified, with the feature of carbon-center or carbon-center adjacent with an oxygen atom. The EPFRs would participate in the formation of ROS, which was indirectly proved by the alkane radicals ascribed to the reaction between hydroxyl radical and xanthate or other organic compounds in tailings and smelter slags. Overall, these organic pollutants would strengthen the biological toxicity together with heavy metals. Moreover, our study first indicated the distribution of EPFRs related to the mining and metallurgy industry, and the electron transfer of EPFRs would further impact the behavior of heavy metals(loids) unexpectedly.

Novel insights into the fate of nitrogen compounds in pore aquifers from molecular characterization of organic matter in Xiliao River Basin

Oral - Abstract ID: 503

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Occurrence and transformation of nitrogen in groundwater are often regulated by the coupling of hydrogeological setting and biogeochemical processes. Understanding the sources, fate and factors that control the mobilization of nitrogen species is critical for better groundwater management and human health protection. In the Xiliao River Plain, northeastern China, shallow groundwater was severely affected by nitrogen contamination, especially ammonia, in two major reaches, but the origin and transformation mechanism is not well known. In this study, the combining of molecular characterization of organic matter with hydrochemical and isotopic analysis were used to explore the differences in dissolved organic matter (DOM) components and their effects on nitrogen occurrence and transformation in various hydrogeologic settings. The results show that high levels of NH_4^+-N (average 1.94mg/L) in groundwater were observed in the XKH reaches, where groundwater flow is relatively sluggish and the organic matter content in the aquifer is rich. The strong humification and degradation of DOM as well as the preferential use of terrestrial humic-like components with high NOSC values mediate the reductive dissolution of iron oxides to produce a large amount of Fe^{2+}, which provides sufficient electron donors for the occurrence of DNRA process, and promotes the presence of high NH_4^+-N groundwater. In contrast, in the XLH reaches, DOM in groundwater is mainly biogenic and less degraded. The degradation of DOM and N-DOM in groundwater is dominated by aliphatic compounds in highly unsaturated compounds and CHO+N molecular formula, respectively, resulting in more mineralization of N-containing molecules and relatively high NH_4^+-N concentration (average 0.73mg/L). The significant accumulation of heteroatom-containing (SP) DOM in groundwater is closely related to microbial activity in XLH reaches. The sulfate reduction process to generate reduced sulfur exists in the groundwater of the XLH basin, which promotes the denitrification process.

Keywords: Pore aquifer, nitrogen, fate, DOM, FT-ICR-MS, stable isotopes

Novel root exudate mediated pathways of rice rhizosphere Cd mitigation

Oral - Abstract ID: 175

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The genetic traits of *in planta* Cd metabolism in low Cd accumulating rice cultivars have been comprehensively investigated. Conversely, rhizosphere Cd protection/immobilization mechanisms from root exudates remain poorly understood. We hypothesized that the stimulated root exudates of low Cd accumulating cultivar under Cd contamination directly immobilized Cd in rhizosphere soil and also stimulated the growth of Cd-immobilizing microorganisms, leading to the low Cd uptake. We used metabolomics and high throughput sequencing to elucidate the dominant root exudates and associated rhizosphere microbial communities of a low-accumulating Cd cultivar grown in Cd contaminated soils. The findings from this characterization were then used to inform a series of factorial Cd adsorption, bacterial strain isolation and controlled growth experiments, for mechanistic determination of the mode of action of root exudate mediated Cd protection. Exudation of two strong chemical solubilizers of Cd in soil, succinic and 2-hydroxypropanoic acid, were decreased under induced Cd contamination. In contrast, linoleic acid and sucrose, whose release increased under Cd contamination, significantly enhanced the chemical immobilization of Cd. Concurrently, these exudates also increased the growth of Cd immobilizing genera such as *Streptomyces* and *Pseudarthrobacter*. Finally, these synergistic chemical and biological processes resulted in low Cd accumulation in rice shoot and root tissue. The accepted paradigm is that primary protection against Cd uptake in rice is an internal cellular process. Here, a complementary strategy, based on the regulation of the plant's external rhizosphere via root exudate control of Cd mobilizing compounds concurrent with promotion of Cd-immobilizing bacteria, is presented. These novel mechanisms provide new perspectives on adaptations to Cd stress and how to rice can be grown more safely.

Novel US nationwide estimates of regulated public water contaminants at various spatial and temporal resolutions for epidemiologic study

Oral - Abstract ID: 826

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Importance and objectives: Previously, there were no nationwide estimates of contaminants regulated by the US Environmental Protection Agency (USEPA) in community water systems (CWSs) that could be readily leveraged for epidemiologic research. As a result, nationwide epidemiologic studies evaluating public water contaminants and related adverse outcomes are sparse, and such studies are critical to informing dose-response assessments and regulatory efforts. We generated contaminant estimates nationwide at the CWS-, Census block-, ZIP Code Tabulation Area (ZCTA)-, and county-level for epidemiologic research, and evaluated their association with adverse birth outcomes, metabolic disease, and several cardiovascular disease in multi-site cohorts.

Methodologies: We evaluated >13 million USEPA-compiled compliance monitoring records (2000-2019, >92% of systems) for N=76 contaminants (inorganics, organics, radionuclides, and disinfection byproducts, including arsenic, fluoride, total trihalomethanes, total haloacetic acids, nitrate, and others). We aggregated contaminant concentrations to USEPA's Standardized Monitoring Framework periods (e.g. quarterly for disinfection byproducts, triennially for inorganics), accounting for treatment. We developed population-weighted averages by joining city-served and system name to Census Place-Relationship Files (ZCTA-level nationwide), and by spatially joining CWS service area and administrative boundaries (ZCTA- and Census block-level, N=14 states).

Main results and conclusions: Estimates are available nationwide at the CWS (N>45,000), ZCTA (N>14,300), and county (N>2,800) levels; and for N>1.9 million Census blocks. We linked these estimates to several NIH-funded cohorts, including the Strong Heart Study, the Multi-Ethnic Study of Atherosclerosis, the National Health and Nutrition Examination Survey, and dozens of birth cohorts in the Environmental influences on Child Health Outcomes consortium. We will present epidemiologic associations with urinary biomarkers of internal dose, cardiometabolic and cardiovascular disease, and birth outcomes. Our novel approach enables the epidemiologic study of regulated water contaminant concentrations and diverse adverse health outcomes nationwide. Individual-level, time-weighted cumulative and/or average contaminant exposure estimates can be generated for other cohorts by leveraging residential addresses/histories.

Numerical study of the dispersion of volatile organic compounds released from liquid crystal displays in an office

Oral - Abstract ID: 811

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People spend about 90% time indoors and exposure to indoor volatile organic compounds (VOCs) is of great importance to evaluating human health effects. Liquid crystal displays (LCDs), widely used in indoor office environments, are found to be a new important source for indoor VOCs, with an emission rate of 8.25×10^{9} molecules·s-1·cm-2, by Liu and Abbatt 2021. Therefore, in this work, dispersion of the VOCs from LCD monitors was investigated in a four-people office environment (3 × 3.5 × 2.5 m, W × L × H) by computational fluid dynamics simulation. Four desks were located in the office with mixed ventilation. The monitors on desks were set as the VOCs sources. The emission rate in the above reference was applied to the monitors for analysis. The results found that the users inhaled around 0.3% - 0.7% of released VOCs with the mean value of 0.5% under an air change rate per hour (ACH) of 2. The highest exposure of the user was around 2.4 times the lowest exposure. The deviation of the exposure of users was due to the different locations. The user below ventilation returns had higher exposure. The exposure per day of the users was estimated to be $(1.8 \pm 0.4) \times 10^{15}$ VOCs molecules, that is, $(2.1 \pm 0.5) \times 10^{-4}$ mg/day. During winter, the mechanical ventilation is usually turned off. The exposure with only a window gap was investigated and it was around 28% higher than that with the ACH of 2. When the ACH was increased to 4, the exposure was 8% lower than the ACH of 2. It is suggested to sustain a higher ventilation rate to reduce the exposure of the users even in winter. This work provides an understanding of the dispersion and exposure to the VOCs from the LCDs.

nZVI-based phytoremediation technology development

Oral - Abstract ID: 354

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Nanoscale zero-valent iron (nZVI) may antagonize the toxicity of co-existing contaminants to plant, along with the removal of contaminants, which enables the development of nZVI-based phytoremediation technologies. In recent years, we put forward a strategy extracting valuable information from joint nanotoxicity studies as an indicator for the development of nano-enabled bioremediation technologies. We established a new soil remediation strategy using nZVI coupled with safe rice-production in paddy soil contaminated with pentachlorophenol (PCP). The specific role of nZVI-derived root iron plaque formation in the safe production of rice was described, and the synergistic effect of nZVI-treatment and rice cultivation was identified as nZVI-facilitated rhizosphere microbial degradation of PCP. nZVI was also found to interact with alfalfa and synergistically remediate polychlorinated biphenyl-contaminated agricultural soil. An indigenous dehalogenation bacteria was isolated from the agricultural soil, and a synergistic effect of soil organic matter and nZVI was observed on the biodegradation of organochlorines. I will briefly present these nZVI-bioremediation technologies, with a focus on the interactions among nZVI, biota, and pollutants.

Occurrence and accumulation of microplastics in agricultural soils

Oral - Abstract ID: 669

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Microplastic pollution is a global environmental concern, particularly in agricultural soils. Organic fertilizers, agricultural film residues, and sludge are major sources of microplastics in these soils. However, the occurrence and accumulation characteristics of microplastics in soils under long-term agricultural activities require further exploration. This study utilized a sequential flow separation and flotation method to isolate microplastics from soil and systematically revealed their occurrence characteristics in agricultural soils under different activities through long-term experimental platforms. The analysis also examined the surface weathering characteristics of microplastics and their accumulation patterns due to long-term application of pig manure, sludge, and plastic mulch. Results revealed that non-mulched soil predominantly contained fibers and fragments, while mulching increased the presence of filmy microplastics. Microplastics in the soil were mainly transparent, black, red, and blue, and most had a particle size <1 mm. Polyester, polypropylene, and polyethylene were the main polymer types in the soils. Long-term application of pig manure, sludge, and mulching led to significant microplastic accumulation. Based on estimates, the annual accumulation of microplastics were 3.5 million and 7.68 ~ 29.04 million items ha-1 in soil with long-term application of pig manure and sludge, respectively. Long-term mulching resulted in the annual accumulation of filmy microplastics up to 14.04 ~ 18.09 million items ha-1 in the soil. The surface of microplastics subjected to long-term weathering showed weathering characteristics such as micron-level cracks and microporosity, increased oxygen-containing functional groups, and clay mineral attachment. This study indicate that long-term fertilization and mulching can lead to high accumulation of microplastics in the soil. Results provide basic data for understanding the characteristics of microplastic accumulation in agricultural soils in China.

Occurrence and fate of metal-bearing particles in soils in Pb-Zn mining and mineral processing area (The Upper Meža Valley, Slovenia)

Oral - Abstract ID: 587

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The Upper Meža Valley in Slovenia is a historic Pb-Zn mining, mineral processing and recycling area where the environment is severely polluted. Over the long period of industrial activities, the soil has become a deposition site for released Pb and other potentially toxic elements (PTEs) and remains an important source and sink for secondary pollution. In-depth knowledge of metal-bearing particles is important for understanding their environmental fate. In our study, we chemically and morphologically characterized the complex associations of metal-bearing particles in soils formed on carbonates, using scanning electron microscopy in combination with energy-dispersive X-ray spectroscopy (SEM/EDS). Combined with an understanding of the general chemical, pedological and mineralogical properties of soils, we interpreted the main processes of solid phase transformations. The results showed that despite long-term exposure, transformations of primary ore minerals (galena, sphalerite, pyrite) in soils are slow. The degree of change also depends on the development of the soil. Oxidation of primary sulphides is the main process driving the changes. It resulted in the formation of microcrystalline pseudomorphs of secondary sulphates, while prolonged weathering resulted in the formation of carbonates and/or oxides in most soils. Lead phosphate, the most stable mineral form of Pb, was formed in the soil where an additional source of P was most probably present (fertilization, grazing). The morphologies of phosphate particles indicate that microbiological activity was involved in their formation. The sequestration of Pb, Zn and Cu by secondary Al, Fe and Mn oxides/oxyhydroxides was shown to be a significant process in the soil, where the aluminosilicate component was increased. In addition to ore minerals, we identified various particles formed in high-temperature processes originating from ore smelting and lead-acid battery recycling.

Occurrence of PFAS in pasture lands of Virginia, United States

Oral - Abstract ID: 522

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Per- and polyfluoroalkyl substances (PFAS) have emerged as a growing environmental concern due to their widespread use and persistence in various ecosystems. This study investigated the occurrence of PFAS in pasture lands, a critical component of the broader environmental landscape that often receives biosolids application. The presence of PFAS in pasture lands raises significant implications for both environmental and public health. These compounds, commonly found in firefighting foams, industrial processes, and consumer products, have been known to bioaccumulate in animals and plants. Pasture lands, serving as a primary source of forage for livestock, become a focal point for understanding the pathways of PFAS entry into the food chain. Soil samples submitted by farmers of pasture lands across diverse geographical regions in Virginia, United States were analyzed for 39 PFAS using the US EPA Method 1633 on an ultra high-performance liquid chromatography coupled with tandem mass spectrometry (UHPLC/MS/MS). In addition, water and sediment samples from surface waters near farmlands receiving biosolids application were also collected and analyzed for PFAS. Our investigation has found widespread presence of PFAS in pasture lands of regions without biosolids application, although their levels are significantly lower than those in the regions with biosolids applications. This finding suggests that although biosolids land application can be a significant source of PFAS, other sources such as atmospheric deposition might also play important roles in contributing to the presence of PFAS in pasture lands. PFAS were also detected in the water and sediment samples near the biosolids-applied farmlands. The levels of PFAS in soil of pasture lands will be compared with their levels in the adjacent aquatic environment. The factors influencing the occurrence and distribution of PFAS in pasture lands and its potential risks will be discussed.

Occurrence, distribution and ecological risks of antibiotic concentration in surface water environment of Suzhou, China

Oral - Abstract ID: 380

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Antibiotic is a class of typical emerging contaminant due to its potential drug resistance, which have raised great attention worldwide. Water environment is the key point for the migration and transmission of antibiotic. Carrying out the occurrence characteristics and risk assessment of antibiotics in water environment is helpful to the prevention, control and management of water resources, as well as improve the management level of public environmental health and protect human health. In this study, we used a new automatic analysis method by online SPE coupled HPLC-HRMS for the whole profiles of antibiotics in water to explore the occurrence status and ecological risks of antibiotics in surface water of the Yangtze River and Taihu Lake in Suzhou City. The results showed that the spatial distribution trend of the average concentration of antibiotics gradually decreased from the urban population concentration area to the suburban area, and the urban area had a high concentration area possibly due to human iatrogenic activities. Natural factors played a major role in the distribution of antibiotic concentrations in surface water in Suzhou. The results of ecological risk assessment showed that most of the areas were low risk, and a few were medium and high risk areas. This study will provide basic data support for water resources management in Suzhou.

Occurrences of tire additive chemicals and their derivatives in high-cold climate environment

Oral - Abstract ID: 220

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The friction between tires and roads can result in the release of additives due to tire surface wear. Tire additives such as Substituted para-phenylenediamines (PPDs), Benzothiazoles (BTHs), and their transformation products are commonly present in urban environments. The ozone transformation product of N-1, 3-dimethylbutyl-n'-phenyl-*p*-phenylenediamine (6PPD), known as 6PPD-Q, exhibits high toxicity to fish. The regions of high-altitude and cold conditions may influence the formation, transformation, and migration of PPDs under intense ultraviolet radiation, leading to unknown risks. We discovered elevated concentrations of 6PPD, 6PPD-Q, and 2-hydroxybenzothiazole (2-OH-BTH) in road dust and stormwater pipe sediments in Lhasa City (China), and the detection rates for these substances all reached 100%. The concentrations of 6PPD (1865 ng/g) and 6PPD-Q (949 ng/g) exceeded those found in cities such as Beijing, Tokyo, and Washington in some samples. The conversion rate of 6PPD-Q (1.64) in Lhasa was higher than that in tropical cities like Guangzhou (0.4) and Hangzhou (0.5). The synergistic effects of rainfall and ozone, along with the type of vehicles, are identified as significant factors influencing the transformation degree. Due to the higher environmental risk of some of the transformation products, special attention should be paid to the environmental behavior and risks associated with tire additives in urban areas of high-altitude and cold regions.

On groundwater arsenic spatial heterogeneity across scales

Oral - Abstract ID: 768

Prof. Yan Zheng [1], *Ms. Baoling Yang* [1], *Dr. Yanhua Duan* [1], *Ms. Wensi Guo* [1], *Ms. Yuxia Yang* [1], *Ms. Bin Xu* [1]

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Geogenic arsenic in groundwater exhibits spatial heterogeneity across scales. Lacking adequate spatially resolved characterization of both the degree of groundwater As heterogeneity and a range of geological and hydrogeochemical governing factors, the mechanisms are still poorly understood despite advances in understanding of how flushing depletes sediment and groundwater As inventory, while redox trapping during discharge does the opposite.

At local scale, unprecedented high spatial resolution characterization of sediment and water chemistry was carried out in a shallow aquifer of Yinchuan Plain in arid northwestern China. Detailed analysis of extractable and bulk As in sediment (n=184), as well as groundwater As and its speciation (n=67) based on 14 depth (0-30m) profiles at 9 sites over a distance of 2.5 km revealed that local scale heterogeneity of groundwater arsenic mirrors that of sediment arsenic. The mean length scale of high groundwater (and sediment) As is ~ 500 m, comparable to previous efforts that delineated groundwater (but not sediment) As heterogeneity at high spatial resolution (3-10 depth profiles per km) in also fluvial-deltaic aquifers of Bangladesh, Vietnam and Nepal.

At basin scale, we compiled 736 lithological borehole records and utilized the TPROGS to construct a regional heterogeneous hydrostratigraphic model of the Baoding Plain (10,516 km^2), part of the North China Plain. Based on a correlation between sediment grain size and As concentration (n=67), a 3D model of sediment arsenic was established. The model reveals that the proportions of high As sediment (>8.8 mg/kg As) in shallow (< 200 m) and deeper (90-500 m) aquifers were 75% and 55% respectively. The mean length of sand lenses with low As is likely < 1 km based on comparison with other basins.

Further research is needed to unravel the mechanisms in order to reach the holy grail of predicting individual well water arsenic concentration.

One health and the use of "omics-technologies"

Oral - Abstract ID: 688

Dr. Laura Langan [1]

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Human health and wellbeing is intrinsically linked to a healthy environment, with health benefits especially associated with an urban environment developed with sustainability and resiliency to climate change events as its central pillars. Offering conceptual and applied research opportunities to advance planetary health and integrative biology in the 21st century, tools such as those found in molecular biology have been instrumental in advancing these aims. Omics based tools have the power to answer pressing health questions including discovery, decision making and diagnosis that span humans, animals, plants, and their shared environment. Challenged to work together, toxicologists, chemists' broader planetary health and ecosystem health in addition to One Health Communities are making progress in defining and managing the growing global threats from chemical pollution. However, to fully leverage these tools and the opportunities they provide, consistency and reliability of data is central. In this talk, with ever increasing toxicological studies available, we highlight opportunities to increase transparency of the research process but also reproducibility of studies thereby increasing scientific credibility. These include reporting recommendations for ecotoxicity data, behavioral ecotoxicity studies, but also omics-based output spanning proteomics, transcriptomics, RT-PCR/RT-qPCR, metabolomics etc. Through the highlighting of these reporting recommendations, we aim to improve the reporting of experiments in the peer reviewed literature, and thereby increase usefulness in anticipatory actions.

Opposite relationships between soil organic carbon and elevation in the midlands and mountainous areas in Ireland related to different types of peat

Oral - Abstract ID: 112

Mr. Yunfan Li [1], ***Dr. Haofan Xu*** [2], ***Prof. Chaosheng Zhang*** [1]
1. University of Galway, 2. Foshan University

Soil organic carbon (SOC) plays an important role in global carbon cycle which is influenced by multiple factors. Elevation, as one of these factors, has a close but complex relationship with SOC concentration. The traditional 'global' statistical models cannot capture the spatial variation thus are inefficient in revealing the detailed relationships between SOC and elevation at the local scale. In this study, a 'local' model of geographically weighted regression (GWR) was used to explore the complex relationships between SOC and elevation in the topsoil of Ireland based on the dataset from National Soil Database of Ireland. The results indicated SOC and elevation exhibited the spatially varying relationships across the study area. Positive relationships in the mountainous areas suggested SOC concentration increased with the increasing elevation. Negative relationships were observed in the midlands where SOC concentration decreased with the increasing elevation. Such spatially varying relationships between SOC and elevation in Ireland were related to the two different main types of peat: blanket peat and raised peat. These two types of peat have different formation processes, thus are distributed at different elevations. In the mountainous areas, low temperature and high humidity create a cool and anoxic environment that mitigates SOC mineralization, promoting the accumulation of blanket peat at a high elevation. In the midlands, the low-lying lakes and wetlands provide an anoxic environment where raised peat is developed and located at a low elevation. The findings of the spatially varying relationships between SOC and elevation in Ireland have demonstrated the importance of modelling SOC at the 'local' level. Attention is required for such modelling using a global algorithm and it is recommended that localized algorithms are considered in modelling SOC.

Optimized Coordination of Urban Water Use System in Minjiang River Basin based on the SWAT model Under Influence of Climate Change

Oral - Abstract ID: 386

Prof. Jiping Wang [1]

1. *Xiamen University of Technology*

The Minjiang River is the largest river system in China's Fujian Province. Future climate change conditions will have a direct impact on the water resources in the basin, as well as the ecological security of the cities within the basin. In this study, we build a SWAT model based on the spatial and observational data of the Minjiang River Basin, using SDSM model to simulate the future meteorological data of each station in the basin under the RCP4.5 and RCP8.5 scenarios of CMIP5, and then predict the basin runoff. A system dynamics feedback model of water resource usage and allocation under the influence of urbanization was developed based on the runoff forecast results to optimize water resource allocation for Fuzhou, Sanming, and Nanping cities in the Minjiang River Basin from 2021 to 2050. The findings indicate a notable upward trend in the multi-year average runoff within the Minjiang River Basin under the two future climatic scenarios of RCP4.5 and RCP8.5. Specifically, it is observed that the yearly runoff is projected to increase by approximately 7.5% and 12.3% respectively. In both cases, the amount of industrial water used by each city over time decreases steadily. In the same cities, there is a parallel rise in water usage within the tertiary sector of the economy. The water allocation scenarios for various industries in 2050 have advanced to the level of medium-developed countries, and this water allocation scenario takes into consideration the red line's restrictions on the availability of water resources. The study's findings can help cities in the Minjiang River Basin allocate water resources and ensure their ecological security in the face of climate change. They can also offer some suggestions for the formulation of water resource planning and other documents to the government.

Organic carbon source tracing and the BCP effect in the Yangtze and Yellow rivers: insights from hydrochemistry, carbon isotope, and lipid biomarker analyses

Oral - Abstract ID: 211

Dr. Min Zhao [1], ***Prof. Zaihua Liu*** [2]

1. *Institute of Geochemistry, CAS,* ***2.*** *Institute of Geochemistry,CAS*

Autochthonous organic carbon (AOC) formed by the biological carbon pumping (BCP) effect in surface waters may serve as a significant carbon sink. The locations, magnitudes, variations and mechanisms responsible for the terrestrial missing carbon sink by aquatic photosynthesis, however, are uncertain, especially in large river systems. In this study, hydrochemical characteristics, carbon isotope compositions of dissolved inorganic carbon (DIC) and organic carbon (OC), n-alkane homologues and the C/N ratios of OC along the Yangtze River and the Yellow River were investigated to constrain the organic carbon source and the significance of BCP effect. It was found that (1) the HCO_3^- concentrations in the Yellow River were much higher than those in the Yangtze River, which was controlled mainly by the temperature effect; (2) the AOC in the two large rivers were characterized by lower C/N ratios and lower $\delta^{13}C_{POC}$. By means of an n-alkanes compound calculation, the proportions of AOC were determined to be in the range of 29-88% (46% in average) and 9-68% (32% in average) of total OC in the Yangtze River and the Yellow River, respectively, indicating intense in-river primary productivity. However, low dissolved CO_2 concentration (CO_2(aq)) (6.17μmol/L in average) limited the aquatic photosynthesis in the dry season of the Yangtze River, indicated by lower proportion of AOC; (3) even in the high turbidity riverine system such as Yellow River, the aquatic photosynthetic uptake of DIC or CO_2(aq) could also produce considerable AOC. These findings showed clearly the formation of AOC by the BCP effect in both the clear and high turbidity riverine systems, suggesting a potential direction to find the terrestrial missing carbon sink.

Overview of Agro-Geology Work During the Last 20 Years in Zhejiang Province, China

Oral - Abstract ID: 393

Ms. Yingchun Wei [1], Dr. Chunlei Huang [1], Ms. Hanqin Yin [1], Dr. Mingxing Xu [1], Dr. Yixian Shao [1], Mr. Anqing Gu [1], Mr. Rui Sun [1], Mr. Ruizhe Guan [1], Mr. Wenming Sun [2], Mr. Huanyuan Chen [1], Ms. Yan Zhou [1]

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"Agro-geology" was first proposed by German geologists F.A. Fellow and F.V. Richthofen in the mid-19th century. Until the early 1960s, agro-geology work was gradually began to receive enough attention from various countries. In China, agro-geology started in the 1970s. Since 2002, agro-geology has gradually become the focus of geological work in Zhejiang Province. As yet, it has undergone two historical conversions. Firstly, it is the upgradation of objectives, from regional geochemical survey at the scale of 1:250,000 to special geochemical survey at the scales of 1:50,000 and 1:10,000. About 83,700 km^2, 20,667 km^2 and 667 km^2 of land quality surveys have been achieved, respectively, and the surveys are gradually focused and refined. Overall, more than 260,000 samples and more than 7 million geochemical data, including soil, irrigation water, atmospheric dry and wet fallout, and crops, were obtained. Based on these, environmental background values and geochemical reference values of 54 soil indicators have been developed, land quality geological survey techniques system have been improved. Secondly, it is the conversion from basic geochemical survey to transformation and application of survey achievements, geo-health brought into sharper focus. Gradually, the abnormal distribution, sources, migration and transformation pathways, and changing trends of beneficial and harmful elements in soil have become clearer. More pervasively, the relationship between the characteristic ecological geochemical elements such as selenium, iodine, etc. and human health has also been revealed. Thereby, land quality geochemical monitoring network have followed. In future, from geo-health perspective, the support for developing "One Health" concept in China will be sustainably provided by agro-geology work.

Oxygen nanobubbles for water/sediment pollution remediation and ecological restoration

Oral - Abstract ID: 741

Prof. Gang Pan [1]

1. York St John University

Oxygen plays important roles in environmental and ecological processes. However, it is often difficult to deliver oxygen to the most needed domain for environmental remediation and ecological restoration. Interfacial nanobubbles may provide a promising solution for these purposes. Here, I will introduce a series of studies of using clay interfacial oxygen nanobubble to: 1) remediate hypoxia/anoxia in sediment and its effect in reducing phosphorus, nitrogen pollution from sediment [1, 2]; 2) reduction of arsenic and mercury toxicity in eutrophic waters [3, 4]; 3) reduction of greenhouse gas emission in eutrophic waters [5]; 4) accelerating aquatic ecological restoration [6-8]. These results suggest that oxygen nanobubbles can provide an environmentally friendly method for comprehensive sediment remediation.

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Per- and polyfluoroalkyl substances (PFASs) in surface water of Ningxia in northwestern China: Occurrence, spatiotemporal distribution, source apportionment and potential risk

Oral - Abstract ID: 309

Mr. Dengchao Liu [1]***, Ms. Menglu Wang*** [1]

1. Ningxia University

Per- and polyfluoroalkyl substances (PFASs) are drawing increasing regulatory and public attention due to their ubiquitous detection in global water systems. However, as a remote province in northwestern China, data on PFASs in surface water in Ningxia are lacking. In this study, 96 surface water samples were collected to investigate the occurrence, spatiotemporal distribution, source apportionment and potential risk of 18 PFASs. The concentrations of Σ_{18}PFASs ranged from 3.28 to 92.91 ng·L^{-1} in dry season, and 1.31 to 25.77 ng·L^{-1} in wet season. PFBS, PFOS and PFHxS were the dominant substances in the dry season while PFBS, PFOS, PFBA dominated in the wet season. The highest and lowest concentrations of Σ_{18}PFASs were found in Yinchuan and Guyuan, respectively. Overall, the concentrations of PFASs in surface water in Ningxia are relatively low compared to studies from other regions in China. Principal component analysis (PCA) was used in combination with data of PFOS/PFOA, PFOA/PFNA, and PFHpA/PFOA to infer possible sources of PFASs. Our results indicate that PFASs in the studied region were more affected by point source pollution, while less affected by atmospheric deposition. The discharge of wastewater by textile mill and other fluorine containing manufacturers might be the main source of PFAS contamination. Meanwhile, surface water collected near national highways can be more affected by traffic dust particles. Finally, results of risk assessments suggest a low risk level of PFOA and PFOS caused by the surface water in the studied region, but the long-term cumulative effect cannot be ignored.

Per- and Polyfluoroalkyl Substances in Biosolids versus Beneficial Use of Biosolids in Agriculture

Oral - Abstract ID: 103

Dr. Jim Ippolito [1], ***Dr. Hui Li*** [2], ***Mr. Zhiliang Xu*** [2]

1. The Ohio State University, 2. Michigan State University

Biosolids land application to cropping systems has been the USEPA's preferred method of recycling plant nutrients, improving soil health, and serving as a convenient approach to managing the solids fraction from wastewater resource recovery facilities. However, there currently are some potential cons with respect to biosolids land application: "forever chemical compounds". We utilized soil, corn and wheat grain samples from a long-term research location in Colorado that received biosolids at agronomic rates (based on crop N needs), over a 20+ year period of time, in order to identify potential of per- and polyfluoroalkyl substances (PFAS) accumulation in soil and plants, and to quantify changes in soil and grain nutrient concentrations. With respect to PFAS, we found that many legacy PFAS and their precursors were still present in soil samples, indicating their long persistence in soils. It is of interest to note that no detectable PFAS concentrations were found in corn kernels and wheat grains. With respect to biosolids land application, our research has proven that biosolids improves soil health over inorganic fertilizer application. Equally important, biosolids improves grain nutrition; biosolids land application increases wheat grain Zn above 25 mg/kg, a lower limit considered by HarvestPlus as essential for biofortification for human consumption. Given that over 2 billion people on Earth suffer from micronutrient deficiencies, and Colorado wheat is exported to areas of the globe where wheat is a main staple, biosolids land application can be construed as making a positive impact on human health, while the concern regarding PFAS accumulation in grain appears to be minimal.

Phages in vermicomposts enrich functional gene content and facilitate pesticide degradation in soil

Oral - Abstract ID: 254

Dr. Mingming Sun [1]

1. Nanjing Agricultural University

Organic fertilizer microbiomes play substantial roles in soil ecological functions, including improving soil structure, crop yield, and pollutant dissipation. However, limited information is available about the ecological functions of phages and phage-encoded auxiliary metabolic genes (AMGs) in organic fertilizers. Here we used a combination of metagenomics and phage transplantation trials to investigate the phage profiles and their potential roles in pesticide degradation in four organic fertilizers from different sources. Phage annotation results indicate that the two vermicomposts made from swine (PV) and cattle (CV) dung had more similar phage community structures than the swine (P) and cattle (C) manures. After vermicomposting, the organic fertilizers (PV and CV) exhibited enriched phage-host pairings and phage AMG diversity in relative to the two organic fertilizers (P and C) without composting. In addition, the number of broad-host-range phages in the vermicomposts (182) was higher than that in swine (153) and cattle (103) manures. Notably, phage AMGs associated with metabolism and pesticide biodegradation were detected across the four organic fertilizers. The phage transplantation demonstrated that vermicompost phages were most effective at facilitating the degradation of pesticide precursor *p*-nitrochlorobenzene (*p*-NCB) in soil, as compared to swine and cattle manures ($P < 0.05$). Taken together, our findings highlight the significance of phages in vermicompost for biogeochemical cycling and biodegradation of pesticide-associated chemicals in contaminated soils.

Pollution characteristics of microplastics in southeast coastal areas of China

Oral - Abstract ID: 311

Dr. Yaci Liu [1]

1. Institute of Hydrogeology and Environmental Geology, Chinese Academy of Geological Sciences

Microplastic pollution is widely distributed from surface water to sediments to groundwater vertically and from land to the ocean horizontally. This study collected samples from surface water, groundwater, and sediments from upper to lower reaches and then to the estuary in 16 typical areas in the Jinjiang River Basin, Fujian Province, China. Afterward, it determined the components and abundance of the microplastics and analyzed the possible microplastic sources through principal component analysis (PCA). As a result, seven main components of microplastics were detected, i.e., polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polyformaldehyde (POM), nylon 6 (PA6), and polystyrene (PS). Among them, PE and PP were found to have the highest proportion in the surface water and sediments and in the groundwater, respectively. The surface water, groundwater, and sediments had average microplastic abundance of 1.6 n/L, 2.7 n/L, and 33.8 n/kg, respectively. The microplastics in the sediments had the largest particle size, while those in the groundwater had the smallest particle size. Compared with water bodies and sediments in other areas, those in the study area generally have medium-low-level microplastic abundance. Three pollution sources were determined according to PCA, i.e., the dominant agriculture-forestry-fishery source, domestic wastewater, and industrial production. This study can provide a scientific basis for the control of microplastics in rivers.

Polycyclic Aromatic Hydrocarbon Residues in Human Milk, Placenta, and Umbilical Cord Blood in Beijing, China

Oral - Abstract ID: 282

Ms. Yixi Tan [1]***, Dr. Yanxin Yu*** [1]

1. *Beijing Normal University*

This paper provides the results of an investigation on dietary intakes and internal doses of polycyclic aromatic hydrocarbons (PAHs) for nonsmoking women from Beijing, China. Concentrations of PAHs were measured by gas chromatography/mass spectrometry (GC/MS) for human milk, placenta, and umbilical cord blood samples from 40 nonsmoking women and for 144 composite food samples covering major food categories. Information on food consumption and estimated ingestion doses of PAHs by the cohort was also collected individually. Relationship among the studied human samples and relative importance of breastfeeding to the total exposure dose of infants were addressed. The median (mean and standard deviation) total concentrations of 15 PAHs in human milk, placenta, and umbilical cord blood with (or without) fat normalization were 278 (9.30 ± 5.75), 819 (35.9 ± 15.4), and 1370 (5.521 ± 3.71) ng/g of fat, respectively, and the corresponding levels of benzo[*a*]pyrene equivalent (B[*a*]P_{equiv}) were 11.2 (0.473 ± 0.605), 16.2 (0.717 ± 0.318), and 13.1 (0.140 ± 0.225) ng/g of fat, respectively. The calculated intake of B[*a*]P_{equiv} by Beijing cohort varied from 0.609 to 4.69 $ng{\cdot}kg^{-1}{\cdot}day^{-1}$ with a median value of 1.93 (2.09 ± 0.921 mean ± standard deviation) $ng{\cdot}kg^{-1}{\cdot}day^{-1}$. Significant correlations were found among human milk, placenta, and umbilical cord blood ($p < 0.05$) for low-molecular-weight PAHs, indicating selective transfer potential of individual PAHs from mother to fetus. Internal dose of PAHs was not in proportion to amounts of food ingestion, daily dietary intake, lifestyle, and social-demographic characteristics of the participants ($p > 0.05$). Ingested doses of PAHs (3.00–102 $ng{\cdot}kg^{-1}{\cdot}day^{-1}$), which were much higher than the inhaled doses (0.152–8.50 $ng{\cdot}kg^{-1}{\cdot}day^{-1}$), were 3–4 orders of magnitude lower than the recommended reference doses, unlikely to impose any obvious risk based on current knowledge.

Polycyclic aromatic hydrocarbons (PAHs) pollution and risk assessment of soils at contaminated sites in China over the past two decades

Oral - Abstract ID: 556

Dr. Qi You [1]

1. *Zhejiang University*

With China's rapid urbanization, soil pollution at contaminated sites has emerged as a significant concern in the country's environmental protection plan. Although extensive research has been conducted on other major contaminants, systematic analysis of polycyclic aromatic hydrocarbons (PAHs) pollution in contaminated soils has been lacking over the past two decades. This study screened relevant literature from the past 20 years using a "front page filtering" approach, and comprehensively evaluated the soil PAHs pollution in these locations by source apportionment, pollution level, ecological risk, and health risk assessment methods, in order to fill these gaps. The results showed: (1) The majority of the contaminated sites in China were petrochemical plants, steel mills, and coking plants; (2) Coal/biomass burning was the predominant contributor to PAHs pollution in the soils at the contaminated sites throughout China; (3) Overall, the level of PAHs contamination was relatively low, with individual contamination levels ranked as BaP > BbF > InP > BaA/Phe > DbA > BghiP > BkF/Flu/Nap > Fl > Pyr/Ant > Chr/Acp > Any; (4) Geographically, Northern and Eastern China exhibited relatively higher pollution levels and ecological risks; (5) PAHs pollution in soil of contaminated sites in China had more pronounced toxic effects on the respiratory tract, carcinogenicity, aromatic hydrocarbon receptors, estrogen receptors, and antioxidant response elements; (6) Children and youths were facing higher health risks compared with adults.

Portable sensors equipped with smartphones for organophosphorus pesticides detection

Oral - Abstract ID: 129

Mr. Jiaqi Xue [1]

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Organophosphorus pesticides (OPs) play an important role in agricultural production and the accurate detection of OP residues is essential to ensure food safety. Portable sensors are expected to be a potential device due to their high detection efficiency, easy-to-use processes and low cost. Due to the widespread popularity and powerful capabilities of smartphones, smartphone-based sensing systems have rapidly developed into ideal tools for portable detection, however, a systematic review on the detection of OPs is still lacking. Therefore, a comprehensive overview of sensors equipped with smartphones for OP detection in recent year is provided; this overview includes their sensing signals (colorimetric, fluorescent, chemiluminescent and electrochemical signals), detection mechanism, analysis applications, advantages/disadvantages and perspectives. Moreover, the progress of sensors equipped with smartphones for the detection of OPs in food is thoroughly summarized. This review contributes to food safety and the development of efficient and reliable methods for smartphone-based OPs detection.

Potential auxiliary metabolic functions and biogeochemical impacts of viruses in arsenic-contaminated paddy soils

Oral - Abstract ID: 535

Mr. Ruichuan Gao [1], ***Prof. Liping Fang*** [2], ***Prof. Fangbai Li*** [1]

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Viruses are an essential part of microorganisms in both terrestrial and marine environments. They modulate the ecology of most cellular microorganisms through lytic infection and lysogenic conversion. During lytic infection, viruses target and lysis dominant microbial populations to reduce the densities of the host population, and therefore release host-derived carbon and nutrition to the ecosystem. While in lysogenic conversion, viruses reprogram microbial metabolism through auxiliary metabolic genes (AMGs) and mediate horizon gene transfer across hosts. Due to the great potential biogeochemical impacts of viruses, numerous studies seek to understand the role of viruses in the biosphere.

However, as one of the typical habitats with high microbial richness in the world, the complexity and diversity of microorganisms in paddy soil have hindered the understanding of viruses in this ecosystem. Therefore, we used both viromes(viral DNA) and metagenomes(eDNA) techniques to explore the diversity and potential ecosystem impacts of viruses from 37 arsenic-contaminated paddy soils collected across Southern China. Combining these data, 48521 viral operational taxonomic units (vOTUs) were identified in this work. 15.24% of the viral contigs were lysogenic, and the rest of them were identified as lytic. Only 901 of the viruses were successfully annotated to the family level, with approximately 98% of viruses were novel compared to existing datasets. The recovered vOTUs encoded thousands of putative AMGs that may impact various biogeochemical cycles, including carbon, nitrogen, sulfur, phosphorus cycling, and arsenic detoxification. In short, we discovered 90 putative AMGs related to nitrate reduction, denitrification, nitrification, and nitrogen fixation, 139 putative AMGs related to central methanogenic pathway, 645 putative AMGs related to arsenic methylation, arsenic resistance, and arsenic transportation. These findings expand the scope of viral roles, and suggest virus may mediate critical elemental cycling processes in paddy soils.

Predicting breakthrough of toxic oxoanions in fixed-bed absorbent columns with complex groundwater solute chemistries

Oral - Abstract ID: 207

Prof. Michael Kersten [1]

1. *Johannes Gutenberg-University Mainz*

Geogenic but toxic oxoanions in groundwater are a worldwide health issue. Granular ferric hydroxide (GFH) is often used for fixed bed adsorbent (FBA) columns in groundwater purification units to remove such contaminations in waterworks. Groundwater can contain not only multiple toxic but also non-toxic oxo-anions (e.g., phosphate and silicic acid) that are known to affect FBA lifetimes. Therefore, understanding competing behavior of that multi-solute mixtures is important to predict accurately breakthrough curves (BTCs) for FBAs in waterworks to plan future operating costs. Rapid small-scale column tests were used to simulate BTCs for complex groundwater chemistries. The BTCs were simulated successfully using a homogeneous surface diffusion model (HSDM) combining equilibrium chemical adsorption and kinetic mass transfer using the software code FAST (www.fast-software.de). Adsorption parameters for various groundwater compositions were predicted using a CD-MUSIC surface complexation model. The results indicated that V(V) is least prone to competitive adsorption effects, and use of the HSDM to predict the BTCs requires then the kinetic mass transfer Biot number to be used as the only fitting parameter. On the other hand, a concentration overshoot could be observed for the two weaker absorbed oxo-anions arsenate and phosphate because of displacement by the vanadate. The model output could recently successfully be verified using pilot-scale FBAs at waterworks. Results of pilot scale test column BTCs of vanadate for three waterworks with different groundwater compositions could be favorably extrapolated with a unique Freundlich constant kF of 3.2 calculated on basis of the multi-solute CD-MUSIC model, and a unique Biot number of 37 fixed for all three different test sites.

Reference:

Dabizha A., Bahr C., Kersten M. (2020): Predicting breakthrough of vanadium in fixed-bed absorbent columns with complex groundwater chemistries: A multi-component granular ferric hydroxide-vanadate-arsenate-phosphate-silicic acid system. Water Research X 9, 100061.

Predicting soil cadmium pollution and identifying critical driving factors in a mining area using machine learning

Oral - Abstract ID: 135

Dr. Cheng Li [1]***, Prof. Zhongfang Yang*** [2]***, Ms. Yang Yeyu*** [1]***, Prof. Zhongcheng Jiang*** [1]

1. *Institute of Karst Geology, Chinese Academy of Geological Sciences,* ***2.*** *China University of Geosciences, Beijing*

Mining activities have resulted in a substantial accumulation of cadmium (Cd) in agricultural soils, particularly in southern China. Rapid identification of the extent of soil Cd pollution and its driving factors is essential for soil management and risk assessment. However, traditional geostatistical methods cannot easily simulate the complex nonlinear relationships between soil Cd and potential features. In this study, sequential extraction and hotspot analyses indicated that Cd accumulation increased significantly near mining sites and exhibited high mobility. The concentration of Cd was estimated using three machine learning models based on 3169 topsoil samples and 10 environmental variables. The random forest model achieved marginally better performance than the other models, with an R^2 of 0.78. Importance analysis revealed that soil pH and Ca and Mn contents were the most significant factors affecting Cd accumulation and migration. Conversely, soil type, terrain, and soil parent materials had little impact on the spatial distribution of soil Cd under the influence of mining activities. Our results provide a better understanding of the geochemical behavior of soil Cd in mining areas, which could be helpful for environmental management departments in controlling the diffusion of Cd pollution and capturing key targets for soil remediation.

Preliminary Exploration of GeoHealth Survey in the High Geological Background Area of the Black Shale Series in Northwestern Zhejiang

Oral - Abstract ID: 185

Prof. Qifeng Tang [1]***, Prof. Jiuchen Liu*** [1]***, Dr. Nan Gai*** [2]***, Prof. Guohui Lu*** [1]

1. National Research Center for GeoAnalysis, 2. National Research Center for Geo-analysis

This study conducts an initial exploration of GeoHealth survey in the high geological background area of the black shale series in northwestern Zhejiang, aiming to comprehend the geological factors influencing human health in this region. The research encompasses the investigation of significant geological issues affecting health, examination of harmful geological conditions, and exploration of beneficial geological conditions for health. The authors clarify the geochemical behaviors of key elements associated with life and health in the black shale series and scrutinize their health effects.

The population exhibits elevated levels of selenium and zinc in hair, while cadmium and nickel levels are comparatively lower. Despite high urinary cadmium (U-Cd) levels in the population, there are low levels of urinary creatinine (U-Cr) and N-acetyl-β-D-glucosaminidase (U-NAG). This suggests that the population experiences higher cadmium exposure and faster cadmium metabolism, yet shows no apparent kidney damage, indicating a significant selenium-cadmium antagonism effect.

These findings underscore the population's ability to counteract cadmium toxicity with elevated selenium levels, revealing a protective mechanism against potential health impacts associated with cadmium exposure. This study contributes to the development of technical methods for GeoHealth investigation and evaluation. It establishes technical approaches for the investigation and evaluation of rural GeoHealth, providing a model for the GeoHealth survey in areas with a high background of selenium and cadmium in the black shale series in the southern part of China.

The study explores the economic transformation of high-quality GeoHealth resources in rural areas and integrates the construction model of characteristic GeoHealth villages. A brand for GeoHealth Villages is established, offering a geological pathway for the transformation from "green mountains and clear waters" to "gold and silver mountains" to align with national strategies such as "Healthy China" "Rural Revitalization" and "Common Prosperity".

Preliminary Study on Geo-Health Survey –from Principle, Methodology to Application

Oral - Abstract ID: 334

Prof. Dawen Liu [1], ***Prof. Siwen LIU*** [1], ***Prof. Qifeng Tang*** [1], ***Prof. Taotao Yan*** [1], ***Prof. Hangxin Cheng*** [2], ***Prof. Qinghua Chi*** [2]

1. *National Research Center for GeoAnalysis,* ***2.*** *Institute of Geophysical and Geochemical Exploration, China Geological Survey*

Firstly, the paper discusses the concept of Geo-Health and the connotation and extension of Geo-Health Survey, and formulates 3 levels technique research framework, reveals the mechanism of the influence of life elements on the human health. Secondly, the key geological indicators, methodology and the technical routine map of the Geo-Health Survey was preliminarily determined, the national level of geochemical data of stream sediment and underground water, human health distribution data, and upper crustal abundance of Eastern of China were collected and managed by GIS system, also, over 40 life elements baseline and threshold value in soil were preliminarily determinated. Finaly, case study was carried out in Guangxi, China and Cambodia.

Priming effects of vermiculite modified rice straw biochar on soil organic carbon: A new perspective of soil bacteria

Oral - Abstract ID: 937

Dr. Yuxue Liu [1]

1. Zhejiang Academy of Agricultural Sciences

Farmland is the largest carbon pool in terrestrial ecosystem. Carbon sequestration in farmland is an important pathway to alleviate global warming. Biochar has been considered an excellent material for soil carbon sequestration because of its high stability. How exogenous minerals and carbonization temperature regulate the priming effects (PEs) of biochar on soil organic carbon has rarely been studied, relative microbial mechanisms especially the roles of soil bacteria are far from known. Therefore, series of biochar were prepared by pyrolysis using 13C isotope labelled rice straw at temperatures of 300, 500, and 700°C with vermiculite modification (VBC300, VBC500, VBC700) and without modification (BC300, BC500, BC700). Incubation experiments were conducted to investigate the PEs of different biochar on the native organic carbon of two types of soil. Results showed that BC300, VBC300, and BC500 induced positive PE, VBC500, BC700, and VBC700 mainly induced negative PE in red soil. Whereas all biochar showed negative PE in paddy soil, with PE intensity order of 500°C>700°C>300°C. Biochar promoted the interaction among soil bacterial communities, causing a shift in the bacterial phyla from copiotrophic to oligotrophic bacteria in red soil, whereas from the coexistence of copiotrophic and oligotrophic to copiotrophic in paddy soil over time. The promotion effect of biochar on bacterial community interaction in paddy soil was less than that in red soil, which led to stronger negative PE. The correlation coefficient between PE and bacteria networks' edge number was 0.626 and 0.909 in red soil and paddy soil, respectively. Vermiculite modification weakened the promotion effect of biochar on bacterial community interaction and thus was benefit for carbon sequestration, especially in red soil. VBC700 had excellent carbon sequestration potential in red soil, whereas that was VBC500 in paddy soil.

Probing thallium transformation behavior from soil to paddy system

Oral - Abstract ID: 335

Prof. Juan Liu [1]***, Ms. Wenhuan Yuan*** [1]***, Ms. Qi'en Ouyang*** [1]

1. *Guangzhou University*

Thallium (Tl) is an uncommon trace metal with extreme toxicity that surpasses that of mercury, cadmium, lead, arsenic. The average lethal dose of Tl is only approximately 10 mg/kg. It occurs naturally in two valence states: Tl(I) and Tl(III). The ionic radius of Tl+ closely resembles that of potassium (K+), facilitating its non-discriminatory uptake of K during metabolism of organisms. Unintentional Tl consumption via food chain is one of the main route of Tl poisoning. This study investigates Tl migration, transformation, absorption and enrichment pattern from soil to paddy system. The results showed that Tl is mainly resided in the iron plaque of paddy root and the rhizosphere soil-root exhibits a negative direction of Tl isotopic fractionation. The enrichment of heavy Tl isotopes in rhizosphere may be attributed to the process of mineral adsorption and precipitation of Tl by iron and/or manganese oxides present in the rhizosphere soil. During rice growth, the kinetic process controls the isotopic fractionation of Tl, wherein Tl is continuously absorbed and precipitated by the root system in the roots. The lighter Tl isotopes will accumulate in the reaction products due to that the roots selectively absorb and enrich Tl(I).

Quantifying the Disease Burden Attributable to Arsenic in Groundwater Globally

Oral - Abstract ID: 248

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Arsenic is a naturally-occurring element in groundwater that is linked to numerous adverse health outcomes. However, we do not yet know how many deaths globally are attributed to arsenic. Current estimates of mortality from unsafe drinking water, compiled by the United Nations for Sustainable Development Goal (SDG) Indicator 3.9.2, do not account for arsenic contamination. We present an effort to produce globally consistent, national-scale estimates of mortality attributable to arsenic in groundwater.

We train a geospatial machine-learning model (XGBoost) to predict the probability of elevated arsenic at six threshold concentrations from 10 to 250 μg/L, using newly-compiled arsenic measurements from 725,000 wells and springs in 133 countries. We multiply the machine-learning predictions by the percent untreated groundwater used for drinking water and by population density and then combine them with global health data and dose-response relationships to estimate the burden of disease attributable to arsenic. We validate our results against representative surveys of household drinking water quality.

We predict that about 100,000 annual deaths may be attributable to arsenic, and suggest current estimates of mortality from drinking unsafe water (Indicator 3.9.2) are under-predicted by 10% because they do not include arsenic. Most of the arsenic-attributed deaths occur in Asian countries, but many others also have high per-capita rates of arsenic-attributed mortality. The results highlight the need for improved monitoring and mitigation efforts.

Rachel Carson’s “Silent Spring” as Environmental Education Promoter: Analysis through the Letter of Thomas Merton, an Alert Reader

Oral - Abstract ID: 441

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Thomas Merton (1915 – 1968), the well-known US American Trappist monk, writer and social critic, addressed a letter to Rachel Carson in January 1963, after having read her book “Silent Spring”, first published in 1962. As an alert reader not educated in the Natural Sciences, his letter, quasi a book review, can serve as a good example of the awareness of the environmental issues raised by R. Carson. In his letter to the authoress, we can recognize most of the elements later outlined as constitutive of Environmental Education, a discipline emerging in 1977 at Tiflis, URSS, from a joint conference of UNESCO and UNEP. The five components of Environmental Education are generally considered to be awareness, knowledge, atitudes, skills and capacity for action. In this presentation the focus is posed on Merton´s observations and reflections regarding the environmental risk in relation to the use of pesticides in particular and the general attitudes of the modern technological society.

Keywords: Environmental Education, Silent Spring, promoter

Rapid identification of active antibiotic resistant bacteria and their gene transfer using high-throughput BONCAT-FACs technology

Oral - Abstract ID: 545

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Active antibiotic resistant bacteria (ARB) in the environment play a major role in spreading the antimicrobial resistance (AMR) but remain largely unexplored. Here, we developed a high-throughput single-cell approach integrating bio-orthogonal noncanonical amino acid tagging, fluorescent-activated single-cell sorting (FACs), and sequencing to reveal both the phenome and genome of active ARB in complex environmental matrices. Active ARB against six types of antibiotics throughout the wastewater treatment process were distinguished and quantified. The percentages and concentrations of active ARB ranged from 0.28% to 45.3% and 1.1×10^4 to 2.09×10^8 cells/mL, respectively. Importantly, the final effluents still contained up to 4.79×10^4 cells/mL of active ARB. Subsequent targeted FACs and genomic sequencing revealed the distinct taxonomic composition of active ARB compared to the overall population. Frequent coexistence of antibiotic resistome and mobilome in active ARB was also identified, including four metagenomic assembly genomes assigned to pathogenic bacteria, thus highlighting the significant health risks posed by their activity, phenotypic resistance, mobility and pathogenicity in the environments. Furthermore, this labeling method was employed to study the gene transfer of environmental plasmids to competent cells. Compared to the traditional plate spread method, this novel technology enabled more rapid detection (within 2–8 h) of the transformation process and tracking of its persistence. Our work advances understanding of previously unaccounted high-risk active ARB in the environments by linking resistance phenotype to genotype. Its high throughput capability will facilitate rapid and quantitative surveillance of active AMR, providing valuable insights for risk control and management.

Rapid in-situ identification of arsenic species using a portable Fe3O4@SiO2@UiO-66@Ag SERS substrate

Oral - Abstract ID: 740

Dr. jingjing du [1]

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The escalating severity of arsenic (As) contamination has caused great harm to human health, which puts forward higher requirements for trace detection of As. The toxicity and mobility of As depend on its oxidation state, where arsenite (As(III)) is 50-100 times more toxic than arsenate (As(V)). The presence of As has been well documented in multiple environmental matrices including groundwater, soil and sediment, and foods. As speciation analysis is usually achieved by separation using high performance liquid chromatography combined with mass spectrometry or atomic absorption/fluorescence spectrometry. These techniques require samples to be collected and transported to the laboratory, which may induce As(III) oxidation, and thus lead to biased conclusions on its toxicity. Surface-enhanced Raman scattering (SERS), with its high sensitivity and unique fingerprint properties, has been used for the analysis of arsenic. However, the weak affinity of Ag for arsenic remains a challenge in the development of spherical Ag-based SERS substrates. In this study, the novel metal–organic framework material UiO-66 has been subjected to modification on a magnetic SERS substrate to form Fe_3O_4@SiO_2@UiO-66@Ag (FUAg). The UiO-66 framework effectively adsorbed arsenic, thereby facilitating convenient access to the hot spots within the interstices of the Ag nanoparticles. Quality SERS spectra can be obtained with As concentrations as low as 10 μg L^{-1}, which is comparable with the As drinking water standard. Using a portable Raman spectrometer, the SERS platform can simultaneously identify As(III) and As(V) in natural water, sludge, juice, and wine. The proposed FUAg substrate offers a novel route for monitoring and detecting arsenic contamination, and a new approach for achieving rapid on-site detection.

Reactive nitrogen emissions and their impacts on regional PM2.5 air quality

Oral - Abstract ID: 585

Prof. Lin Zhang [1], *Dr. Yixin Guo* [1], *Dr. Zehui Liu* [1]

1. *Peking University*

Reactive nitrogen emissions (Nr; including nitrogen oxides, NO_x, and ammonia, NH_3) are important precursors of airborne $PM_{2.5}$ that adversely affect human health. Understanding their contributions to $PM_{2.5}$ is crucial for synergistic policies on climate and air pollution mitigation. Here we use chemical transport models to quantify the contribution of Nr compounds to total $PM_{2.5}$ concentration. We show that nitrogen accounted for 39% of global $PM_{2.5}$ exposure in 2013, increasing from 30% in 1990 with rising reactive nitrogen emissions and successful controls on sulfur dioxide. Controlling NH_3 tends to be more effective than NO_x for deep emission controls, however, with low-ambitious emission reductions, controlling NO_x emissions would still be more effective in many populated regions where NH_3 was saturated for secondary inorganic aerosol formation. Improving agricultural nitrogen management through strategies, such as reduced nitrogen fertilizer use and improved manure management, would reduce agriculture NH_3 emissions by 23%-39% in China. We also identify optimal Nr control pathways for Europe by integrating emission estimations, air quality modeling, exposure-mortality modeling, Nr control experiments and cost data. When costs are considered, strategies for both western and eastern Europe shift in favor of NH_3 controls, as NH_3 controls up to 50% remain 5-11 times more cost-effective than NO_x per unit $PM_{2.5}$ reduction there.

Red Mud-Based Catalysts for Efficient Removal of Organic Pollutants in Wastewater

Oral - Abstract ID: 955

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Red mud (RM) is a byproduct of alumina extraction from bauxite. According to statistics, for every ton of alumina produced, 1 to tons of red mud are generated. Due to its radioactive and alkaline properties, the extensive storage of this waste in fields causes severe pollution problems to the surrounding soil, air, and groundwater. This poses an ongoing threat to human health and the sustainable development of the ecological environment. Therefore, it is imperative to find reliable, efficient, and environmentally friendly methods for the large-scale disposal of red mud. We utilized the inherent iron components in red mud to prepare catalysts for Fenton/Fenton-like reactions to degrade organic pollutants in water. The successful establishment of these reaction systems provides a feasible approach for the comprehensive utilization of red mud and the effective removal of organic pollutants from wastewater, thereby contributing to solving environmental and sustainability issues.

Regulation of Hydrologic Connectivity on Lacustrine Groundwater Discharge to Determine Nutrient State of Lakes

Oral - Abstract ID: 325

Prof. Yao Du [1]

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Lacustrine groundwater discharge (LGD) represents a crucial but often underestimated mechanism contributing to the hydrological and nutrient dynamics of lakes. Although existing studies have primarily focused on LGD and associated nutrient fluxes in individual lakes within natural environments, the influence of anthropogenic changes in hydrological conditions on the LGD and associated nutrient fluxes among a group of lakes remains unknown. In this study, we specifically targeted four oxbow lakes situated in comparable regional climatic, geomorphological, and geological contexts, albeit exhibiting different degrees of hydrologic connectivity to the Yangtze River (YR). By employing a 222Rn mass balance model coupled with hydrological, hydrochemical, and nutrient data, we aimed to elucidate the impact of hydrologic connectivity on LGD, associated nutrient fluxes, and subsequent nutrient state within the lakes. The results indicated that with a direct channel connection to the YR, the oxbow lakes exhibited higher rates of LGD and associated nutrient fluxes than those disconnected from the YR by a sluice. This suggested that enhanced hydrologic connectivity was consistent with a higher LGD and associated nutrient flux during the dry season. Notably, oxbow lakes with improved hydrologic connectivity demonstrated more pronounced fluctuations in water level between the wet and dry seasons, resulting in increased LGD. This phenomenon can be attributed to greater groundwater storage replenishment from lake water recharge during the wet season and larger hydraulic gradient between groundwater and lake water due to lake water outflow during the dry season. As a result, the higher LGD-associated nutrient fluxes contributed to a higher nutrient state within the lake. Different from previous studies, this study for the first time revealed the regulatory role of hydrologic connectivity on the nutrient state of lakes through groundwater discharge. This study offered new perspectives for improving our comprehension of the nutrient states in lakes reliant on groundwater sources.

Release of perfluoroalkyl substances from point sources with attempt to identify new analogues

Oral - Abstract ID: 975

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The main sources of PFAS in the environment are from typical point source release, including industrial facilities and wastewater treatment plants (WWTPs). To elucidate the multimedia distribution and transfer patterns of PFASs from a point source, 25 neutral and ionizable PFASs were analyzed in 94 multimedia samples including air, rain, outdoor settled dust, soil, plant leaves, river water, surface sediment, and shallow groundwater from two fluorochemical manufacturing parks (FMPs) in Fuxin, China. The concentrations of individual PFASs in air, outdoor settled dust, and surface river water decreased exponentially as the distance increases from FMPs, whereas the concentrations of short-chain (C_2–C_4) perfluoroalkyl carboxylic acids (PFCAs) remained high (3000 ng/L) in the surface water 38 km away. Both C_2 and long-chain ($>C_6$) PFCAs have greater sediment-water distribution coefficients and deposit dust-air coefficients, which have great influences on the long-range transport potential of different analogues. Currently, over 15,000 PFAS have been compiled in the database. Solely monitoring legacy PFAS by target analysis will result in a serious underestimation of the PFAS environmental risks. Consequently, the suspect and nontarget screening (NTS) based on GC or LC-HRMS were performed on atmosphere, wastewater, and sludge samples collected from two WWTPs in Tianjin to discover emerging PFAS and their fate. A total of 40 PFAS and 64 PFAS were identified in the atmosphere and wastewater/sludge, respectively, among which 5 short-chain perfluoroalkyl sulfonamide derivatives, 4 ionic PFAS, and 15 aqueous film-forming foam-related cationic or zwitterionic PFAS have rarely or never been reported in WWTPs in China. Comparing the applicability of the two air sampling methods for NTS, active air sampling is more conducive to the enrichment of emerging PFAS. Although most emerging PFAS could not be eliminated efficiently in conventional treatment units, deep bed filtration and advanced oxidation processes could partly remove some emerging precursors.

Remediating petroleum hydrocarbons in highly saline–alkali soils using three native plant species

Oral - Abstract ID: 70

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Phytoremediation of total petroleum hydrocarbons (TPHs) contamination is a process that uses the synergistic action of plants and rhizosphere microorganisms to degrade, absorb and stabilize pollutants in the soil, and has received increasing attention in recent years. However, this technology still has some challenges under certain conditions (e.g., highly alkaline and saline environments). The present study was selected three native plant species (alfalfa, tall fescue, and ryegrass) to remediate petroleum pollutants in greenhouse pot experiments. The results indicate that TPH contamination not only inhibited plant growth, soil chemical properties and soil fertility (i.e. lower plant biomass, chlorophyll, pH, and electrical conductivity), but also increased the malondialdehyde, glutathione, and antioxidant enzyme activities (catalase and polyphenol oxidase). Further, correlation analysis results illustrated that TPH removal was strongly positively correlated with chlorophyll, soil fertility, and total organic carbon, but was negatively correlated with dehydrogenase, polyphenol oxidase, pH, and electrical conductivity. The highest TPHs removal rate (74.13%) was exhibited by alfalfa, followed by tall fescue (61.79%) and ryegrass (57.28%). The degradation rates of short-chain alkanes and low rings polycyclic aromatic hydrocarbons (PAHs) were substantially higher than those of long-chain alkanes and high rings PAHs. The findings of this study provide valuable insights into petroleum decontamination strategies in the highly saline - alkali environments.

Research of high iodine in deep groundwater in the Zhangwei watershed, North China Plain

Oral - Abstract ID: 362

Prof. YUANJING ZHANG [1]

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Iodine is critical for biological systems, too much or too little iodine intake will lead to a higher possibility of disease. Particularly, in Zhangwei watershed of North China Plain, groundwater is the main drinking water source and its quality is closely related to public health. To address these issues, 194 deep groundwater samples were collected from the Zhangwei watershed to analyze their constituents including iodine. Statistics, principal component analysis and hydrological methods were employed to determine the distribution of iodine concentrations and their controlling hydrogeochemical processes. The results showed that the iodine concentration range from 2 to 446 μg/L and generally increased along the groundwater flow direction. Three zones with high iodine concentration (> 20 μg/L) were delineated as the alluvial–proluvial plain (Zone I, average 70 μg/L), alluvial–lake plain (Zone II, average 83 μg/L) and coastal plain (Zone III, average 199 μg/L), respectively. The dissolution of iodine-containing minerals in Taihang Mountain, the biodegradation of organic matter in the central lacustrine sediments and the release of iodine-containing substances in the eastern Marine sediments due to the Quaternary transgression are the main mechanisms for the formation of iodine in the deep groundwater of the three regions. Major mineral solubility index and solubility CO_2, pH Phreeqc calculation results further indicated that leaching is the control factor for the groundwater chemical types in Zone I and II, for Zone III the iodine is controlled by historical transgression, the reverse cation exchange adsorption occurred. In one word, the iodine sources and hydrogeological conditions determined the high iodine concentrations of deep groundwater in the studied watershed. These findings can provide foundation for further insight into the high iodine concentration of deep groundwater in other hydrogeological units of the North China Plain and other similar units over the world, thereby ensuring drinking groundwater safety.

Response of nitrifiers to aquatic acidification in estuarine and coastal waters

Oral - Abstract ID: 941

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In the context of an increasing atmospheric carbon dioxide (CO_2) level, acidification of estuarine and coastal waters is greatly exacerbated by land-derived nutrient inputs, coastal upwelling, and complex biogeochemical processes. A deeper understanding of how nitrifiers respond to intensifying acidification is thus crucial to predict the response of estuarine and coastal ecosystems and their contribution to global climate change. Here, we show that acidification can significantly decrease nitrification rate but stimulate generation of byproduct nitrous oxide (N_2O) in estuarine and coastal waters. By varying CO_2 concentration and pH independently, an expected beneficial effect of elevated CO_2 on activity of nitrifiers ("CO_2-fertilization" effect) is excluded under acidification. Metatranscriptome data further demonstrate that nitrifiers could significantly up-regulate gene expressions associated with intracellular pH homeostasis to cope with acidification stress. This study highlights the molecular underpinnings of acidification effects on nitrification and associated greenhouse gas N_2O emission, and helps predict the response and evolution of estuarine and coastal ecosystems under climate change and human activities.

Revisiting the impact of sea surface temperature on sea spray aerosol production

Oral - Abstract ID: 232

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Sea spray aerosol (SSA) plays an important, yet uncertain, role in the global climate system. The sensitivity of SSA emission to sea surface temperature is not well understood, making it difficult to accurately assess the role of SSA in a warming climate. There is a lack of field observations to develop parameterisation or constrain the models, particularly in the sub-micron size ranges that influence cloud formation. In this study, we use long-term *in-situ* measurement to investigate the impact of sea surface temperature on SSA production over the pristine Northeast Atlantic. Our results show that wind speed is the primary driving force for SSA production. While sea surface temperature increases the SSA volume , it leads to a decrease of SSA number. This finding helps explains the contrast between laboratory experiments and field observations of SSA production. A better appreciation of SSA production in a warmer climate is essential for reducing uncertainties in model projections.

Revisiting the Stress Gradient Hypothesis: insights from compartmental bacterial interactions in mycorrhizosphere

Oral - Abstract ID: 37

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Whether one can predict bacteria-bacteria (B-B) interaction (i.e., competition or facilitation), governed by stress and resource, is a central question of microbial ecology. The stress gradient hypothesis (SGH) provides a framework for prediction. However, applicability of the SGH in plant-fungal symbiosis remains uncertain. Here, we established rice-arbuscular mycorrhizal (AM) fungal symbiosis in cadmium (Cd) stress, analyzed bacterial profiles in six compartments (endosphere, rhizoplane, rhizosphere, hyphosphere, hyphae, and bulk soil), and examined rhizosphere and hyphosphere metabolome profiles. We observed obvious compartmental and Cd-stress effects on bacterial communities, with hyphosphere exhibiting the most potent effect. AM fungus stabilized hyphosphere bacterial community, promoted competitive B-B associations, and increased relative abundances of bacterial families (e.g. *Lactobacillaceae*, *Moraxellaceae*, *Xanthobacteraceae*, *Flavopacteriaceae*, and *Burkholderiaceae*) which was decreased by Cd stress. Compared to the treatment without Cd amendment, bacterial connection in hyphosphere was also drastically decreased in the treatments with Cd amendment. The mycorrhizosphere B-B interaction revealed in this study differed from traditional SGH stress-resource relation, which might be attributed to the stress-induced substances. Our findings call for a reevaluation of the SGH within mycorrhizosphere, emphasizing significance of stress-induced exudate modifications and their role as bacterial resources.

Risk Assessment of Biochar Remediation of Pb Contaminated Water - A Whole-cell Bioreporter based Technique

Oral - Abstract ID: 878

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Lead (Pb) pollution has become one of the most serious and widespread problems of heavy metal pollution in aquatic environment. In recent years, the use of biochar to remediate Pb pollution in aquatic system has increasingly become more attractive. However, it is still unknown whether Pb adsorbed by biochar still poses an environmental risk. It has been demonstrated that the detection of Pb bioavailability by whole-cell bioreporters will directly reflect its environmental risks. In this study, we investigated the adsorption capacity of biochar prepared by two different materials (peach wood and corn straw) at three different temperatures (300, 500, 700 ºC) for Pb in water. Whole-cell bioreporters were used to evaluate the bioavailability of Pb adsorbed by biochar. The results showed that the adsorption capacity of corn straw biochar on Pb was higher than that of peach wood biochar. 500 ºC corn straw biochar displayed the strongest adsorption capacity on Pb, which was 37.9 times higher than that of 300 ºC peach wood biochar. Partial Pb adsorbed by biochar is still bioavailable, which is closely related to the mechanism of Pb adsorption by biochar. It is interesting to note that the bioavailability of Pb adsorbed by peach wood biochar was higher than that of corn straw biochar. This is mainly due to the fact that the adsorption of Pb by peach wood biochar was mainly based on physical adsorption, which enables the adsorbed Pb on its surface to be directly recognized by whole-cell bioreporter. However, the adsorption of Pb by corn straw biochar was dominated by complexation, which caused more Pb to change its chemical speciation thus reducing its bioavailability. This study will provide theoretical basis and guidance on how to screen high-quality biochar during the remediation of Pb polluted water so as to reduce the environmental risk after remediation.

Riverine nutrient fluxes and environmental effects on China's estuaries

Oral - Abstract ID: 204

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Estuaries are a key area of the land-ocean interaction zone with important ecosystem services. However, estuaries had received more and more nutrients from watersheds and other sources, leading to a significant increase in eutrophication potential. An increase in riverine nutrient fluxes significantly influences the estuarine ecosystem. This study collected nutrient data in most of China's rivers from 1963 to 2015 to estimate the nutrient fluxes from major rivers and analyze interannual variability of nutrient fluxes and estuarine environmental effects. The Index of Coastal Eutrophication Potential (ICEP) was used to quantify the impacts of riverine inputs in the Jiulong River Estuary. The results showed that the nutrient fluxes from the Yangtze River increased annually from 1963 to 2012. The trend of nutrient fluxes from the Yellow River was consistent with that from the Jiulong River. The areal nutrient fluxes from China's major rivers were higher, while the areal nutrient yield rates per capita were lower than those from major world rivers. China's estuaries were predominantly phosphorus-limited and slowly moving toward lower DSi:DIN ratios with time. Meanwhile, the nutrient limitation of phytoplankton growth in most of China's estuary systems was moving toward a higher incidence of phosphorus and silicon limitations as a result of increased DIN fluxes, and this would likely alter phytoplankton communities. Furthermore, Nutrient loads in the Jiulong River Estuary had significantly altered since the 1980s. The DIN fluxes during 2006-2020 increased 637.14% compared to the previous period (1981-2006). The annual mean DIP fluxes in the same two periods were 1.131×10^2 t/a and 2.282×10^2 t/a, respectively. The riverine nutrient fluxes and their structure were significantly altered. After 2006, the N-ICEPs became positive for 90% of the years, while the P-ICEPs were negative throughout all years. The chlorophyll-a concentrations were significantly correlated with both N-ICEPs and P-ICEPs.

Rn-222 in tap waters of an Italian volcanic region. Stochastic risk assessment vs. guideline approach.

Oral - Abstract ID: 285

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The composition of groundwaters mainly depends on the geological features of their reservoirs. Naturally occurring radionuclides (NORs) such as K-40, U-238, and Th-232 (including their decay products) and other radionuclides of cosmogenic origin can be found in water following their contact with some rock types. Radon-222, a noble gas and a radioactive isotope belonging to the decay chain of U-238 may also be present in groundwaters following contact with volcanic materials or active structures. The decay of Radon-222 into its daughter products can occur in the human body following water ingestion or inhalation, exposing population to ionizing radiations with possible severe threat to public health.

A good amount of scientific literature shows that applying a risk assessment-based approach to waters can lead to a higher degree of public health safety protection than using guidelines. WHO (2004) and the EU Council (EU, 2001) suggest assessing health risk for Rn-222 by determining the Indicative Dose (ID) which is the radiation dose an individual assumes through ingestion and/or inhalation due to environmental exposure.

Different lithologies in the Campania region (Southern Italy), including volcanic and sedimentary rocks, influence the concentration of metals and gases in groundwaters mainly used for drinking. This work is based on the data from a large-scale Rn-222 monitoring on Campania's tap waters. Specifically, a total of 181 measurements were completed on different sections/points of the regional water supply system, including public fountains (98), water tanks (52), wells (21), and springs (10). A stochastic risk assessment was performed for homogeneous areas supplied by specific hydrogeological units, and the probability for the local population to be exposed to an unacceptable risk from Rn-222 resulted in considerably high for those areas totally or partially supplied by waters proceeding from the regional volcanic domains (E.g., Mt. Somma-Vesuvius, Mt. Roccamonfina, etc.).

Roles of Lipid Mediators in Investigating the Susceptibility of Individuals at Risks of Cardiovascular Diseases to Air Pollution

Oral - Abstract ID: 480

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Importance of the work and objectives: Air pollution poses heightened risks for cardiovascular disease (CVD)-prone individuals, but the underlying mechanisms remain unclear. Bioactive lipid mediators have been recognized as crucial intermediate pathways in air pollution-associated CVD development. Investigating the relationship between air pollution and the regulation of lipid metabolism in populations at risk of CVD holds public health significance for understanding susceptibility to air pollution and protecting susceptible populations.

Methodologies: Using panel study design and employing techniques such as exposure assessment of $PM_{2.5}$ components and particle size, lipidomics analysis, and causal statistical modeling, we established exposure-response relationships and identified critical components and time windows. The research explored interactive mechanisms between lipid metabolism changes and immune cells, oxidative stress markers, hemodynamic indicators, and platelet activation.

Main results: This study focused on prediabetes, hypertension, and chronic obstructive pulmonary disease (COPD) populations. **(1)** In prediabetic individuals, fasting blood glucose levels modified air pollution health effects. Immune-metabolic cross-talk emerged as a key mechanism, with prediabetes showing higher CYP450 eicosanoid concentrations after short-term exposure to ambient $PM_{2.5}$, leading to an intensified inflammatory response. **(2)** Hypertensive individuals exhibited vasoconstriction changes as a key mechanism, with increased vasoactive lipid molecules (20-hydroxyeicosatetraenoic acid) within 7-15 hours after $PM_{2.5}$ exposure, particularly influenced by organic carbon components. **(3)** For COPD populations, susceptibility to air pollution was suggested, with thrombosis identified as a key mechanism. Ultrafine particle exposure in COPD individuals showed a stronger association with thromboxane B2 concentration, accompanied by oxidative stress and inflammatory responses.

Conclusions: These findings provide mechanistic insight suggesting that bioactive lipid mediators, involving immune-metabolic cross-talk, hemodynamic changes, and thrombosis processes, emerged as crucial mechanisms for CVD-susceptible populations facing air pollution. Additionally, it offers a scientific basis for decision-makers to manage environmental air quality tailored to susceptible populations.

Salinity-induced partitioning of short-chain legacy and novel PFAS substances between dissolved and particulate phases in river-estuary-coast continuum

Oral - Abstract ID: 868

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In this study, legacy and novel perfluoroalkyl substances (PFAS) in dissolved and particulate phase samples of Xiaoqing River from the headwater to estuary region were investigated. The downstream area of Xiaoqing River was found to be heavily influenced by discharged wastewater from a fluorochemical industry park and possessed an extremely high total PFAS concentration. Various PFAS substances were observed in the samples: apart from a high concentration of perfluorooctanoic acid (PFOA), several perfluoropolyether carboxylic acids (PFECAs) were also found in significant numbers, constituting 16.9%-35.4% of the dissolved phase. In the particulate phase, HFPO-TrA, as a specific kind of PFECA, was shown to significantly concentrate, and together with PFOA it made up over 95% of the total PFAS concentration. The distribution behavior of PFAS between dissolved and particulate phases was studied, and we found a different mechanism for short-chain PFAS species such as perfluorobutanoic acid (PFBA) and perfluoromethoxyacetic acid (PFMOAA) involved in the distribution between dissolved and particulate phase. Such partition behavior was found to be seasonal and dependent on various environmental factors, such as salinity, TOC and nutrients. We propose that this may be due to an unknown process in addition to the classical hydrophobic interaction for certain short-chain PFAS to undergo adsorption on the particulate surface, and it may be associated with the bioaccumulation process of PFAS in the ocean.

Screening, identification and degradation characteristics of PBAT degrading bacteria in soil

Oral - Abstract ID: 414

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Plastic mulch film can increase temperature, keep soil moisture and increase crop yield, widely used in agricultural production. However, due to the low recovery rate of mulch film recycling, the residual mulch film in the soil is easily fragmented or degraded into microplastics under light exposure, mechanical shear force and biological actions. Thus, plastic mulch film has become one of the essential sources of microplastics in soil. Polyadipate/butylene terephthalate (PBAT) is a biodegradable plastic polymer with ideal ductility, heat resistance, tear resistance and biodegradability. PBAT is one of the most active and best biodegradable materials in the research of biodegradable plastics, which has been widely applied to make biodegradable mulch films in recent years. However, studies have shown that PBAT only exhibits a good degradation effect under specific conditions, and the limited existing PBAT degrading strains are difficult to degrade PBAT mulching film effectively under mild environmental conditions. In this study, a few PBAT degrading bacterial strains were screened and isolated from the agricultural soil in Shandong province, which has a long history of plastic mulching film utilization. With a comprehensive analysis of the indicators, such as OD value of the bacterial cultures, the morphologic changes and weight loss rate of PBAT films, an efficient PBAT degrading bacterial strain was successfully isolated. The morphological, physiological and molecular identification of the strain were also carried out. Finally, the dynamic degradation of PBAT by the isolated strain was characterized, including the changes of molecular weight, roughness, chemical functional groups, hydrophobicity, surface morphology and biofilm composition characteristics of PBAT microplastics. The results of this study will provide a new bioresource for the biodegradation of PBAT plastics, and will provide a scientific basis for revealing the degradation mechanism of biodegradable plastic mulching films.

Secondary organic aerosol formation from the oxidation of IVOCs

Oral - Abstract ID: 308

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Long-chain alkanes are one of the most important intermediate volatility organic compounds in the atmosphere, which can contribute to secondary organic aerosol formation, especially in urban areas. We measured the rate constants of different structures of alkanes with OH radicals and Cl atoms at room temperature, the gas phase and particle phase were proposed according to products information. These findings would improve the understanding of the contribution of long-chain alkanes to secondary aerosol in the atmosphere.

Secondary precipitates of sediments in karst mining-impacted fluvial system: effective scavengers of heavy metals

Oral - Abstract ID: 563

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Heavy metal pollution caused by mining activity is a global environmental concern. The processes of migration and transformation of heavy metals carried by mining are more complicated in karst areas where carbonate rocks are widely distributed and closely related to the genesis and spatial distribution of polymetallic sulfide deposits. Water, suspended particulate matter (SPM), and sediments are the crucial media in which heavy metals migrate and it is important to elucidate the geochemical behavior of heavy metals in these environments. The carbonate rocks in karst mining areas provides a natural buffering effect that eventually adjusted the pH of acid mine water to neutral and slightly alkaline. As pH increases, the metal ions tend to hydrolyze, which promotes adsorption or precipitation occurring in the river. As ferrous ions are oxidized to ferric ions in fluvial systems, large amounts of ferric ions are hydrolyzed to form ferric hydroxide and ferric hydroxysulfate, which combine with organic matter in the water to form SPM. The strong capacity of iron hydroxide and iron hydroxysulfate to adsorb other heavy metals enriches the latter in the SPM. When the heavy metals bound to SPM exceed its carrying capacity during transportation, they precipitate as sediments. Coquimbite, goethite, jarosite, and hematite were identified in sediments using Raman spectroscopy. These iron phases can absorb heavy metals, so secondary precipitates in sediments are effective scavengers that can remove heavy metals. Therefore, the intrinsic buffering effects of carbonate rock in karst mining environments result in the natural removal of heavy metals. It is not necessary to add alkaline materials but only to utilize the natural geology and carry out long-term monitoring, which allows efficient, low-cost control of the heavy metals pollution risk.

Sedimentary records of persistent organic pollutants (OCPs and PCBs) in Ngoring Lake, the central Tibetan Plateau, China: Impacts of westerly atmospheric transport and cryospheric melting

Oral - Abstract ID: 164

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Lake sediments in remote alpine regions are used to infer information on persistent organic pollutants (POPs) delivery via long-range atmospheric transport (LRAT) with limited influences from local sources. When studying the deposition history of POPs on the Tibetan Plateau, regions influenced by westerly air mass flow have received insufficient attention compared with regions governed by the monsoon. Herein, we collected and dated two sediment cores from Ngoring Lake to reconstruct the depositional time trends of 24 organochlorine pesticides (OCPs) and 40 polychlorinated biphenyls (PCBs) and assess the response to emission reductions and climate change. DDTs, HCHs, hexachlorobenzene (HCB), and PCBs were all detected in the sediment core at low concentrations of 110–600, 4.3–400, 8.1–60, and 3.3–71 pg/g, respectively. The composition of PCBs, DDTs, and HCHs was dominated by congeners with 3 and 4 chlorines (avg. 70 %), p,p'-DDT (avg. 90 %), and β-HCH (avg. 70 %), respectively, indicating the influence of LRAT and the contribution of technical DDT and technical HCH from potential source regions. Temporal trends of PCB concentrations normalized by total organic carbon echoed the peak of global emissions of PCBs around 1970. The rising trend of concentrations of β-HCH and DDTs after the 1960s in sediments was mainly explained by the input of contaminants with melting ice and snow from a cryosphere shrinking under global warming. This study verifies that westerly air mass flow brings fewer contaminants to the lacustrine environment on the Tibetan Plateau than the monsoon and demonstrates the impacts of climate change on the secondary emission of POPs from the cryosphere to the sediments.

Selenium Hyperaccumulator plant Cardamine violifolia-a potential material for biofortification and phytoremediation

Oral - Abstract ID: 962

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Cardamine violifolia is a new selenium (Se) hyperaccumulator plant which was discovered in Yutangba Se mining field, Enshi, Hubei Province, China. Since discovered in 2006, many scholars have carried out numerous researches for this plant. The obtained important progresses include Se speciation analysis, mechanism of Se hyperaccumulation, development and application of it. This review mainly presented these research progresses in its discovery, Se speciation analysis, mechanisms underlying Se tolerance and hyperaccumulation, and its potential utilization in Se biofortification. It grows in Yutangba village, where the only independent selenium ore deposit occurred in world. The firstly discovered wild *Cardamine violifolia* accumulated Se content at a maximum of 1427mg/kg DW in seedling leaves which growing in the Se mine drainage creeks of Yutangba. Most scholars detected out that the predominant form of Se in *Cardamine violifolia* is selenocystine ($SeCys_2$). However, the most abundant Se compound in Cardamine violifolia was identified to be selenolanthionine by Mihály Dernovics. It maybe has a unique Se metabolism and tolerance mechanism in contrast with the typical Se hyperaccumulators, *Astragalus bisulcatus, and Stanleya pinnata*. The mechanism of Se hyperaccumulation of *Cardamine violifolia* involves in rhizosphere bacteria, sulfate transporter and sulfur assimilatory enzyme genes. In particularly, there were more significant progresses in the development and application of *Cardamine violifolia*. It has been approved by National Health Commission of the People's Republic of China as a new source of food. Therefore, it possesses very significant research and utilization value. It could be used as important organic Se resource for production of Se-rich foods and plant material to remediate Se contaminated soil and water. Therefore, *Cardamine violifolia* would be a potential material for biofortification and phytoremediation.

Separating Daily 1 km PM2.5 Chemical Composition in China since 2000 via Deep Learning Integrating Ground, Satellite, and Model Data

Oral - Abstract ID: 948

Prof. Xi Chen [1]

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Fine particulate matter ($PM_{2.5}$) chemical composition has strong and diverse impacts on the planetary environment, climate, and health. These effects are still not well understood due to limited surface observations and uncertainties in chemical model simulations. We developed a fourdimensional spatiotemporal deep forest (4D-STDF) model to estimate daily $PM_{2.5}$ chemical composition at a spatial resolution of 1 km in China since 2000 by integrating measurements of PM2.5 species from a high-density observation network, satellite $PM_{2.5}$ retrievals, atmospheric reanalyses, and model simulations. Cross-validation results illustrate the reliability of sulfate (SO_4^{2-}), nitrate (NO_3^-), ammonium (NH_4^+), and chloride (Cl^-) estimates, with high coefficients of determination (CV-R^2) with ground-based observations of 0.74, 0.75, 0.71, and 0.66, and average root-mean-square errors (RMSE) of 6.0, 6.6, 4.3, and 2.3 $\mu g/m^3$, respectively. The three components of secondary inorganic aerosols (SIAs) account for 21% (SO_4^{2-}), 20% (NO_3^-), and 14% (NH_4^+) of the total $PM_{2.5}$ mass in eastern China; we observed significant reductions in the mass of inorganic components by 40–43% between 2013 and 2020, slowing down since 2018. Comparatively, the ratio of SIA to $PM_{2.5}$ increased by 7% across eastern China except in Beijing and nearby areas, accelerating in recent years. SO_4^{2-} has been the dominant SIA component in eastern China, although it was surpassed by NO_3^- in some areas, e.g., Beijing–Tianjin–Hebei region since 2016. SIA, accounting for nearly half (□46%) of the $PM_{2.5}$ mass, drove the explosive formation of winter haze episodes in the North China Plain. A sharp decline in SIA concentrations and an increase in SIA-to-$PM_{2.5}$ ratios during the COVID-19 lockdown were also revealed, reflecting the enhanced atmospheric oxidation capacity and formation of secondary particles.

Serum apolipoprotein A-I depletion is causative to silica nanoparticles-induced cardiovascular damage

Oral - Abstract ID: 125

Prof. Yang Song [1]

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The rapid development of nanotechnology has greatly benefited modern science and engineering and also led to an increased environmental exposure to nanoparticles (NPs). While recent research has established a correlation between the exposure of NPs and cardiovascular diseases, the intrinsic mechanisms of such connection remain unclear. Inhaled NPs can penetrate the air-blood barrier (ABB) from the lung to systemic circulation, thereby intruding the cardiovascular system and generating cardiotoxic effects. In this study, on-site cardiovascular damage was observed in mice upon respiratory exposure of silica nanoparticles (SiNPs), and the corresponding mechanism was investigated by focusing on the interaction of SiNPs and their encountered biomacromolecules en route. SiNPs were found to collect a significant amount of apolipoprotein A-I (Apo A-I) from the blood, in particular when the SiNPs were pre-adsorbed with pulmonary surfactants (PS). While the adsorbed Apo A-I ameliorated the cytotoxic and pro-inflammatory effects of SiNPs, the protein was eliminated from the blood upon clearance of the NPs. However, supplementation of Apo A-I mimic peptide mitigated the atherosclerotic lesion induced by SiNPs. In addition, we found a further declined plasma Apo A-I level in clinical silicosis patients than coronary heart disease patients, suggesting clearance of SiNPs sequestered Apo A-I to compromise the coronal protein's regular biological functions. Together, this study has provided the first evidence that the protein corona of SiNPs acquired in the blood depletes Apo A-I, a biomarker for prediction of cardiovascular diseases, which gives rise to unexpected toxic effects of the nanoparticles.

Shaping environment and health system resilience through the UNDRR public health scorecard

Oral - Abstract ID: 808

Prof. Ben Ryan [1], ***Prof. Shelby Garner*** [1], ***Prof. Bryan Brooks*** [2], ***Prof. Mayumi Kako*** [3], ***Mr. Sanjaya Bhatia*** [4]

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Introduction

Environment and health systems have been impacted over the last century by rapid urbanization, deforestation, and biodiversity loss. This has disorientated the climate and resulted in more frequent interactions between the environment, animals, and humans. Due to this rapid change, preparedness, response, and resilience needs are increasingly dynamic. An innovative tool that could help address this challenge is the United Nations Public Health System Resilience Scorecard (Scorecard).

Methodology

The Scorecard was applied in 13 locations across eight countries with 285 participants using a participatory action workshop format. Participants included environmental health specialists, academics, clinicians, emergency professionals, and government officials. The Scorecard was applied to rank preparedness levels using a Likert scale 0-5 for each resilience indicator/question. A modified Delphi process was used to prioritize aggregated recommendations from all workshops at the United Nations Office for Disaster Risk Reduction's Global Education and Training Institute (UNDRR-GETI) in Incheon, South Korea.

Results

The workshops identified 70 aggregated strategies. A consensus-based process was used to explore at rank the strategies at the UNDRR-GETI workshop. There were 23 strategies identified as priorities. These related to integrating multidisciplinary teams into public health, including public health risks in emergency plans, improving the ability to manage influxes of patients, and enabling local transport mechanisms. Addressing ecosystem needs relating to food supply, water quality, and biodiversity were also found to be an important element for improving community resilience.

Conclusion

A reliable and translatable method is needed to mitigate the impact of disasters and climate extremes on environment and health systems. This requires a “systems of systems” approach. The Scorecard provides the tool needed through the multidisciplinary and community-based approach required to identify and prioritize system-wide actions. Ultimately, the Scorecard is ideal for shaping environment and health system resilience strategies and actions now and into the future.

Soil Health, Plant Health and Human Health

Oral - Abstract ID: 51

Prof. Dharani Dhar Patra [1]

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Soils are the basis of agriculture and the medium in which nearly 95% of our food is directly or indirectly produced. Healthy soils produce healthy crops that in turn nourish human and animals. It regulates water cycle and carbon dynamics, decomposition takes place in to the soil and the nutrients become available again. Several concepts are there to recognize the value and importance of soil, which includes the concepts of soil fertility and productivity, soil quality and soil health. The concept has changed subsequently and has become broader taking in to account the role of soil in global ecosystems.

Humans have tended to focus on soil almost solely for producing through intensive agriculture, and this narrow focus now causes rapid soil degradation, including loss of soil organic matter, erosion, and salinization. Climate change, soil degradation due to land use conversion and improper agricultural practices are some of the significant threats to the agricultural production, availability and stability of food supply.

Soil Contamination is a global-scale threat to environmental and human health. Industrial wastes such as harmful gases and chemicals, agricultural pesticides, fertilizers and insecticides are the most common causes of soil pollution. Soil chemical processes play essential roles in human health by controlling the distributions of environmental contaminants. Assessing the ecological risk of contaminated soil, pesticide application, sewage sludge amendment, and other human activities leading to exposure of the terrestrial environment to hazardous substances is a complicated task with numerous associated problems. There is urgent need for a tiered approach in ecological risk assessment of contaminated soils. A weight of evidence approach may be an obvious choice to deal with these uncertainties. The TRIAD approach, which incorporates and categorizes information in a triangle – chemistry, toxicology, and ecology – is an appropriate tool for handling conceptual uncertainties.

Soil metabolome impacts the formation of the eco-corona and adsorption processes on microplastic surfaces

Oral - Abstract ID: 402

Prof. Yang Song [1]

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The Eco-corona on microplastics refers to the initial layer of biomolecular compounds adsorbed to the surface after environmental exposure. The formation and composition of the eco-corona in soils has attracted relatively little attention; however, this has important implications on the fate and impacts of microplastics, and their associated chemical additives, in the terrestrial environment. To this end, black polyethylene film microplastics, white polyethylene film microplastics and pure polyethylene microplastic granules were selected as typical polyethylene (PE) microplastic, which is one of the most abundant microplastics in soil. Three types of soil, including mollisol soil, fluvo-aquic soil, and red soil, were collected to obtain different soil metabolomes. Both the non-targeted and targeted metabolomics, along with several spectroscopic techniques, were used to test the formation of eco-corona on microplastics based on soil metabolites. The sorption of dibutyl phthalate (DBP) as a proxy for a soil contaminant on the microplastics with or without eco-corona was investigated. Here we demonstrate a fast formation of eco-corona on polyethylene microplastics exposed to water-extractable soil metabolites (WESMs) via two pathways: direct adsorption of metabolites on microplastics and bridging interactions mediated by macromolecules. The main eco-corona components were identified as lipids and lipid-like molecules, phenylpropanoids and polyketides, nucleosides, nucleotides and their analogues. The WESMs were found to reduce sorption of organic contaminants on microplastics by two pathways: reduced adsorption to the eco-corona surface and co-solubilization in the surrounding water. The impact of eco-corona formation should be considered an integral part of environmental fate and risk assessments of terrestrial emissions of microplastics and associated contaminants.

Soil moisture dynamics regulates the release rates and lability of copper in contaminated paddy soils

Oral - Abstract ID: 187

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Climate change has led to more frequent extreme weather, causing greater fluctuations in soil moisture which in turn affects heavy metal distribution. Limited knowledge on how these moisture changes impact heavy metal mobility hinders precise predictions of their environmental behavior and risks.

In this study[1], we employed stirred-flow experiments to investigate the release kinetics of copper (Cu) from two contaminated agricultural soils. We developed a quantitative model that can describe the rates of Cu release from contaminated soils under various moisture content conditions. Additionally, we combined both experimental and modeling approaches to quantify the labile Cu fractions in soils under different moisture conditions. Our kinetic experiments and modelling results showed that the release rates and lability of soil Cu were highly associated with the soil moisture contents, in which, surprisingly, high soil moisture contents effectively reduced the release rates of Cu even with little changes in the reactive portions of Cu in both soils. A suite of comprehensive characterization on soil solid and solution components along the incubation suggested that soil microbes may regulate soil Cu lability through forming microbially derived organic matter that sequestered Cu and by increasing soil particle aggregation that protected Cu from releasing. Therefore, incorporating soil moisture dynamics into environmental models is essential for accurately predicting the behavior and risk of heavy metals on-site, especially as global changes are anticipated to cause greater variations in soil moisture content. The findings of this study have provided basis to further develop environmental assessment methods for soil heavy metals under the conditions of soil moisture variability influenced by climate change.

Soil nutrients limitation control bottom-up effects of micro-food web derived ecological functions in a degraded agroecosystems

Oral - Abstract ID: 516

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Soil micro-food web drives ecological services via bottom-up and top-down effects in degraded agroecosystems. Bottom-up and top-down effects of soil micro-food web might respond sensitively to variations of soil nutrients status in degraded agroecosystems by restoration managements, such as leguminous intercropping. However, those trophic cascade effects of soil mico-food web are scarcely estimated and compared by previous studies that launched in degraded agroecosystems. To bridge these knowledge gaps, in this study, we analyszed the relationships between soil nutrient limitations and trophic cascade effects of soil micro-food web under of three plantation typesing types, Camellia oleifera monoculture (CK), C. oleifera–Arachis hypogaea (peanut) intercropping (CP), and C. oleifera–Senna tora intercropping (CS), within a fully controlled C. oleifera agroforestry system in a nutrient- poor purple soils. Our study found that leguminous intercropping alters the abundance of bacteria,fungi, protist, and nematodes, with the community structure of higher trophic lever organisms responded more sensitive, i.e., consumer protist and nematodes. The SEM results indicated that leguminous intercropping directly affected bacterial community structure by altering soil N and P limitation, and cascaded to affect community structure at higher trophic levels (bacterivore and omnivores-predators nematodes) in the bottom-up effect, and omnivores-predators nematodes indirectly influence soil ecological enzymes through plant nematodes in the top-down effect. Network analysis indicated positive interactions dominate in micro-food web and further supported the SEM results. The results suggest that in highly sensitive degraded ecosystems, responses of soil micro-food web structure and function to legumious intercropping represented restoration managementis, were easier to shaped by nutrient limitations controlled bottom-up effect than top-down effect.

Soil Salinization evolution: a case-study of Baixo Vouga Lagunar

Oral - Abstract ID: 753

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Soil salinization is a global phenomenon, affecting different ecosystem functions, such as: changes in the chemical composition and degradation of water resources, loss of biodiversity and fertile soil, etc. In Portugal, this problem is essentially limited to coastal areas. Ria de Aveiro is a shallow mesotidal coastal lagoon connecting Vouga River catchment area to the Atlantic Ocean through a single outlet, where the hydrodynamics is mainly driven by tidal forces. The Baixo Vouga Lagunar (BVL), located at the confluence of the Vouga River with Ria Aveiro, has been affected by several process such as: (1) surface or subsurface seawater intrusion linked to sea level rise, (2) reductions of riverine freshwater flow, (3changes in the quality of fresh subsurface water, (4) anthropogenic changes of coastline, and (5) storm surges. All these events have led to a reduction in yields over the years, which cause rural abandonment.

In 1995, a flood bank was built for the defence of the BVL against the invasion of salt water. In 2006 a soil campaign was carried out to evaluate soil salinization situation. However, the flood bank has not been fully completed, but the authorities intent to finish this soon. Thus, to evaluate the actual situation and compare with the previous data, a new soil campaign was performed.

The results of soil samples (0-25 cm) show: acid pH (3.92-7.91); high organic matter contents, ranging from 1.24 to 18.7%; and large variations in electric conductivity values (0.16-41.5 mS/cm). Twenty percent of sampled soils show moderate to very high salinity. Comparing these results with those obtained in 2006 it turned out that an increase of salinity occurs in areas near watercourses connected to Ria de Aveiro, which is caused by flood events. However, in other areas the EC values have been decreasing, maybe due to the flood bank.

Sorption of Selenite (IV) and Selenate (VI) on Magnesium Precipitate derived from Seawater Electro-Chlorination Facility

Oral - Abstract ID: 319

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Selenium (Se) is a trace element in Earth's crust and is known as both essential and potentially toxic depending on its concentration in a solution. Selenium can be entered into the water systems by weathering of Se containing rocks and volcanic eruptions and various anthropogenic sources such as mining and agricultural activities. In natural water systems, Se can be present in different oxidation states; selenide (− II), selenium (0), selenite (IV), and selenate (VI). Of these 4 species, selenite (IV) and selenate (VI) are known as water-soluble species that possess the majority of selenium toxicity for living organisms, including plants, animals, and human beings. Consequently, the World Health Organization (WHO) and the European Union (EU) have set a tight guideline for Se in drinking water, as 40 μg/L and 10 μg /L, respectively.

To address selenite and selenate removal from solutions, various approaches utilizing Fe and Al-based adsorbents and biochar have been explored from their economic viability and applicability. This study aimed to utilize magnesium precipitate obtained from a seawater electro-chlorination facility as a potential adsorbent for selenite and selenate removal. Batch tests were conducted for adsorption kinetics, isotherms, and the effect of pH and other anions. Selenite and selenate adsorption mechanisms were investigated using analytical techniques such as SEM-EDX, FTIR, XRD, and XPS. Furthermore, a surface complexation model with PHREEQC-PEST was applied to elucidate detailed adsorption mechanisms between MP and selenite & selenate.

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Source Apportionment and Health Risk Assessment of Heavy Metals in Dust Around Bus Stops in Kaifeng City Based on APCS-MLR Model

Oral - Abstract ID: 352

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In order to reveal the influence of urban transportation systems on the quality of urban ecological environment, this study selected dust from bus stops, which is strongly disturbed by transportation, as the research object. The contents of eight heavy metals (V, Cr, Co, Ni, Cu, Zn, Cd, and Pb) in the dust were determined. In this study, a combination of methodologies including APCS-MLR, Kriging interpolation, geo-accumulation index method, pollution load index method and human health risk assessment model were utilized to investigate the dust at bus stops,considering both environmental pollution and human health impacts. The results showed that the average values of ω(Cr), ω(Ni), ω(Cu), ω(Zn), ω(Cd), ω(Pb) , and ω(As) in the bus stops dust were 68.36, 59.73, 5.81, 19.34, 40.10, 208.32, 1.01, and 49.46 mg·kg−1, respectively. The concentrations of heavy metals (Cd, Zn, Pb, Cu, and Cr) in the dust were all higher than the background values in surrounding dust. The average geo-accumulation index of heavy metals was Cd > Zn > Pb > Cu > Cr > V > Ni > Co. The APCS-MLR model identified four sources: natural source (34.17%), traffic source (29.84%), industrial-natural mixed source (14.64%), and unknown source (21.35%). The spatial distribution plots of the contribution rate of the traffic source was consistent with the trends of traffic volume and bus route density distribution. Health risk results showed that the risk for children was higher than for adults. Cr was the main non-cancer factor, and Cd was the main cancer factor. Natural and traffic sources contributed the most to non-cancer risk and cancer risk, respectively. Overall, this study provides an in-depth analysis of dust heavy metals from the perspective of source apportionment, and provides scientific guidance for the management of dust heavy metals in Kaifeng City.

Sources, transport and bioaccumulation of PFAS in coastal regions

Oral - Abstract ID: 343

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Per- and polyfluorinated alkyl substances (PFAS) are a group of man-made compounds, several of which have been found to bioaccumulate, undergo long-range transport, are persistent and cause adverse effects in humans and biota. PFAS have been used as surfactants in a wide range of applications, including aqueous film-forming foam, fluoropolymer production and the coating of textiles, carpets and paper products to impart water and stain repellency. Wastewater treatment plants are a known point source of PFAS to aqueous environments, leading to potentially large discharges reaching estuarine and coastal regions. In a targeted study of PFAS sources along the Pawcatuck River (RI, USA), we identified legacy and current textile mills as sources of PFAS. We estimated monthly mass flows (g month^{-1}) of perfluorohexanoic acid (45±56) and perfluorooctanoic acid (30±45) from the upstream river influenced by an active mill. In contrast, mass flows of perfluorononanoic acid increased from7.5 to 21 g month^{-1} between the upstream and downstream portions of the rivers, released from historical textile waste lagoons. Once PFAS reach estuarine and coastal environments, they get assimilated by the base of the food web, namely phyto- and zooplankton. Measurements along off the North Atlantic shelf implied that precursor compounds might be taken up by plankton preferentially Estuaries also represent important nurseries for fish, leading the further trophic magnification of PFAS along the foodweb. Bioaccumulation of PFAS has been observed in fish, in particular the liver, with increasing concentrations for PFAS with longer chain-lengths. Beyond the perfluorinated compounds, several precursor compounds have also been identified in fish. Coastal marine birds, such as Great Shearwaters, are among the top predators. Perfluorooctane sulfonate was the major legacy perfluoroalkyl acid present in these birds, making up 58% of concentrations observed across all habitats, while novel PFAS were present in birds close to a fluoropolymer production site.

Spatial distribution, sources and health risk assessment of heavy metals in the surrounding farmland soils of lead and zinc mining areas

Oral - Abstract ID: 793

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In order to find out the impacts of the lead-zinc mining area and tailing ponds on the surrounding farmland, soil and atmospheric deposition samples from farmland around a lead-zinc mine in Hengyang, Hunan Province of China were systematically collected. The heavy metal contents and patterns were analyzed, and the ecological risk of the heavy metal area was evaluated using the secondary phase to primary phase comparison method (BSP) and the EPA health risk evaluation model. The results show that Cd and Pb in the soil of the lead-zinc mine area exceeded the standard, As was mainly in the residue state and humic acid binding state, Pb was mainly in the residue state and ferromanganese binding state, and Cd was mainly in the ion-exchange state. Cd, compared with Pb and As, mainly originated from mining, has strong biological validity, high toxicity and serious pollution, and there is a certain risk of carcinogenicity for the study area as a whole. It is recommended to carry out long-term monitoring and control of the surrounding farmland soil, and explore other green value-added utilization pathways.

Keywords: lead-zinc mining; farmland soil; heavy metals; health risk assessment

Spatial monitoring and microplastic concentration variability in different environmental matrices from Galway Bay

Oral - Abstract ID: 15

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Plastic marine litter has been identified in the marine environment in the late 1970s. Microplastic (MP) pollution has been regularly assessed and monitored since the early 2000s, in various environmental matrices including biota, sediment and water. This MP data is essential to understand and estimate spatio-temporal trends over time, while providing valuable feedback to decision-makers. In this work that assesses sources, pathways and fate of microplastics, a joint sampling approach was carried out on surface water, benthic sediment, and marine biota in Galway Bay, Ireland. The average MP concentrations in surface waters were 1.42 ± 0.33 MPs m-3; while in biota were 4.46 ± 0.36 MPs ind-1; and in benthic sediments were 5.60 ± 1.54 MPs kg-1. Fibres were the dominant MP type across all matrices. The diversity of MP colours and polymer types was higher in water and biota samples, in comparison to the seafloor sediment. The most common MP colours were red, black, and blue; while nylon, polyamide, polyester, and polycarbonate were the most common polymer types. Microplastic concentration data can contribute to enhance existing monitoring programmes that reply to national and European strategies such as the Marine Strategy Framework Directive (MSFD), particularly to descriptor 10. The data in this work reveals that MP concentrations are highly variable and dependent on environmental matrix, with benthic sediments being an accumulation sink. Understanding the spatial-temporal variability will allow to move into the next step of assessing fate and impact of MP pollution in Ireland.

Spatio-temporal dynamic characteristics of water-related ecosystem service interactions in the Min Delta Urban Agglomerations from 2000 to 2020 : implications for water environmental protection and sustainable management of water ecology.

Oral - Abstract ID: 412

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Water maintains ecosystem stability and provides a wide range of services to support human well-being. Exploring the spatial and temporal dynamic distribution and complex interconnections of water-related ecosystem services (WESs) is a pre-condition for sustainable management of multiple concurrent WESs from a macro perspective. In this study, we mapped the provision of three major WESs, namely water conservation (WC), soil conservation (SC), and flood regulation services (FRS), in the Min-Delta Urban Agglomeration (MDUA) as an example. We further delved into the temporal and spatial trade-offs and synergistic dynamics among different WESs, and subsequently provided sustainable spatial planning and management strategies for water ecology. The results show that (1) all three WESs in MDUA have uneven spatial distribution, with WESs in the Northwest slightly better than those in the Southeast coastal area; (2) from 2000 to 2020, all three WESs in MDUA show significant decreases, with WC decreasing the most, 62.99%, and FRS decreasing the least, respectively, by 44.49%; (3) between 2000 and 2020, there are both trade-offs and synergies among the three pairs of WES in MDUA, with synergies playing a dominant role, in which both WC-FRS and SC-FRS show synergies, while WC-SC has trade-offs and trade-offs, and from 2000 to 2020, all three pairs of WES in MDUA at the grid scale exhibit the characteristics of increasing synergistic effects or weakening trade-offs.The trade-offs and synergistic relationships between different WESs in MDUA have obvious spatial and temporal heterogeneity, and the results of the study suggest that attention should be paid to the optimal management of water-ecological zoning in the future development and protection.

Spatiotemporal characteristics of soil erosion in a typical watershed consisting of different landscape: A case study of the Qin River Basin

Oral - Abstract ID: 690

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Soil erosion has a severe impact on habitat and productivity. It is considered to be a major environmental threat prevalent in ecosystems. However, few researchers have studied the spatial distribution of soil erosion intensity among different geographic environmental factors. The Qin River Basin is a geographical unit consisting of mountains, hills, and plains
with significant regional characteristics, and it has a basin area of 14,810.91 km2. This study uses the Geographical Information Systems, Revised Universal Soil Loss Equation model to analyze the spatiotemporal changes in the soil-erosion intensity in the Qin River Basin from 1990 to 2018. Different environmental factors of land use, slope and altitude on erosion intensities of 19 secondary land types were analyzed. It can better reflect the soil erosion under different environmental factors and different land use types. Results show that the soil erosion modulus of Qin River Basin were 10.25 t hm−2 a−1, and it belong to slight erosion from 1990 to 2018. Soil erosion intensity is greater in grassland and woodland than in cropland. The strongest soil erosion occurred in the sparse forestland, and the lowest was in beach land. Soil erosion was the highest for a slope of 15~25° and an altitude of 1200~1500m. Rainfall and slope are important factors lead to soil erosion, indicating weak water and soil conservation implemented in these areas. Therefore, priority should be given to these geomorphic units to formulate and implement soil-erosion control and ecological restoration policies in the Qin River Basin. This study provides a good reference for preventing and controlling soil erosion in river basins.

Special distribution of nanoplastics in the central nervous system of zebrafish during early development

Oral - Abstract ID: 980

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There is growing concern about the distribution of nanoplastics (NPs) in the central nervous system (CNS), whereas the intrusion is poorly understood. Here, by using microinjection of fluorescent-labeled NPs to simulate the route of exposure, we showed that maternal derived NPs were specially distributed in the CNS of zebrafish during early development. The microinjection of fluorescent-labeled NPs was used to simulate the route of exposure. Polystyrene NPs (PS-NPs) were observed in the brain, eyes and spinal cord through gametal exposure. Importantly, these NPs stranded in the CNS but not transferred to other organs during development. Furthermore, using neuron GFP-labeled transgenic zebrafish, co-localization between NPs and the neuron cells revealed that NPs mostly enriched in the CNS surrounded but not the neurons. Even so, the intrusion of NPs into CNS induced the significant upregulation of some neurotransmitter receptors, leading to an inhibited effect on the movement of zebrafish larvae. This work provides insights in understanding the intrusion and distribution of NPs in the CNS and the subsequent potential adverse effects.

Speciation changes of thallium during ageing in a thallium-spiked soil

Oral - Abstract ID: 147

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Thallium (Tl) is one of the most toxic heavy metals in the environment. However, geochemical information on the formation of Tl-minerals in soil and on the effects of Tl residence time on mineral stability is scarce. We determine the fate of Tl-mineral phases in soils spiked with 300 and 1,000 mg/kg Tl to investigate the ageing of Tl(I) and Tl(III) over an 18-month period. Soils were sampled after 2 hours, 48 hours, 1 and 4 weeks, 3, 6, 12, and 18 months, and analyzed using an 8-step sequential extraction procedure to provide detailed insights into the changes in binding in and on geochemical fractions of Tl over time. We hypothesized that ageing converts highly toxic Tl(III) into less toxic Tl(I) forms and that there will be a shift from more available to more stable fractions. Tl(I) and Tl(III) show a similar pattern but different abundances in exchangeable and soluble fractions. Tl(I) in the residual fraction decreases over time from 35 to 28%, while Tl(III) increases from 17 to 27%. Tl(III) was bound to 17% on carbonates after 3 months, but the amount decreased after 6 months. A similar effect was found for Mn-bound Tl(III). Our results show that Tl(III) was initially bound to more exchangeable fractions and later stabilized in the residual fraction, while Tl(I) shifted from residual to more mobile fractions over 6 months. These results will be expanded from the remaining 12 months of the experiment. The soil samples will also be analyzed via XANES (X-ray Absorption Near Edge Structure) to elucidate the Tl-mineral phases and their transformations over time. This study will help to understand the long-term geochemical behaviour and toxicity of Tl in the pedosphere as well as its potential health risks for humans and the environment.

Spectrophotometric identification of physical UV filters in red and white clays in South Africa

Oral - Abstract ID: 678

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Spectrophotometric identification of physical UV filters in red and white clays in South Africa

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Abstract

Exposure to UV radiation from outdoor recreational activities increases the risk of skin cancer incidence. The main preventative measure is the application of sunscreens. However, commercial sunscreens are costly, limiting access to lower-income groups. Physical sunscreens are affordable with natural availability of inorganic UV filters, ZnO and TiO_2.

An investigation into the presence of active oxides in red and white clays harvested from iLembe Municipality in KwaZulu-Natal, South Africa using AAS and XRF was conducted, and their potential as affordable sunscreens were evaluated.

AAS results indicated a 0.01% presence of ZnO in white clay and 1.12% in red clay. Fe_2O_3 occurred at 0.04% in white clay and 3.54 % in red clay. TiO_2 was undetermined due to the lack of acetylene burner. XRF data highlighted the following predominant oxides found in red clay as Si (36.41 %); Al (24.89 %); Fe (18.10 %) and TiO_2 (1.48 %), whereas ZnO was not detected. White clay comprised Si (50.26 %); Al (33.06 %); Ti (1.96 %) and Fe (1.49 %).

ZnO and TiO_2 were thus present in these clays. A limitation in their commercial application is the concentrations which are lower than the theoretical 20% required in the formulation of sunscreens and cannot be utilized individually to provide the required photoprotection.

Keywords: Photoprotection, UV filters, AAS, XRF

Spontaneous iodide activation at the air−water interface of aqueous droplets

Oral - Abstract ID: 437

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We present experimental evidence that atomic and molecular iodine, I and I2, are produced spontaneously in the dark at the air−water interface of iodide-containing droplets without any added catalysts, oxidants, or irradiation. Specifically, we observe I3− formation within droplets, and I2 emission into the gas phase from NaI-containing droplets over a range of droplet sizes. The formation of both products is enhanced in the presence of electron scavengers, either in the gas phase or in solution, and it clearly follows a Langmuir−Hinshelwood mechanism, suggesting an interfacial process. These observations are consistent with iodide oxidation at the interface, possibly initiated by the strong intrinsic electric field present there, followed by well-known solution-phase reactions of the iodine atom. This interfacial chemistry could be important in many contexts, including atmospheric aerosols.

Spring Festival points the way to cleaner air in China

Oral - Abstract ID: 614

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Migration during the Chinese Spring Festival is the largest collective human activity of its kind in the modern era. The accompanied substantial emission reduction provides an opportunity to verify the effectiveness of future air pollution control strategies. With long-term satellite and in-situ observations, we show that fine particulate matter (PM2.5) concentration in eastern China decreased by ~30% during the Spring Festival in response to a 30–40% reduction of gas-phase precursors (NO2 and SO2). Despite the potential influence of nonlinear atmospheric chemistry, the mitigation of PM2.5 concentration shows an overall near-linear dependence on the precursor reductions with similar slopes over most metropolitan areas in China. Based on it, projections suggest that current policy strategies on end-of-pipe controls and industry upgrades cannot suffice to meet air quality goals in China, and further cleaning of the air depends fundamentally on sustainable advances in both heavy industry upgrades and clean energy transition.

Standardisation of Applied Geochemical Methods

Oral - Abstract ID: 487

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The International Union of Geological Sciences (IUGS) is the entity responsible for setting up international standards in the earth sciences. These standards are set up by its Commissions. Under this premise, the Commission on Global Geochemical Baselines has compiled the "International Union of Geological Sciences Manual of Standard Methods for Establishing the Global Geochemical Reference Network". It presents, for the first time, a comprehensive overview of the geochemical methods and procedures that should be used across the Earth's land surface to map the distribution of chemical elements in various sample types. As the sampling will cover the whole globe, according to the Global Terrestrial Network (GTN) grid cells, the procedure must be consistent for all sample types and, therefore, is standardised to be applicable in all morphoclimatic environments. It describes in detail all the necessary methods that should be used from planning the sampling campaign, through sampling of rock, residual soil, humus, stream water, stream sediment, overbank sediment and floodplain sediment; sample preparation; development of project reference materials; analytical methods; quality control and assurance procedures for the production of harmonised data sets; data levelling of existing regional geochemical data sets with respect to the established Global Terrestrial Network datum; data conditioning for the production of seamless geochemical maps; data management and map plotting and, finally, project management. Applying these methods allows the production of internally consistent quality-controlled data sets for each sampling medium for multipurpose use. Any applied geochemist carrying out a geochemical mapping project at any scale and purpose should find a wealth of useful information within the pages of this Manual.

The Standard Methods Manual is freely available from the following hyperlink: https://www.globalgeochemicalbaselines.eu/content/174/iugs-manual-of-standard-methods-for-establishing-the-global-geochemical-reference-network-/.

Study on the spatial and temporal characteristics of ozone and its generation mechanism in coastal city of Southeast China

Oral - Abstract ID: 959

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Xiamen is a typical coastal city, locates in southeast of China and west bank of Taiwan Strait. It has a southern subtropical maritime monsoon climate, and it’s mild and rainy all year round. Taking Xiamen’s rapidly urbanizing administrative district as an example, this study focuses on the effect of both subtropical maritime climate and rapid urbanization on the characterization of the spatial and temporal distribution of ozone and its generation mechanisms. Research methodologies such as multiple linear regression, HYSPLIT model, spearman correlation analysis, potentially-source contribution function and continuous wavelet transform are used in this study. Results show that: In the past five years, the interannual rate of increase of MDA8 O_3 - 90% is 2.5 $\mu g \cdot (m^3 \cdot a)^{-1}$, and its monthly variation is in M pattern, which annual peak occurs in September in 2019-2022, and occurs in April on 2023 due to the influence of El Nino. Humidity is one of the most important factors for ozone production in this region with an inhibitory effect. Temperature not only contributes to ozone production, and it can trigger heat suppression when in the range of 33~36□. Temperature is negatively correlated with ozone when MDA8 O_3 is less than 100 $\mu g \cdot m^{-3}$. In summer, the peak of daily variation in ozone shifts forward and production rate increases affected by sea breeze. This study further explores the influence of sea and land breezes and heat island effect due to the urbanization on ozone transport paths.

Substantial burial of terrestrial microplastics in the Three Gorges Reservoir, China

Oral - Abstract ID: 698

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Hydropower dams impact the transport of microplastics from rivers to the ocean. The Yangtze River is a large source of plastics to the ocean. Here, we report microplastic concentrations and compositions across a range of size fractions for sediment samples collected in the upper and lower reaches of the Three Gorges Dam in 2008, 2015, 2019 and 2020. The load of sedimentary microplastics also was estimated based on the annual sediment deposition and mass budget. We find a gradual increase in microplastic abundance over time, with preferential retention of small-sized (<300 μm) microplastics in the dam reservoir sediments. Small microplastics accounted for between approximately 44 and 90% of identified microplastics, and 82% of all polyethylene particles, which were the dominant polymer type. Our estimate of the total plastic mass load in reservoir sediments suggests that the Three Gorges Dam retains as much as 8048 ± 7494 tons yr−1 microplastics in sediments, which is equivalent to 47 ± 44% of the Yangtze River microplastic flux to the ocean.

Sulfur disproportionation-methanogenesis co-driven organic matter conversion processes can promote iodine enrichment in groundwater in middle reaches of Yangtze River

Oral - Abstract ID: 1008

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Microbes trigger the transformation of iodine-bearing organic matter (OM) and Fe minerals are considered to be the key process controlling iodine (I) release into groundwater. However, the key active I-mobilizing biogeochemical processes and associated OM turnover in groundwater are still poorly understood. To this end, this study combined 16S rRNA gene sequencing and Fourier transform ion cyclotron resonance mass spectrometry (FT-ICR MS) to characterize the function of active microbial communities, and the molecular composition and structure of OM in groundwater with different iodine concentrations in the middle reaches of the Yangtze River, China. The results showed that OM conversion processes co-driven by active methanogenesis and sulfur disproportionation constrain iodine enrichment in groundwater. When sulfur disproportionation is the dominant biogeochemical process in groundwater, methanogenic microorganisms and sulfur disproportionation microorganisms may compete to utilize biodegradable organic molecules as an energy source, promoting iodine release into groundwater, and resulting in recalcitrant OM remaining in groundwater. However, this process does not lead to large amounts of iodine release because iodine in groundwater systems is primarily bound to relatively high-molecular-weight recalcitrant OM with high humification, and mineralization of small-molecule biodegradable organic compounds may not be the primary process in inducing iodine mobilization. In contrast, when methanogenesis is the dominant biogeochemical process in groundwater systems, methanogenic functional microorganisms can use N-containing highly unsaturated compounds and polyphenols as an energy source to produce aliphatic and oxygen-poor highly unsaturated compounds, which can facilitate iodine release into groundwater. At the same time, biodegradable organic molecules produced during methanogenesis can be supplied to sulfur disproportionation functional microorganisms for metabolism, further facilitating iodine release into groundwater. This study provides a novel insight into iodine enrichment in alluvial-lacustrine groundwaters, which is constrained by the interactions between OM structure and functional microorganisms at the molecular level.

Surface absorbed water on soot significantly promotes the generation of radicals in contact electrification

Oral - Abstract ID: 984

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Interfacial contact processes play an essential role in the atmosphere. Surface absorbed water on soot significantly promoting the generation of radicals was discovered in contact electrification of water vapor with soot. Dry soot can hardly trigger the evolution of radicals, while the soot with absorbed water can readily induce the generation of radicals in contact. The induced radicals mediating nitrate ion (NO_3^-) reductive reaction associated with the contact process was investigated. ^{1}H solid-state nuclear magnetic resonance spectra were employed to illuminate the impact of absorbed water in contact electrification. Our observations revealed that the surface-absorbed water distinctly influences the hydrogen network on soot, further affecting the generation of radicals in contact electrification, which may have great potential to change atmospheric chemistry reactions.

Susceptibility modeling of hydro-morphological processes considered river topology

Oral - Abstract ID: 320

Dr. Nan Wang [1], ***Dr. Mingxiao Li*** [2], ***Prof. Hongyan Zhang*** [1], ***Prof. Weiming Cheng*** [3], ***Prof. Luigi Lombardo*** [4]

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Hydro-morphological processes (HMP, any natural phenomenon contained within the spectrum defined between debris flows and flash floods) are most likely to occur in small catchments, especially buffer zones along or near rivers. However, previous studies on HMP prediction lacked consideration of the physical interactions between catchments, resulting in insufficient predictive and explanatory capabilities of the models. In this work, we fully considered the role played by river topology and developed a Topology-based HMP susceptibility Modeling (Topo-HMPSM) to simulate the dynamic interactions between catchments and predict the susceptibility of HMPs for the Yangtze River Basin (China) during 1985-2015. Results confirmed that our proposed model outperforms four selected baseline models (RF, GBDT, GRU, and LSTM) with the best F1-score. This work is a new attempt to incorporate physical mechanisms into deep learning models. A graph-based deep neural network improves the predictive and interpretability of HMP susceptibility modeling using embedding learning techniques. Our findings highlight the consideration of river topology to predict HMP to support hazard mitigation.

Sustaining Vitality: A Conceptual Framework for Peatland Preservation and Health Equity

Oral - Abstract ID: 737

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This paper presents a conceptual framework to enhance sustainable peatland management by integrating environmental pollution, human health, and sustainability considerations. Peatlands, critical ecosystems for carbon sequestration and biodiversity, face widespread degradation due to human activities, leading to environmental pollution and health risks. Our framework emphasizes understanding the interconnectedness between peatland degradation, pollution pathways, and health outcomes, advocating for interdisciplinary approaches that foster ecosystem resilience and mitigate pollution-related health risks. We highlight the importance of robust governance structures, policy interventions, and community engagement to promote sustainable land-use practices, biodiversity conservation, and cultural heritage preservation. By fostering research, innovation, and stakeholder collaboration, this framework offers a pathway towards achieving environmental sustainability, protecting human health, and safeguarding the integrity of peatland ecosystems worldwide.

Keywords: Peatlands, Sustainability, Environmental Pollution, Human Health, Governance, Policy, Community Engagement, Biodiversity Conservation, Sustainable Development.

Swine farming shifted the gut antibiotic resistome of local people.

Oral - Abstract ID: 404

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Antibiotic resistance genes (ARGs) are prevalent in the livestock environment, but little is known about impacts of animal farming on the gut antibiotic resistome of local people. Here we conducted metagenomic sequencing to investigate gut microbiome and resistome of residents in a swine farming village as well as environmental relevance by comparing with a nearby non-farming village. Results showed a shift of gut microbiome towards unhealthy status in the residents of swine farming village, with an increased abundance and diversity in pathogens and ARGs. The resistome composition in human guts was more similar with that in swine feces and air than that in soil and water. Mobile gene elements were closely associated with the prevalence of gut resistome. Some plasmid-borne ARGs were colocalized in similar genetic contexts in gut and environmental samples. Metagenomic binning obtained 47 ARGs-carrying families in human guts, and therein Enterobacteriaceae posed the highest threats in antibiotic resistance and virulence. Several ARGs-carrying families were shared by gut and environmental samples (mainly in swine feces and air), and the ARGs were evolutionarily conservative within genera. The findings highlight that swine farming can shape gut resistome of local people with close linkage to farm environmental exposures.

The characteristic and control of microbial contamination in soil

Oral - Abstract ID: 805

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Microbial contamination, including human bacterial pathogens (HBPs), antibiotic resistance genes (ARGs), and virulence factor genes (VFGs), pose threat to ecological security and human health. However, their characteristic and control in soil are urgently needed. Here, the systematic metagenome is conducted to explore changes in ARGs, VFGs and HBPs in farmland soil, which revealed that many manure-borne ARGs, VFGs, and HBPs could be spread into soil. A total of 157 potential HBPs accounting about 1.33% of total bacteria were detected. Compared with the background soil, the abundance of ARGs in pig and silkworm manure soil increased by 4.0-6.0×10^8 copies/g soil. ARGs against “last-resort” antibiotics were extensively persisted in manure-amended soils (up to 10^7 copies/g soil). The network analysis revealed positive co-occurrence patterns of ARGs-HBPs, VFGs-HBPs and ARGs-VFGs. Therefore, effective strategy to mitigate the risks of microbial contamination should be developed. We demonstrated root exudates effectively decreased the abundance of HBPs by 48.30% and 72.54%, respectively, which was accompanied by the reduction of VFGs (reduced by 6-11%) and ARGs (reduced by 20-27%). In addition, fermentation broth from fruit and vegetable waste (FFVW) have remarkable ability as a soil amendment and in reducing ARGs and VFGs/ARGs-carrying HBPs pollution. More importantly, root exudates and FFVW reduced the intra-species (70%) and inter-species conjugation frequencies among bacteria (60%), considerably inhibiting the dissemination of ARGs and VFGs via horizontal gene transfer. Further analysis illustrated that these two strategies were both mainly attributed to the inhibition of quorum sensing (QS). The decrease in QS signals mediated by root exudates disturbed bacterial communication and inhibited biofilm formation (20-65%), resulting in a decreased in risk of ARGs and VFGs. This study suggested some environmentally friendly approaches for controlling microbial contamination in soil, which is crucial for both soil and human health under the framework of “One Health”.

The control potential and mechanisms of solar light/periodate system on pathogenic microorganisms

Oral - Abstract ID: 548

Dr. Chengsong Ye [1]

1. Xiamen University

Disinfection plays an essential role in waterborne pathogen control and disease prevention, especially during the COVID-19 pandemic. In addition to the bactericidal effect, the ideal disinfection strategy should also have the characteristics of not producing disinfection byproducts, DNA leakage, and other secondary contamination. However, currently widely used disinfection methods, including chlorine disinfection and ultraviolet irradiation, cannot fully meet the above requirements. Catalyst-free solar light/periodate (PI) system has recently presented great potential in water disinfection, whereas the in-depth mechanisms for efficient bacterial inactivation and secondary contaminants control remain unclear. Our work delineated the critical role of singlet oxygen in dominating bacterial inactivation by the PI/simulated sunlight (SSL) system. Multi-evidence demonstrated the prominent disinfection performance of this system for *Staphylococcus aureus* in terms of culturability (> 6 logs CFU), cellular integrity, and metabolic activity. Particularly, as a selective disinfection strategy, the PI/SSL system may function to diminish bacterial culturability without damaging the cell membrane. This property could reduce the leakage of intracellular antibiotic resistance genes (ARGs) and effectively reduce the spread of secondary disinfection pollution (ARGs). Non-targeted metabolomic analysis suggested that the PI/SSL system inactivated bacteria by triggering the accumulation of intracellular reactive oxygen species and the depletion of reduced glutathione. Overall, this study deciphers more comprehensive antibacterial mechanisms of this environmentally friendly disinfection system, facilitating the technical development and application of the selective disinfection strategy in environmental pathogens and ARGs spread control.

The disparities in PM2.5 pollution between China's urban and rural Areas and their driving factors

Oral - Abstract ID: 459

Prof. Ye Huang [1]

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Fine particulate matter, known as PM2.5, stands as the primary pollutant in China's air, posing threats to both ecological environments and public health. Although there has been systematic research on PM2.5 pollution in China, the distinct characteristics of urban and rural disparities, as well as the driving factors behind these differences, remain unclear. Leveraging remote sensing and model data, our analysis focuses on the spatial and temporal features of urban and rural PM2.5 pollution disparities at the prefecture-level city scale in China. Additionally, we explore the predominant roles of meteorological factors and socio-economic factors in influencing these differences. Examining temporal trends, we observe fluctuating increases in the concentration differences of urban and rural PM2.5 from 2000 to 2014, followed by a subsequent decrease after 2014. Spatially, areas with notable disparities in urban and rural PM2.5 pollution are predominantly found in the Beijing-Tianjin-Hebei region, Chengdu-Chongqing urban agglomeration, the middle and lower reaches of the Yangtze River, the Fen-Wei Plain, and the northwest of Xinjiang. Meteorological factors, particularly variations in urban and rural precipitation and temperature, emerge as the primary drivers shaping the differences in urban and rural PM2.5 pollution in China. Precipitation significantly influences spring disparities, while temperature plays a crucial role in disparities during summer and winter. Notably, the impact of differences in urban and rural population density on PM2.5 pollution disparities closely follows meteorological factors.

The effect of biochar on Cd uptake in rice, based on the changes in interannual, biochar, and rice varieties

Oral - Abstract ID: 834

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Cadmium (Cd) pollution in soil and excessive Cd in rice are important issues around the world. Biochar has been widely used as a soil amendment to reduce Cd availability in soil-rice system. However, there is limited research that systematically reported the remediation effects based on multiple biochar and various rice cultivars in different years. A three-year field experiment was conducted to explore: 1) the effects of six commercial biochar (30 t/ha) on Cd uptake and accumulation in two rice varieties; 2) the differences in Cd uptake among 13 rice varieties and their responses to the application of biochar
(30 t/ha). The results showed that there were significant differences of Cd concentrations in the grains of different rice varieties, while hybrid rice cultivars had higher Cd accumulation ability than conventional cultivars. Different types of biochar can significantly reduce the Cd content in rice, while rice straw biochar had the best effect. Cd concentrations in rice grains varies largely among different years, which may attribute to the interannual fluctuations in temperature and rainfall; therefore, planting low accumulation varieties or applying biochar alone cannot ensure that the Cd content in rice is below the national standard limit. The effects of biochar and cultivars on Zn accumulations in rice grains were also discussed. Combining biochar with low Cd accumulation varieties provide a much more practical solution to ensure the safe production of rice.

The geochemical circulation of nutritional and potentially harmful elements in the human body: Current researches on bioavailability, bioaccessibility and dose-response relationships

Oral - Abstract ID: 621

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Abstract

About 99 per cent of the mass of the human body is made up of six elements: oxygen (O_2), carbon (C), hydrogen (H_2), nitrogen (N_2), calcium (Ca), and phosphorus (P). However, there are a number of other elements present in living tissues in much smaller amounts (trace elements, including metals, metalloids and isotopes) some of which are known to be nutritionally essential and others nonessential or even potentially toxic at very low levels of concentration.

The essential trace elements function primarily as catalysts in enzyme systems and other metabolic processes. Both the essential elements and nonessential elements can potentially give rise to disease depending on the concentration levels (excess or deficiency) present in living tissues. Bioavailability, bioaccessibility and dose-response relationships are among the main determinants of whether or not adverse effects are to be expected when organisms are exposed to toxic elements.

This paper presents an updated summary of the results from researches on the role of the physico-chemical properties of the different environmental media (soil, water and air) that control the bioavailability, bioaccessibility and dose-response relationships of elements that enter the human body using the phenomenon of geophagy (deliberate or sometimes inadvertent consumption of soil) in Africa as a case in point.

Finally, examples of the role of the physicochemical properties of geophagic soils in controlling bioavailability, bioaccessibility and dose-response relationships are discussed and an examination made of the criteria required for deciding whether bioavailability data should be used in a Human Health Risk Assessment.

Key words: Elements in human body; Dose-response; Excess/Deficiency; Geochemical diseases; Africa

The global potential for mitigating nitrous oxide emissions from croplands

Oral - Abstract ID: 221

Prof. Feng Zhou [1]

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Agricultural activities contribute almost half of the total anthropogenic nitrous oxide (N_2O) emissions but there is substantial potential to mitigate their emissions. Unfortunately, proper assessment of mitigation measures is hampered by large uncertainties introduced during the quantification of cropland-N_2O emissions and mitigation potentials. This review summarizes the up-to-date datasets and approaches to provide spatially-explicit and crop-specific assessment of the global potential to mitigate N_2O emissions through multiple strategies, including nitrogen (N) fertilization optimization, irrigation improvement, human dietary shift, and their combinations. Over the past six decades, global cropland-N_2O emissions have quadrupled to 1.2 Tg N_2O-N yr^{-1}. The highest mitigation potential is 0.7 Tg N_2O-N (i.e., 58% of global cropland-N_2O emissions) without compromising the crop production, with 86% of the potential was achieved by optimizing N fertilization and the rest from improved irrigation and shifting diets. Over three quarters (77%) of the global mitigation potential could be achieved from South Asia, Europe Union, China, Southeast Asia, other American countries, and the USA. More than two thirds (69%) of the global mitigation potential could be achieved from maize (20%), other crops (19%), vegetables & fruits (17%), and rice (13%). Future research and policy priorities for more accurate estimation of cropland-N_2O mitigation potentials are proposed, including the aspects of extending the N_2O observation network, improving modelling capacity, quantifying the feasibility of mitigation measures, and seeking for additional mitigation measures.

The health effect of subway environmental exposure

Oral - Abstract ID: 427

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With the city's quantitative expansion and its corresponding traffic congestion, around the world underground subway systems are the most-used general public transport in lots of major cities. The pulmonary inflammation induced by inhalation of subway PM2.5 is an outcome of interstitial lung disease characterised by fares of neutrophilic inflammation and by a substantial infiltration of CD4+ T cells. T cells are the kernel of pulmonary inflammation provoked by the inhalation of subway PM2.5 and the TLRs signal is one of the key pathways driving the pathogenesis of pulmonary inflammation by subway PM2.5. Our results demonstrate a dose-response manner between subway PM2.5 exposure and inflammatory injuries of extrapulmonary organs, which could be related to the TLR/MyD88/NF-κB signaling pathway. The exposure to subway platforms leads to the decrease in lung function indicators, the increase in exhaled nitric oxide and the expression of inflammation related factors in the serum of healthy volunteers. The conclusion of this study suggests that people who travel by the subway on a daily basis and expose to the underground transportation environments should concern about their respiratory health. The efficient measures to reduce PM2.5 concentration in subway stations should be developed, such as enhancing ventilation and emission control.

The heterogeneous reaction mechanism of atmospheric chlorine precursors at the cool air-liquid interface

Oral - Abstract ID: 431

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The heterogeneous reactions of chlorine precursors, such as HOCl and nitryl chloride (ClNO2), on air-water surfaces is of great interest because of their significant role in chloride lifecycle. Air-water surface is ubiquitous on ice surfaces under supercooled condition, affecting uptake and heterogeneous reaction processes of trace gases. Herein, a distinctive heterogeneous reaction mechanism of HOCl/ClNO2 is suggested on air-water surface under supercooled condition using combined classic molecular dynamics (MD) and Born−Oppenheimer MD simulations. To HOCl, the surface makes the Cl atom becomes the reactive site and is easily attacked by other species. Meanwhile, water on the surface forms a chain that decreases the energy barrier of the HCl formation form HOCl. To ClNO2, it is found that ClNO2 dissociates into a Cl- and NO2+ ionic pair. The resulting NO2+ undergoes hydrolysis reaction and continuously produces H3O+ and HNO3, resulting in surface acidification. In turn, surface acidification is a prerequisite to make the reaction of ClNO2 with Cl- barrierless, generating rapid formations of Cl2 and HONO. In conclusion, heterogenous reaction of ClNO2 on air-water surface finally contributes to molecule chloride and OH precursor. The proposed mechanism of the two chlorine precursors highlights the the key role of the air-water surface in the Cl chemistry in extremely cold environment like Arctic and other high latitude regions in wintertime.

The Hydrochemical Characteristics and Metal Element Health Risk Assessment of Typical Karst Springs in Northern China

Oral - Abstract ID: 896

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Longzici spring is an important water source for industry, agriculture and urban life in Linfen City. Identifying hydrochemical and heavy metal characteristics for rational development and utilization of karst groundwater resources and spring ecology. Taking the karst groundwater in the Longzici Spring Area as the research object，systematic sample collection and isotope analysis were carried out． Hydrochemistry, multivariate statistical analysis, and health risk assessment models were used to analyze the hydrochemical characteristics of groundwater. Revealed the hydrogeochemical characteristics, environmental isotope characteristics, metal element distribution characteristics, and health risks of Longzi Temple spring water exposure, The karst groundwater in Longzi Temple is mainly composed of $SO_4 \cdot HCO_3$-Ca and $SO_4 \cdot HCO_3$-Ca·Mg type water, A total of 70.3% of the karst groundwater SO_4^{2-}samples exceed the standard. The average concentrations of metal elements in groundwater from high to low are Fe, Al, Mn, Ni, as, Cu, Co, Pb, Hg and CD, respectively. Al, Mn, Fe and as exceed the limit of class III water standard in the quality standard for groundwater. Multivariate statistical results show that Pb, Ni, Co, CD, Mn and Cu are mainly affected by the geochemical background, while Al, Fe, Hg and as are closely related to human mining activities under the unique geological background of Shanxi Province. The health risks mainly came from drinking water, and the health risks through skin infiltration would not cause obvious harm to human body. As in spring groundwater is the main metal element causing the greatest health risk, so it should be controlled in the utilization of water resources, especially when it is used as drinking water source for children.

The involvement of HIF-1 signaling pathway in fluoride-induced liver injury

Oral - Abstract ID: 998

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Abstract

Excessive fluoride exposure has been linked to both skeletal and non-skeletal damage, with emerging evidence suggesting its association with impaired liver function. However, the precise mechanisms underlying fluoride-induced liver injury remain limited. Therefore, we used bioinformatics analysis combined with in vivo and in vitro experiments to explore the pathogenesis of liver injury caused by fluoride exposure.

Initially, the 408 genes associated with fluoride and liver disease were queried in the Comparative Toxicogenomics Database. Subsequently, these genes underwent Gene Ontology (GO) and Kyoto Encyclopedia of Genes and Genomes (KEGG) pathway analyses using the Oebiotech platform. Additionally, Protein-Protein Interaction network of these 408 genes was conducted using String database and Cytoscape software to calculate Betweenness Centrality (BC). The 20 hub genes were subsequently screened based on BC. Similarly, KEGG analysis was performed on the hub genes. Remarkably, both HIF-1 signaling pathways and apoptosis were also enriched among hub genes. To verify fluoride-induced liver injury and its specific mechanism, we conducted combined in vivo and in vitro experiments. In vivo experiment, 4-week-old SD rats were randomly selected to the control group (drinking pure water) and the fluoride-exposure group (drinking 100 mg/L NaF) for 8 weeks. There were obvious cell vacuoles, inflammatory infiltration and hemorrhage in the liver of rats in the fluoride-exposure group. Furthermore, based on the BC values, the qPCR experiments were validated in HepG2 cells exposed to NaF concentrations of 20, 40, and 80 mg/L. The results confirmed up-regulation of genes related to HIF-1 signaling pathway (*EGFR*, *AKT1*, *HIF1A*). And the genes related to apoptosis (*BCL2*, *Bax*, *Caspase3*) were activated by *HIF1A* in the fluoride-exposed group.

Consequently, our results reveal that fluoride exposure can induce hepatocyte apoptosis causing liver injury through activation of the HIF-1 signaling pathway.

Keywords: Fluoride, liver, HIF-1, Apoptosis

The joint effects of heat-humidity compound events on drowning mortality in Southern China

Oral - Abstract ID: 582

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Importance of the work and objectives: Several previous studies have examined the association of ambient temperature with drowning. However, no study has investigated the effects of heat-humidity compound events on drowning mortality. In the current study, we investigated the association of heat-humidity compound events with drowning mortality using a distributed lag non-linear model (DLNM) based on a large dataset in Southern China, and further assessed the mortality burden attributed to heat-humidity compound events.

Methodologies: The drowning mortality data and meteorological data during the 5 hottest months (May to September) were collected from 46 cities in Southern China (2013-2018 in Guangdong, Hunan, and Zhejiang provinces). DLNM was first conducted to examine the association between HHCEs and drowning mortality at city level. Then, meta-analysis was employed to pool the city-specific exposure-response associations. Finally, we analyzed the additive interaction of heat and humidity on drowning mortality.

Main Results and conclusion: Compared to wet-non-hot days, dry-hot days had greater effects (Excess Rate (ER)=32.34%, 95% Confidence interval (95%CI): 24.64%, 40.50%) on drowning mortality than wet-hot days (ER=14.38%, 95%CI: 6.80%, 22.50%). During dry-hot days, males (ER=42.40%, 95%CI: 31.92%, 53.72%), adolescents aged 0~14 years old (ER=45.00%, 95%CI: 21.98%, 72.35%) and urban city (ER=36.91%, 95%CI:23.87%, 51.32%) showed higher drowning mortality risk than their counterparts. For wet-hot days, males, adolescents and urban city had higher ERs than their counterparts. Attributable Fraction (AF) of drowning attributed to dry-hot days was 23.83% (95%CI: 21.67%, 26.99%) was significantly higher than that for wet-hot days (11.32%, 95%CI: 9.64%, 13.48%). We also observed high temperature and low humidity had additive interaction on drowning mortality. We found that dry-hot days had greater drowning mortality risk and burden than wet-hot days, and high temperature and low humidity might have synergy on drowning mortality.

The Past, Current Situation, and Future of China's Health Geological Survey

Oral - Abstract ID: 744

Dr. Jing Jin [1]

1. China Geological Survey

Health geological survey is a new type of comprehensive geological survey developed by the China Geological Survey since 2018, based on medical geology research. This article systematically reviews the development process of China's health geological survey from medical geology to health geology, and compares and analyzes the differences between health geology and medical geology in terms of benefits and harms to human health. Showcased the current status of health geological survey work. In the past 5 years, a total of nearly 40 million yuan has been invested, and more than 10 projects have been established. Pilot investigations focusing on drinking water endemic diseases, longevity villages, and mining areas have been carried out in more than 10 typical areas in Northeast, North, South, Southwest, and Northwest China. A preliminary technical and methodological system for health geological surveys has been established. In the future, health geological surveys will focus on elements that affect people's health, such as the earth's magnetic field and radioactivity, and will be deployed nationwide within 5-10 years, an integrated survey system of 'investigation-evaluation-monitoring-zoning' will be established, and one map of health geology will be constructed.

The role of geopolymers in environmental remediation: A case study of electrolytic manganese residue

Oral - Abstract ID: 960

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With the development of national social economy, the environmental pollution problems caused by general industrial waste are more and more, which has threatened people's health and ecological environment. Take manganese ore as an example, electrolytic manganese is one of the ways to obtain manganese resources in the world, due to environmental factors in the production process, the current electrolytic manganese producing countries are mainly China and South Africa. Especially in China, the annual output of electrolytic manganese is more than 1 million tons. According to statistics, each production of 1 ton of electrolytic metal manganese will produce 10 to 12 tons of electrolytic manganese slag. It is worth noting that because the waste slag contains a large number of soluble heavy metal ions and ammonia nitrogen and sulfate, in the process of storage, these harmful components will inevitably penetrate down with the water body through natural leaching, causing adverse effects on the ecological environment around the storage yard.

This report mainly introduces the preparation of industrial waste-based cementitious materials by alkali-activated geopolymer system. Focusing on the reaction process between electrolytic manganese residue as the precursor material of aluminosilicate and alkaline solution (sodium hydroxide, sodium silicate, etc.), the practical properties of electrolytic manganese residue-based geopolymers are studied, with a view to providing a green, efficient, and sustainable way for the reduction and resource utilization of industrial waste.

The role of thyroid stimulating hormone in the association between cadmium exposure and cognitive function

Oral - Abstract ID: 912

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Significance: Although animal studies have indicated Cadmium-induced neurotoxic effects through thyroid hormones disruption, few human-based studies have evaluated the effects of thyroid hormones on the association between Cadmium (Cd) exposure and cognitive function.

Objective: A cross-sectional study on 536 elderly adults was carried out in two counties with higher soil Cd.

Methods: The concentrations of urinary Cd and thyroid hormones were determined by inductively coupled plasma mass spectrometry and immunochemiluminometric assays, respectively, while the Mini-Mental State Examination (MMSE) was used to assess the cognitive status of participants. Conditional PROCESS analysis and the Johnson-Neyman technique were used to evaluate the moderation effect of thyroid hormone on the association between Cd exposure and cognitive function.

Results: For this population sample, the median (interquartile range) concentration of urinary Cd and daily dietary Cd intake was 2.52(1.30-4.86) μg/g Cr and 0.66(0.35-1.23) μg/kg BW, respectively. It was found that Cd exposure were negatively associated with the levels of thyroid stimulating hormone (TSH) and free triiodothyronine (FT3), as well as MMSE scores. Moreover, both lower (<2.30 mIU/L) and higher TSH levels (>4.50 mIU/L) were associated with lower MMSE scores. A significant interaction effect of Cd and TSH was observed in our study [β (95%CI)=0.17(0.01, 0.32), p=0.039], the negative relationship between urinary Cd and MMSE score could be found when TSH levels were below 4.08 mIU/L but not at higher levels.

Conclusions: Our results suggested that higher Cd exposure was associated with worse cognition performance in the older population, lower TSH could promote this association.

The sustainable and appropriate reuse of contaminated soils from brownfield sites in Ireland.

Oral - Abstract ID: 75

Mr. Owen Williams [1]

1. *Ireland Brownfield Network*

Contaminated soils can present an unacceptable risk to the health of site users and the water environment. To mitigate this risk, brownfield regeneration strategies in Ireland often rely on the excavation and disposal of these impacted soils to landfill. The opportunity to reclaim and return these soils back into the development cycle is therefore permanently lost. To promote a more circular economy approach to the process of managing brownfield soils, the Ireland Brownfield Network has been developing a procedure that will allow for the compliant reuse of these soils in specific and appropriate circumstances. Where developers and landowners can demonstrate that the excavated soils can be proven suitable for use (both geotechnically and geochemically), where there is a defined and agreed need for these soils, and where their reuse would not represent an unacceptable risk to human health or the wider environment, then the excavated soils need not be treated as a waste. This proposed non-waste status would be in keeping with all relevant domestic and EU waste legislation and would prevent soils from being discarded as a liability as opposed to being considered as a resource for alternative and future reuse. By adopting this voluntary proposed procedure, the Ireland Brownfield Network hopes that brownfield redevelopment in Ireland becomes more sustainable and less reliant on landfill disposal solutions.

Tipping points of marine phytoplankton to multiple environmental stressors

Oral - Abstract ID: 20

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Importance of the work:

Globally, anthropogenic climate change is threatening marine species. However, whether and how global marine phytoplankton, which represent the base of marine food webs, will exceed their tipping points under multiple climate factors remains unclear. Here, by establishing machine learning models, we identified the tipping points of global marine phytoplankton production and resistance under eight environmental stressors.

Objectives:

We aim to demonstrate the effectiveness of machine learning, specifically ensemble machine learning, in studying ecological responses to global climate changes with multiple stressors. Our next goal is to investigate the productivity, resistance, and biodiversity tipping points of phytoplankton that are threatened by intensifying climate changes. We intend to build models to analyze the relationships between extreme disturbances, environmental factors, and phytoplankton production, resistance, and richness. Lastly, we aim to identify and predict the tipping points of global marine phytoplankton production and resistance under multiple environmental stressors using machine learning models.

Methodologies:

We collected and identified extreme events of nine environmental variables describing the key dimensions dominating global marine phytoplankton responses. This study provides a framework for building robust machine learning models and identifying the critical tipping points of phytoplankton during multiple climatic and environmental disturbances using reliable machine learning models.

Main results:

Phytoplankton production and resistance are affected by multiple factors and the temperature and partial pressure of carbon dioxide dominate the risks for reaching their tipping points. If the current emission scenario continues, 50% (40-61% at 90% confidence) and 41% (2-80% at 90% confidence) of tropical areas would reach the tipping points of ongoing phytoplankton production and resistance decline, respectively, in 2100.

Conclusion

Compared with single- or few-factor studies, machine learning (for example, ensemble machine learning) provides a powerful and realistic solution for policy-makers facing large-scale ecological responses to global climate changes under multiple environmental stressors.

Towards the understanding of the aquifers of Salto, Uruguay hydrochemistry as drinking water: a medical geology perspective

Oral - Abstract ID: 114

Dr. Elena Alvareda [1], *Prof. Julian Ramos* [1], *Mr. Mariano Caceres* [2], *Prof. Lucas Bessone* [1], *Ms. Sofía Da Rocha* [1], *Dr. Rafael Navas* [1], *Dr. Valery Bühl* [3], *Dr. Pablo Gamazo* [1]

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In recent years, there has been a significant surge in drilling activities aimed at meeting the burgeoning demands of Uruguay's productive and industrial sectors. Consequently, an urgent need arises to assess any potential changes in water quality. Since 2016, the interdisciplinary Research Group of the Water Department at the Universidad de la República of Uruguay has undertaken multiple projects focused on Hydrochemical characterization and the evaluation of water quality with a Medical Geology approach.

Moreover, an extensive monitoring network of wells has been established in the Salto district, encompassing the San Antonio basin. This area is under intensive scrutiny for its water quality suitability for irrigation and drinking. The predominant water quality issues identified include elevated levels of Arsenic (ranging from 4.0 to 49.3 ugL^{-1}), Zinc (15.4 to 396.0 ugL^{-1}), Cr (only one well-recorded 3.1 ugL^{-1}), phenols (0.01 to 0.05 mgL^{-1}), Total Phosphorous (50.0 to 178.5 ugL^{-1}), nitrates (12.7 to 168.5 mgL^{-1}), and notably, 50% of the analysed wells exhibit microbiological contamination (specifically, faecal coliforms).

In 2021, the first risk distribution models for arsenic in groundwater in Uruguay were conducted in collaboration with Dr. Polya's group from the University of Manchester. This was achieved through a machine learning approach using 504 arsenic data points from Uruguayan wells provided by the State Sanitary Services Department (OSE). The findings revealed that the littoral southwest region presents the highest probability of experiencing elevated arsenic levels.

Building upon this, in 2023, integrated new fluoride data into the OSE database, we identified fluoride levels ranging from 0.038-2.5 mgL^{-1}. The maximum value of 2.5 mgL^{-1} was recorded in the Cerro Largo District. These comprehensive findings spotlight the most vulnerable areas that demand attention to safeguard human health. Furthermore, they illustrate promising progress in raising awareness regarding the critical importance of monitoring and maintaining water quality.

Toxicity mechanism of human respiratory system exposed to typical pathogens in vitro

Oral - Abstract ID: 353

Prof. Guiying Li [1]***, Ms. Caiqing Peng*** [1]***, Prof. Taicheng An*** [1]

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There are various pathogenic bacteria in the air that cause respiratory infections, and most of them are transmitted in the form of “aerosols”. Inhalation and deposition of pathogenic bacteria in the respiratory system area can cause allergic reactions or toxic reactions in humans and animals and even cause human diseases. In this study, a typical opportunistic pathogen *pseudomonas aeruginosa* (*P. aeruginosa*) was employed to expose respiratory epithelial cell lines (nasal mucosal cells HNEpC, nasopharyngeal cells NP69, bronchial cells 16HBE, and lung epithelial cells Beas-2B).

P. aeruginosa tended to adhere and invade to NP69 cells during the process of exposure to respiratory tract. In addition, nucleotide oligomeric structure domain (NOD) like receptor (NLRs receptor) genes (*NOD1* and *NOD2*) were found to be upregulated by 1.1-26.5 times in NP69 cells, and the cells specifically recognized the cell wall of *P. aeruginosa* and activated downstream signaling. The downstream toxicity also showed that *P. aeruginosa* were the target cells of *P. aeruginosa* in respiratory tract. *P. aeruginosa* inhibited the proliferation activity of respiratory tract cells and promoted the secretion of IL-6 and IL-1β. The cells showed an inflammatory response, which was confirmed by activating the NOD signaling pathway. Subsequently, the up-regulation of genes regulating mesenchymal transformation markers in epithelial cells indicated that the inflammatory cells may further develop into organ fibrotic cells and cancer cells.

These results resulted in valuable insights on the exposure risk of pathogenic bacteria to human respiratory cells, and molecular biological references for the health hazards and mechanisms of bioaerosols. It can be used as a reference to self-protection of the population and exposure detection of pathogenic microorganisms in epidemic period.

Tracing historical water quality changes in a Canadian lake: Unveiling shifts from agriculture to urbanization from sediment cores

Oral - Abstract ID: 847

Dr. Jovana Radosavljevic [1], *Ms. Stephanie Slowinski* [1], *Dr. Chris Parsons* [1], *Prof. Fereidoun Rezanezhad* [1], *Prof. Philippe Van Cappellen* [1]

1. University of Waterloo

In the face of accelerating agricultural intensification and urban growth, aquatic ecosystems are subject to increasingly complex and evolving challenges impacting sediment and water quality. Our research explores the history of Lake Wilcox in Ontario, Canada, providing insights on key periods of environmental change during watershed development going back to 1920. Through analysis of dated sediment cores, including the depth distributions of phosphorus, organic carbon (TOC), total nitrogen (TN), and chlorophyll-a (*chl*-a), and supported by multi-decadal water chemistry monitoring data, we reconstruct the successive impacts of agricultural intensification followed by urbanization. Analysis shows that agricultural expansion between 1945 and 1975 increased sediment inflow, eutrophication, and the sedimentary concentrations of total P, TOC, TN and *chl*-a. Simultaneous increases of the sediment TOC:TP ratios during this period suggest more intense hypolimnetic hypoxia, driven by the high agricultural P loads. Conversely, the subsequent phase of rapid urbanization (>1990) saw decreasing sediment accumulation rates that, together with changes in the composition of sedimentary P, are attributed to the implementation of hydrological and nutrient best management practices in the watershed. However, urbanization brought a new challenge – salinization. Increased lake salinity due to road salt use has been strengthening water column stratification by increasing water density. This is exacerbating summer anoxia and hypoxia that, in turn, intensifies the internal loading of P from the bottom sediments. Thus, despite significant reductions to P loading from the watershed, the eutrophication problems have persisted. These findings reveal a previously unrecognized yet crucial link between salinization and eutrophication, implying salinity management, along with traditional P load reductions, is essential for mitigating eutrophication in freshwater bodies. This research highlights the power of geochemical sediment core analysis in tracing the historical trajectories of pollution and nutrient cycling within lake ecosystems and demonstrates the important insights for future management of aquatic environments.

Tracing the Atmospheric Processing of Particulate Imidazole Compounds by Single particle Mass Spectrometry

Oral - Abstract ID: 160

Prof. Guohua Zhang [1]

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As a potential fraction of brown carbon, particulate imidazole compounds may initiate photosensitive reactions and have substantial radiative effects. However, our knowledge of the atmospheric processing of imidazole compounds is still in its nascent stage. On the basis of a single-particle aerosol mass spectrometer measurement, the mixing state of imidazole-containing particles and high-time-resolved variations of imidazole compounds were investigated. Five imidazole compounds (methylimidazole, ethylimidazole, dimethylimidazole, imidazole-2-carboxaldehyde, and 2,2′-biimidazole) were identified, overall accounting for 10% of all of the detected particles. They are tightly correlated and internally mixed with enhanced carbonyls, amines, and ammonium, supporting their secondary formation from these precursors. The number fraction of imidazole-containing particles exhibited predominant diurnal variations, especially on sunny days. A sharp decrease in the number fraction from morning to noon is most likely attributed to photochemical degradation. This is also confirmed by the reverse correlation ($r = -0.77$; $p < 0.01$) with photochemical indicators (temperature and O3) and our laboratory experiment by exposure of imidazole compounds to sunlight. Multiple linear regression and random forest analysis further support the hypothesis, with precursors (i.e., carbonyls and amines/ammonium) and O3 being the most important factors (□70%) regulating the variations of imidazole compounds.

Tracking the fate of halogenated organic contaminants in the environment by compound-specific isotope analysis

Oral - Abstract ID: 209

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Significant amounts of industrially produced organic compounds are used today in various areas of our life such as fuels, pesticides, and flame retardants resulting in their wide presence in the environment. Many of these anthropogenic organic compounds are classified as toxic/carcinogenic pollutants. Therefore, knowledge of their fate in the environment is of great importance.

The attenuation of organic pollutants in the environment can occur through degradative and/or non-degradative transformations. Degradation of the contaminant as a result of biological or chemical processes can lead to its mineralization or transformation to other organic compounds. However, in some cases, the degradation products can be even more dangerous than the initial contaminant.

In our study, we applied multi-elemental compound-specific isotope analysis (CSIA) to investigate the transformations of brominated and chlorinated organic contaminants. The investigated processes included abiotic reactions such as hydrolysis, Fenton oxidation, and dihaloelimination and microbiological transformations under aerobic and anaerobic conditions. To characterize the studied processes, double isotope trends (C-Cl, C-Br) were constructed. The implementation of two-element CSIA was performed to understand the transformation of bromochoroethane (BCE) and tetrabromoneopentyl alcohol (TBNPA) contamination occurring in Israel.

Transformation mechanism and health effects of typical preservative parabens

Oral - Abstract ID: 971

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1. *Guangdong University of Technology*

The pervasive presence of emerging contaminants (ECs) in environments and their associated adverse effects are underscored. Notably, the increased toxicity observed in the environmental transformation of ECs is often linked to the formation of transformation products (TPs). However, understanding the interaction and formation mechanisms contributing to increased toxicity, particularly concerning estrogenic effects, remains an unresolved challenge. To address this gap, by combining quantum chemical and molecular simulations with experiments, the identification and formation of TPs as well as their molecular interactions of estrogenic effect during the transformation of preservatives parabens such as benzylparaben (BZP). Our results revealed the identification of three previously unknown TPs during the transformation of BZP using a non-targeted analysis. Notably, two of these novel TPs exhibited higher estrogenic activities compared to the parent BZP. Furthermore, the binding free energies (ΔG_{bind}) of the oligomers BZP-*o*-phenol and BZP-*m*-phenol (-29.71 to -23.28 kcal/mol) were lower than the parent BZP (-20.86 kcal/mol), confirming that their stronger binding affinities to the ERα-LBD. In-depth examination of the formation mechanisms indicated that these toxic TPs primarily originated from the successive cleavage of ester bonds ($O\text{-}CH_2C_6H_5$ and -COO group), followed by their combination with BZP*. In summary, this study provides valuable insights into the mechanisms underlying the formation of toxic TPs and their binding interactions with endocrine-disrupting effects. It offers a crucial framework for elucidating the toxicological patterns of ECs with similar structures.

Transformation of exogenous lead in soil during anoxic-oxic alteration: Insights into the roles of phosphorus and organic matter from kinetic modeling

Oral - Abstract ID: 14

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Lead (Pb) can enter soil and sediment during flooding events such as surface runoff and intensive rainfall. However, it remains poorly understood the key fraction(s) controlling exogenous Pb^{2+} transformation during anoxic-oxic alteration, particularly how the indigenous phosphorus and organic matter contribute to Pb immobilization/release. In this study, a kinetic model was established to investigate the Pb transformation in a soil freshly contaminated with two levels of exogenous Pb^{2+}, i.e., 30 and 150 mg/kg, under alternating anoxic-oxic conditions, based on the results of Pb fractions determined via seven-step sequential extraction, dissolved organic carbon, sulfate, dissolved and HCl extracted iron, phosphorus, and soil surface sites. Our results revealed that the potentially available Pb, including dissolved, exchangeable, and specifically adsorbed fractions, was gradually transferred to the fulvic complex, Fe-Mn oxides bound, and sulfides bound Pb after 40-day anoxic incubation, while the fulvic complex Pb was further increased after 20-day oxic incubation. The concentrations of phosphorus that was extracted by 0.5 M HCl increased over time under anoxic conditions and then decreased under oxic conditions, which showed similar trend to the available Pb that was extracted with 0.03 M NH_4F in 0.025 M HCl. When Pb binding to the HCl-extracted phosphorus was added in the reactions of kinetic modeling, the simulated results of Pb transformation indicated that phosphorus was more important than organic matter for Pb immobilization under anoxic conditions. Under oxic conditions, however, the phosphates, Fe-Mn oxides, and sulfides bound Pb was slowly released and then complexed by fulvic acids due to the re-immobilization of dissolved organic matter in soil. The model established with low Pb level has been successfully applied to simulate the Pb transformation with high Pb level. Our findings provide a comprehensive understanding of the roles of phosphorus and organic matter in controlling Pb transformation in soil from kinetic modeling.

Transformation-derived risks and selective oxidation of highly concerned pharmaceuticals in water

Oral - Abstract ID: 496

Dr. Mingbao Feng [1]

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As emerging organic pollutants, pharmaceuticals are continuously entering environmental water bodies and exerting long-term and irreversible toxicity on aquatic species. Together with their occurrence in global water, more and more toxic and structurally stable transformation products have been also found. How to evaluate the transformation behavior of pharmaceuticals and their transformation-derived toxicity is an urgent environmental problem to be solved. Additionally, the abundant background components in water could competitively deplete water treatment oxidants and may generate toxic and persistent organic by-products. Therefore, the development of green and efficient water decontamination technologies with superior selectivity has become a hot topic in the water treatment field. The presenter will introduce his recent work on the transformation-derived risks and selective oxidation of pharmaceuticals in the aquatic environment. The research facilitates the understanding of the transformation-derived environmental risks of pharmaceuticals, and provides scientific basis for the development of efficient and selective oxidation strategies for sustainable water purification.

Transformed nanoparticles in the environment: the rise of beasts?

Oral - Abstract ID: 829

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Growing production and usage of nanoproducts result in the dissemination of engineered nanoparticles (ENPs) in the environment. Once released into the environment, ENPs undergo different physical, chemical, and biological transformations, which affect their properties and fate, including toxicity. Thus, in the present study, the chemical and biological transformations of two widely used ENPs (nano-CuO and nano-ZnO) were conducted, and further, the toxicity of transformed ENPs (*trans*-ENPs) was tested. The chemical transformation included sulphidation, while biological modification entailed creating protein corona (BSA) on ENPs surface. Because once-transformed ENPs may constantly be subject to modification, sulphidized ENPs were also coated with protein corona. *Trans*-ENPs were physicochemically characterized (TEM, DLS, BET, XRD, XRF, XPS, FTIR, ICP-OES). The acute toxicity of pristine (*p*-) and *trans*-ENPs was evaluated using daphnia (*Daphnia magna*) and cress (*Lepidium sativum*) as test organisms. The *p*-ENPs caused higher toxicity towards both organisms compared to *trans*-ENPs. However, considering the phytotoxicity level, the values of EC_{50} for BSA@ZnS were lower than ZnO, ZnS, and BSA@ZnO. In turn, toxicity to *D. magna* presented a different trend: ZnO~BSA@ZnS < ZnS < BSA@ZnO. Transformation of nano-CuO significantly decreased the toxicity to crustaceans and plants as follows: BSA@CuS < BSA@CuO < CuS < CuO. A strong body of data demonstrates that the bioactivity of ENPs is assigned to released metal, ENPs themselves, or both. However, the analysis of the concentration of Zn^{2+} and Cu^{2+} in test media did not reveal a clear relation with observed endpoints. It may indicate other mechanisms are responsible for toxicity e.g. the different biological identify of ENPs with biocorona may diversify their bioaccumulation. The study shed light on the transformation of ENPs, including their various behavior and toxicity patterns, which may be useful for the risk assessment related to nano-pollution.

Tunable oxygen vacancy and chainmail-structured graphene for boosting carbamate decomposition kinetics in CCS

Oral - Abstract ID: 813

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Importance of the work and objectives

Amine-based chemisorption using monoethanolamine (MEA) holds the promise for decarbonization due to its high capacity, maturity, and feasibility for controlling large volumes of CO_2-containing emissions from industrial sources. The amine-scrubbing process mainly involves two steps: absorption and desorption of CO_2. Unfortunately, high-temperature (~120°C) desorption requires extra energy consumption, hindering its further practical application. Catalytic carbamate decomposition using acid catalysts (SACs), has emerged as a most effective approach to reduce energy consumption of solvent regeneration. Specifically, the Brønsted acid sites (BASs) in SACs play a role of proton donors to accelerate the proton transfer process in the CO_2-loaded solvent and reduce the desorption energy. However, the regeneration of BASs in the basic amine-rich solution is challenging. Besides, Lewis acid sites (LASs), unsaturated coordination of metal atomic sites, combined with H_2O to form BASs releasing protons. However, the metal leaching caused the MEA degradation. The chemically stable metal sites not only enhanced adsorption of active substances, but also protects them from direct attack by leaching and oxidation.

Methodologies

The experimental regeneration of CO_2-MEA rich solvent was performed using the batch reactor. To better understand carbon capture in industrial process, a bench-scale continuous CO_2 adsorption-desorption (BCCAD) system with two random packing columns was constructed. This system allowed for the testing of various solvents and catalysts in a controlled environment, such as temperature, pressure, and flow rates, to provide valuable insights into their performance in capturing CO_2.

Main results and conclusion

We explore herein the idea through *in-situ* constructing OVs in heterojunctions to enhance the acidity. To enhance the chemical stability of catalyst, we developed the graphene nanochainmail-protected nanoparticle. The results of pyridine-adsorption infrared spectroscopy showed that the acidity of the material increased. Cyclic experiments show the success of chainmail-structured graphene protection strategy.

Understanding dissolved organic matters in reclaimed water and stormwater: Implications for reuse safety

Oral - Abstract ID: 397

Mr. Shufeng Lin [1], ***Prof. An Liu*** [1]

1. Shenzhen University

Importance of the work and objectives

Reclaimed water and stormwater are two important alternative water sources to mitigate water resource shortage. They can be reused by discharging into drinking water sources. Due to different sources, characteristics of dissolved organic matter (DOM, a precursor of disinfection by-products, DBPs) present in reclaimed water and stormwater would be different. This means that when they are blended with drinking water sources, it is very likely that DBPs formation is different. This study compared reclaimed water and stormwater in terms of DOM characteristics and DBPs formation. The research outcomes are expected to contribute to alternative water source reuse safety.

Methodology

This study investigated reclaimed water and stormwater (including stormwater runoff and rainwater without reaching ground surface)'s DOM characteristics, including concentrations, aromaticity, molecular weight, hydrophobicity/hydrophilicity and compositions. Additionally, two regulated DBPs' formation potential (FP), namely trihalomethane (THMs) and haloacetic acid (HAAs) were also compared for reclaimed water and stormwater.

Main results

The results showed that reclaimed water had higher dissolved organic carbon (DOC) concentrations (6.02-10.8 mg/L) than stormwater (3.62-5.48 mg/L) while $SUVA_{254}$ values of stormwater runoff (1.92-2.53 L/(mg-C·m)) were higher than reclaimed water (1.11-1.24 L/(mg-C·m)). Additionally, reclaimed water is more hydrophobic while stormwater runoff and rainwater are more hydrophilic. Although all water types included the highest fraction of DOM with molecular weight <1kDa (43.0%-77.5%), reclaimed water primarily contained soluble microbial products (SMPs)-like and humic acid-like substances while stormwater runoff primarily contained humic acid-like DOM. In terms of DBPs, reclaimed water showed relatively higher FP than stormwater runoff while rainwater had the lowest DBPs FP.

Conclusions

These outcomes can provide useful insight to effective water resource management and hence ensure water reuse safety. Particularly, when reclaimed water or/and stormwater are discharged into drinking water sources, these results can provide guidance to efficiently undertaking drinking water treatment.

Understanding the Interplay of Environmental, Socio-Economic, and Demographic Factors on Child Malnutrition in Flood-Prone Regions: A Comprehensive Quantitative Analysis

Oral - Abstract ID: 802

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Child nutrition is closely related to the available household conditions, living facilities, and the surrounding environment. One of the factors of child malnutrition is a flood. It significantly affects children's health and economic potential in low and middle-income countries. Consequences into adulthood, both in terms of health status, morbidity, and mortality of the children. Floods may also increase the prevalence of infectious diseases, such as diarrhea, leptospirosis, and cholera; vector-borne diseases are also noticed, leading to increased malnutrition in children **.** The study examines the interplay between flood-prone regions, socio-economic factors, demographic characteristics, and environmental conditions to understand their collective influence on the malnutrition status of children aged 1-5. The study is based on a comprehensive quantitative primary survey encompassing flood-prone and non-flood-prone regions. The determinants of nutritional deficiency, namely stunting, wasting, and underweight, were measured using the WHO standard Z-score. We have applied descriptive statistics, bivariate and multivariate analysis, and binary logistic regression for data analysis. The study findings reveal that the prevalence of stunting (54%), wasting (15.61%), and underweight (41%) while in the flood-prone region, the prevalence is relatively high stunting (57%), wasting (16.2%), and underweight (44%). Flood-prone regions and socio-demographic indicators, i.e., poor socioeconomic status, low birth weight, mother's illiteracy, housing conditions, and diversity of dietary habits, were significantly associated with child malnutrition. Improving socio-economic status, education, and increasing awareness among mothers about child care and nutrition can help improve maternal nutrition during pregnancy and thus enhance low birth weight. In sum, appropriate nutritional strategies, awareness programs, improvement in food security, and proper sanitation facilities may help improve children's nutritional status in flood and non-flood-prone regions**.** By addressing these factors comprehensively, it is possible to mitigate the adverse effects of flooding on child malnutrition and foster healthier outcomes for children in these areas.

Understanding the Release Kinetics of Brominated Flame Retardants from Microplastics

Oral - Abstract ID: 300

Prof. Hefa Cheng [1]

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The widely occurring debris of plastic materials, particularly microplastics, can be an important source of brominated flame retardants (BFRs), which are one of the main groups of chemicals added in the production of plastics from polymers. The release kinetics serves as a key linkage between the occurrence of BFRs in microplastics and their risk to the environment and ecosystem. The releases of flame retardants from microplastics typically involve three major steps: internal diffusion, mass transfer across the plastic-medium boundary layer, and diffusion in the environmental media. We demonstrated that the overall mass transfer rates for the releases from microplastics into air and aqueous medium are both controlled by diffusion within the plastic matrix. The overall release rates of BFRs from microplastics, which are dependent on the particle's geometry, can often be described by the Fick's Law. The physicochemical properties of BFRs and plastic matrix, and ambient temperature all affect the release rates, and can be described with empirical and semi-empirical models. Limited by the extremely slow diffusion in plastic matrices, the fluxes of BFRs released from microplastics are generally very low, and are unlikely to pose significant risk to the ecosystem. However, weathering of microplastics, which reduces their particle sizes and likely disrupts their polymeric structures, can greatly accelerate the releases of BFRs. These understanding could help better predict the risk of BFRs and other additives in the matrices of microplastics on the environment and ecosystem.

Unravel the defluorination mechanism and structural dependence of per- and polyfluoroalkyl substances (PFAS) for pollution control and optimal design of alternatives.

Oral - Abstract ID: 679

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Per- and polyfluoroalkyl substances (PFAS) are global concerning pollutants ubiquitously distributed in environmental matrices and biota, with > 14, 000 structures in the market. Their demonstrated persistence, bioaccumulation, and toxicity have increasingly compelled worldwide restrictions on the production and use of certain PFAS and probable regulations in drinking water. However, the superior stability and omniphobicity imparted by C−F bonds make PFAS indispensable in many industrial branches, making it difficult to ban them entirely. Producing alternatives with retained functionality but minimized adverse impact to the environment and remediation cost serves as a sustainable way to avoid regretful substitution as well as to resolve PFAS contamination. Destructive approaches with complete defluorination of PFAS are thus desired at the emission source. In this study, we demonstrate one single oxidizable site can trigger the complete destruction of PFAS by heat activated persulfate. Twenty-eight PFAS in four categories (−COO−, −CH, C=C, and $-NH_2$) were found to be completely defluorinated by persulfate within 12 h at 85 °C. For those without oxidizable site, we use hydrated electron produced from UV irradiation of aqueous sulfite to initiate reductive hydrodefluorination and break C−F directly under ambient conditions. Density functional theory (DFT) calculations were performed to unravel the structural dependent reactivity and depict the key reaction pathways. In particular, we found PFAS with favored electron transfer accepting moieties (C−Cl, −C=C−, COO^-, and $-(CF_2)_{n\geq6}$) will promote the degradation by hydrated electron. By achieving complete destruction for most PFAS structures, our results provide practical treatment and remediation technologies to solve the global PFAS control challenge. The unraveled mechanism for the defluorination of PFAS by persulfate and hydrated electron provides the opportunity to establish structure-reactivity prediction models for various other PFAS and optimal design of fluorochemicals considering both functionality and degradability.

Unveiling Per- and Polyfluoroalkyl Substance Contamination in Chinese Paper Products and Assessing Their Exposure Risk

Oral - Abstract ID: 123

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Per- and polyfluoroalkyl substances (PFAS) have garnered global attention in consumer goods due to their chemical stability and hydrophobic properties. Here we investigated the contamination characteristics, migration patterns and health risks of per- and polyfluoroalkyl substances (PFAS) in 66 Chinese paper products by using targeted and non-targeted screening methods. Among 57 targeted PFAS, 5 and 6 PFAS was found in the hygiene paper products (<LOQ-12.6 ng/g, 36%) and stationery paper products (<LOQ-8.8 ng/g, 54%), respectively. A total of 25 PFAS were detected in the 39 food contact paper products, with concentrations up to 1630 ng/g. Suspect and non-targeted analysis have found 28 PFAS with confidence levels 1-3, 132 certain PFAS compounds (confidence level 4) and 56 homologue groups (confidence level 5), containing newly identified long-chain fluorotelomer polymers (9:3/11:3FTCA, 11:3/13:3FTUCA) and X:2 FTOH-Sulfate. A potential transformation relationship between the detected PFAS was proposed, starting from X:2 FTOH and finally transforming to $C_nF_{2n+1}COOH$. Microwave heating can increase the release of PFAS in popcorn bags, coinciding with the transformation of long-chain PFAS into short-chain ones. The migration experiments indicated that the ethanol in food simulants can increase the migration of PFAS, and short-chain PFAS exhibits a greater migration trend in 50% ethanol than that in 95% ethanol. The estimated daily intake values for 6 of 18 paper bowls/plates exceeded the EFSA's 2020 recommendation of 0.63 ng/kg bw/day, posing a potential threat to human health. Our findings suggest that PFAS used in paper products could be released during the use and might affect human health.

Unveiling the antifungal potential of cold atmospheric plasma: Optimizing parameters for effective eradication of Candida albicans biofilm

Oral - Abstract ID: 745

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Objectives: Given that *Candida* spp. pose significant threats in healthcare-associated infections, there is a growing demand for innovative management strategies. This research delves into the efficacy of cold atmospheric plasma for treating *C. albicans* biofilms. ***Methods***: The study focuses on the in vitro response of *C. albicans* biofilms to varying parameters of plasma application, specifically exploring the effects of treatment duration and input voltage. Assessment of plasma influence on *C. albicans* includes viability, cell membrane integrity, and intracellular oxidative stress evaluation. The research also involves analysing biofilm chemical composition and assessing hyphae morphology before and after plasma treatment. ***Results***: Higher plasma input voltage and extended exposure time reduced *C. albicans* cell viability, with complete reductions observed after a five-minute plasma treatment across all tested input voltages. Microscopic examination following fluorescence staining further confirmed the impact of plasma treatment. Low exposure voltages potentially induced hormesis, as observed in *C. albicans* growth kinetics measurements. Intracellular oxidative stress assessment demonstrated increased intensity with prolonged treatment times. Plasma treatment influenced hyphae, causing signs of contraction and compression. Chemical analysis revealed a distinct impact of increasing plasma voltage and exposure time on lipids, proteins, and carbohydrates. ***Conclusion***: This study uncovers the potential of plasma as a promising approach to combat Candida spp. biofilms, providing insights into the intricate dynamics of its impact on biofilm viability, morphology, and composition. Findings have applicable public health value for fungi elimination from various surfaces ranging from human and veterinary medicine to industry and household environments.

Urban anthropogenic soils – potential urban diffuse soil contamination

Oral - Abstract ID: 81

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Information-based Strategies for LAND Remediation (ISLANDR) project gathers information on data sources for diffuse and local soil contamination in Europe. ISLANDR is funded by the European Union Horizon Europe research and innovation programme. In addition to atmospheric deposition or application of agrochemicals, diffuse contamination can be linked to urban soil management. One of the ISLANDR test areas is the city of Toulouse in France. There is some diffuse contamination caused by historical land use in the surface soil: Cu, Hg, Pb, C10-C40 and dioxins. Based on the previous findings and studies of BRGM, the city has been divided in 5 land units for excavated soil management.

Historical land use has caused diffuse lead contamination in urban anthropogenic soil in the Finnish city of Turku as well. In Turku, ten samples were selected for detailed geochemical and mineralogical studies. Geochemical studies included the analysis of semi-total Pb concentrations by aqua regia and weak leaches by ammonium-acetate-EDTA and by ammonium oxalate as well as Pb isotopes studies. Mineralogical analyses were conducted by FE-SEM-EDS. Pb isotope signatures revealed that Pb in the studied soils is derived from anthropogenic sources, since the isotope ratios were different from those in local geological sources. Mineralogical studies reveal a great variety of anthropogenic Pb carrier phases, thus there has been a mixture of diffuse Pb contamination in Turku.

In both cities, the elevated concentrations of metals in fillings must be taken into account in the re-use of soil and in land use planning. Historical reuse of excavated soil might have caused urban diffuse contamination. This can still be the case if the contaminants of emerging concern are not considered before the re-use of urban soil.

Urban geochemistry of Cagliari (Italy): towards a healthy city

Oral - Abstract ID: 130

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This study explores the urban geochemistry of Cagliari (Italy), with a specific focus on the topsoils (0-10 cm) in publicly accessible areas surrounding the built environment of the metropolitan city. The study aims to enhance existing strategic and planning tools for city management, addressing the prolonged impact of urban expansion on the delicate balance with the natural environment.

Utilizing a meticulous stratified systematic sampling approach, 58 samples were collected during the dry season from June to September 2022. Concentrations of Potential Toxic Elements (PTEs – Ag, As, Cd, Ce Co, Cr, Dy, Fe, Li, Mn, Mo, Na, Nd, Ni, Pb, Zn) were determined by Aqua Regia extraction, with subsequent inductively coupled plasma mass spectrometry (ICP-MS) analysis. Following these results, a subset of 30 samples were further investigated to evaluate the sample's mineralogy by X-Ray Diffractometry. Additional analyses were conducted on the subset to assess bioaccessibility through various methods, including: a dilute HNO_3 extraction (0.43M), a simple bioaccessibility extraction test (SBET) to estimate oral bioaccessibility, and an artificial-sweat extraction test aimed at estimating dermal bioaccessibility. Subsequently, the extractions underwent further scrutiny through the application of atomic absorption spectrometry (AAS) and ICP-MS techniques.

Our findings indicate that, despite sustained human activity since the Neolithic era, Cagliari's topsoils remain relatively clean, with concentrations (save for a few outliers) below Italian national contamination threshold for residential areas. Furthermore, the results derived from the bioaccessibility tests reinforce that anthropogenic influence on the surface environment hasn't reached levels posing a potential risk to the local population. These insights provide a new cornerstone for Cagliari's development of well-informed decisions in future strategies for sustainable urban development and environmental conservation, affirming the city's commitment to improving soil quality and fostering the health and well-being of its residents.

Using Artificial Intelligence and Big Data to inform Peatland Policy Development

Oral - Abstract ID: 12

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It is important to understand the significance of peatlands in the context of global Greenhouse Gas (GHG) emissions in order to fully appreciate the need for developing policies to restore and preserve them on a sustainable basis. Peatlands account for only 3% (circa 4 million km2) of the total global land area while they contain more than 30% of all global soil carbon weighing in at roughly 500 Gigatonnes (Gt). To put this in context, that is more than 1,000 times the weight of every single human being currently living on planet Earth or 100 billion African bull elephants or twice the total amount of carbon held in the biomass of all the world's forests. Using Artificial Intelligence and Big Data to inform Peatland policy development is one way that that we can fast-track the restoration of peatlands in order to reduce global GHG emissions by up to 5%.

Using HL7-FHIR as an Integration Platform for Chronic Disease Services Management and Planning in the Irish Healthcare Sector

Oral - Abstract ID: 97

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Background and Objects: As with healthcare systems in most countries, public healthcare systems in Ireland remain separate, posing challenges to effective healthcare service planning and delivery. The RECONNECT project proposes a novel method to develop digital health assets with the following objectives: (1) Integrating complex, mission-critical systems within the HSE related to chronic disease; (2) Prioritizing data privacy and governance; and (3) Facilitating seamless integration with future digital resources.

3- Step Methodology:

1. Structural Integration: A Federated Database design enables autonomy for existing systems while also facilitating different levels of privacy.
2. Semantic Integration: Inclusion of a Record Linkage to support an integration strategy in the absence of an individual identifier in current healthcare systems.
3. Adoption of Standards: Proposal of a new framework using the Fast Healthcare Interoperability Resources (HL7-FHIR) model for high levels of interoperability, independent of participating healthcare systems. The framework also aligns with the national electronic health record (EHR) and its proxies, such as the Integrated Information Service (IIS).

Results and Conclusion: The RECONNECT integrated chronic disease system differs significantly from any healthcare systems currently in place in Ireland. It is designed to:

(1) Incorporates a generic architecture based on Record Linkage, specifically designed for applicability in settings with loosely coupled information systems.
(2) Adhering to the global healthcare standard HL7-FHIR, it represents a novel application in the Irish context. This ensures a robust foundation for future interoperability in both inter-system and intra-system communication and integration.
(3) The system has the capability to efficiently reuse and share digital assets where appropriate.
(4) It incorporates a privacy layer to ensure the confidentiality of patient information.
A demonstration system, utilizing synthetic data from the Hospital Inpatient Enquiry (HIPE) system and the Chronic Disease Management (CDM) system, has been implemented on Neo4j for analysis, testing and visualization purposes.

Using machine-leaning models to assess water availability relative to socioeconomic status variables in the Northeast United States

Oral - Abstract ID: 198

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1. *U.S. Geological Survey*

In New Hampshire, USA, nearly 50 percent of the population use private wells. In parts of the southeast and southwest United States potential well-water-supply issues (for example, low yield or poor water quality) disproportionately affect some populations including those with lower socioeconomic status. The U.S. Geological Survey New England Water Science Center and the New Hampshire Department of Environmental Services are collaborating to investigate associations between proxy socioeconomic data and the susceptibility of private wells to water quality or quantity concerns—or, more broadly, water availability. We examined drinking water concerns for communities and individuals that are most susceptible to water quality or quantity issues by examining statistical associations between well construction characteristics, water quality, and socioeconomic status (SES) indicators for income and race.

We assessed vulnerabilities associated with private well water use at the Census block group scale using an USEPA tool that provides environmental, demographic, and socioeconomic indicators. We also assessed vulnerability at the individual well scale using data on race for Census blocks and parcel-specific data, such as taxable value. Preliminary results of univariate correlation and multivariate modeling suggest (1) well yields are lower and well depths are shallower for populations with older homes and homes taxed less, with the inverse for newer, higher taxed homes; (2) well yields and well depths are greater for newer homes; (3) water levels are deeper and well yields decrease with increasing well depth; and (4) the decrease in water levels and well yields is at a much lower rate than the increases in depth. This means that more water is available for use from deeper wells, which are generally associated with more affluent (higher SES) populations. Next steps include additional analyses by county and statewide, thorough discussion of limitations, and reporting.

Using pine bark and mussel shells as soil amendments to establish a rehabilitation strategy for Cu polluted viticultural soils

Oral - Abstract ID: 611

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Cu tends to accumulate in the upper layers of vineyard soils, given the historical application of copper-based fungicides in viticulture. Reducing the susceptibility of soils to Cu contamination is crucial because the literature has previously documented on the possible adverse effects of this accumulation in the soil to the various ecosystem compartments. This can be achieved through the development of practices that decrease its mobility and bioavailability in vulnerable soils (more acidic and poorer in organic matter), such as the use of amendments, that can modulate the behaviour of Cu in soils.

Therefore, the potential of soil amendments to remediate copper polluted soils was assessed, with the aim of identifying a strategy to safeguard vulnerable soils to Cu. This was accomplished by incorporating two soil amendments - pine bark and mussel shell - to a viticultural soil spiked with different concentrations of Bordeaux mixture. The effects of the amendment's addition to vineyard soils, their ability in reducing their vulnerability to Cu contamination and its mobilization to the aquatic compartment, were evaluated through a battery of ecotoxicological assays with both terrestrial and aquatic species.

For the most part, amendments were responsible for improving results of ecotoxicological assays, when comparing with those of the non-conditioned soil, being the aquatic plant *L. minor* the exception to this trend. Regarding Cu contamination, soil amendments brought benefits to the performance of all the tested species, which can be corroborated by the EC_{50} results. The EC_{50} values for these assays compared with the ones obtained for the non-conditioned soil were generally higher, although not in a linear way with increasing amendment concentrations. But in a general manner, the 24 mg kg^{-1} of the amendment's mixture had a positive effect in improving soil habitat and retention functions.

Validation of Dietary Intake of Dichlorodiphenyltrichloroethane and Metabolites in Two Populations from Beijing and Shenyang, China Based on the Residuals in Human Milk

Oral - Abstract ID: 258

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1. Beijing Normal University

This paper presents the results of an investigation on association between dietary intakes and human milk concentrations of dichlorodiphenyltrichloroethane and metabolites (DDTs) of two populations from Beijing and Shenyang, China. We analyzed human milk samples from 76 women and 287 composite food samples covering major food categories for concentrations of DDTs. We also collected information on food consumptions and calculated dietary intakes of DDTs of the participants on individual basis. The median values of the measured DDTs in human milk were 125 ng/g lipid and 132 ng/g lipid for the samples from Beijing and Shenyang, respectively. The mean (±standard deviation) daily dietary intakes of DDTs by the two groups were 32.0 ± 14.2 ng/kg·day and 27.9 ± 11.3 ng/kg·day, respectively. The temporal trends of decreasing in DDTs and increasing in DDE/DDT ratio suggested that the residuals were primarily from historical application. We found a significant correlation between human milk concentration and daily dietary intake of DDTs, while the dietary intake could explain 22% of the variation in the DDTs in human milk. In addition to dietary exposure, we also found that maternal body mass index (body weight divided by the squared height), body weight, body height, and mother's age contributed significantly to the variation of DDTs in human milk after intake normalization. The result of a probabilistic risk assessment indicated that the exposure of infants to DDTs through breast feeding would be a public health concern for years to come, although breast feeding is still recommended.

Vanadium in the soil-water nexus: fate, governing factors, potential risk, and remediation approaches

Oral - Abstract ID: 411

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Vanadium (V), although serving as an important component of industrial activities, has bioinorganic implications to pose highly toxic hazards to humans and animals. Vanadium can be transported in the soil-water nexus, and the transport can occur between soil-water, soil-plant and can be accumulated in the food chain and cause a potential human health risk. Vanadium is a redox-sensitive element with three dominant oxidation states (+3, +4 and +5) in environment. In the soil liquid phase, V(+5) is mobile and toxic under oxic conditions, while V(+3) is less toxic and might be expected to be predominant under euxinic conditions. In the soil solid phase, V is distributed among different mobile and immobile fractions, including the easily mobile, oxidizable, reducible, and mineral binding forms. The fate of V in the soil-water nexus and its solubility is governed by soil redox potential (E_H), soil pH, aliphatic and aromatic compounds of dissolved organic carbon (DOC), Fe-Mn oxides content, and microbial activities. Vanadium can react variably in response to changing soil E_H: under anoxic alkaline conditions, V mobilization can decrease because V(+5) can be reduced to relatively less soluble V(+4) via inorganic reactions such as with H_2S and organic matter and by metal-reducing microorganisms. Vanadium released into soil and water environments has obvious ecological and health hazards at high concentration levels. For example, when V enters the human body through diet and respiration it can cause respiratory disturbances, with possible human diseases including depression, neurasthenia, severe movement disorders, and chronic neurological disorders. Immobilization of soil V and mitigating its ecological and human health risk could be enhanced via reducing V(V) to less soluble V(IV) by decreasing E_H, increasing alkalinity, addition of aromatic organic compounds, and Fe-rich amendments, and/or natural reductants (e.g., organics, reducing iron minerals), which can be microbially enhanced.

Visual tracking of label-free microplastics in wheat seedlings and their effects on crop growth and physiology

Oral - Abstract ID: 415

Prof. Yongming Luo [1]

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The effects of microplastics on crop plants have attracted growing attention. However, little is known about the effects of microplastics and their extracts on the growth and physiology of wheat seedlings. In this study, hyperspectral-enhanced dark field microscopy and scanning electron microscopy were used to accurately track the accumulation of 200 nm label-free polystyrene microplastics (PS) in wheat seedlings. The PS accumulated along the root xylem cell wall and in the xylem vessel member and then moved toward to the shoots. In addition, lower concentration (≤ 5 mg/L) of microplastics increased root hydraulic conductivity by 80.6 % - 117.0 %. While higher PS treatment (200 mg/L) considerably decreased plant pigments content (chlorophyll a, b, and total chlorophyll) by 14.8 %, 19.9 %, and 17.2 %, respectively, and decreased root hydraulic conductivity by 50.7 %. Similarly, catalase activity was reduced by 17.7 % in root and 36.8 % in shoot. However, extracts from the PS solution showed no physiological effect on wheat. The result confirmed that it was the plastic particle, rather than the chemical reagents added in the microplastics, contributed to the physiological variation. These data will benefit to better understanding on the behavior of microplastics in soil plants, and to providing of convincing evidence for the effects of terrestrial microplastics.

Volatile organics and odors in the indoor environment

Oral - Abstract ID: 661

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Many of the odors present in indoor environments are associated with volatile organic compounds (VOCs), and complaints about poor indoor air quality are triggered rather by unpleasant or unexpected odors than be VOC test results. Therefore, it is important to study both VOC emissions and odor emissions from typical indoor materials such as construction materials, furniture, or furnishings. While accurate analysis of most VOCs is now possible using various techniques, determining odors remains challenging. Even standardized approaches like ISO-16000-28 rely on groups of human panelists and require statistical treatment of the data. Human olfactory perception is non-linear and can vary significantly between different substances, making it difficult to determine odor intensity even for single substances. There are currently no mature and reliable concepts available for assessing combinations of odors, which is the typical case in indoor environments. The situation is even worse for the odor quality/hedonic tone, where individual dislikes or preferences, as well as personal experiences, play a significant role and standardization becomes difficult or nearly impossible.

This presentation will provide an overview of the current state of development in VOC and odor testing, including their combination. It will highlight the possibilities, limitations, and shortcomings of different approaches. Examples of successful testing procedures for investigating construction products, furniture and consumer products will be discussed. A particular emphasis will be on the application of these procedures in researching various fragrance products and identifying off-odors.

Vulnerability of Portuguese vineyards soil to copper contamination: understanding regional variations

Oral - Abstract ID: 612

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The application of Cu-based fungicides throughout the years, lead to an accumulation of this potential toxic element in vineyard soils. However, its behaviour and availability will differ between soil types as it is dependent on physical and chemical properties such as texture, pH, and organic matter. This is specially concerning in a country like Portugal, that has different wine regions with different soil types. Thus, it is important to understand which soil properties most contribute to Cu behaviour/availability and vulnerability to be able to tackle this environmental problem. Soil samples from different Portuguese wine regions were collected and several physical and chemical properties were determined. Afterwards, soils were contaminated in laboratory conditions with different concentrations of Cu, left to acclimate for a month at room temperature and natural photoperiod and ecotoxicological assays were performed with aquatic species (using soil elutriates) and terrestrial organisms (using whole soil). In aquatic assays, the bioluminescence inhibition of *Allivibrio fischeri* (following manufacturers guidelines), growth inhibition of *Lemna minor* (OCDE guideline 221) and *Raphidocelis subcapitata* (OCDE guideline 201) and immobilization of *Daphnia magna* (OCDE guideline 202) were assessed. In the case of terrestrial assays, it was evaluated the reproductive output of *Eisenia fetida* (OCDE guideline 222) and *Folsomia candida* (OCDE guideline 232) as well as the germination and growth of *Medicago sativa* (OCDE guideline 208). Copper levels in the soil elutriates and tissues of earthworms and plants were also analysed. Results showed that the soil from Vinho Verde region (the one with the lowest pH) was more vulnerable towards Cu contamination as lower Cu concentrations already impaired the viability of the organisms tested. Furthermore, the species tested showed different levels of vulnerability when exposed to Cu which could be related with Cu levels found in the whole soil and soil elutriates as these also differed.

Wheatbiome project: Exploring the crosstalk between soil properties, cultivars, agronomic practices and microbiome for a sustainable wheat production

Oral - Abstract ID: 850

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Wheat, together with other cereals, account for more than half of total food and feed production. To meet the demands, FAO forecasts that by 2026 a 11% increase in wheat production is required. It is known that microorganisms play a pivotal role in regulating plant metabolism and have the potential to impact crop yield and quality. In this context, one of the main objectives of the European Project Wheatbiome (https://www.wheatbiome-project.eu) main goals is to understand: the crosstalk between soil properties (physical and chemical), and agronomic practices, wheat cultivars and the soil microbiome as a key for sustainable wheat production. This will be achieved through two case studies: (i) field trials in The Netherlands – focusing on wheat cultivars (five) and on soil types (four); and (ii) field trials in Spain - focusing on irrigation practices (irrigated vs. non-irrigated) and on production modes (organic vs. conventional). This study includes soil physical and chemical characterization, pesticide residues analysis, the structural and functional diversity of the bulk and rizhosphere soil microbial community through metabarcoding and BiologTM Ecoplates analysis. Results obtained until now, showed that in the The Netherlands case study the soil properties were not affect by the wheat cultivar, only reflecting the different soil types. In the Spanish case study, difference on soil physical-chemical properties did not allow to draw robust conclusions about the effect of agricultural practices on soil properties. Differences in the metabolic activity and in functional profile (carbon sources used) of the soil microbial community of one field in Spain, may be due to the lack of irrigation, however differences in soil type between fields do not allow supporting this hypothesis.

Whole blood cadmium levels and depressive symptoms in Chinese young adults

Oral - Abstract ID: 153

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Objectives

To investigate the association between Cd exposure and depressive symptoms in Chinese young adults. And to investigate the potential metabolic changes associated with high blood Cd concentrations.

Methods

We conducted a cohort study in 2019 and 2021. Blood Cd and depressive symptoms were collected during baseline and follow-up. The nine-item Patient Health Questionnaire (PHQ-9) scores were used to assess depressive symptoms. We used the generalized linear mixed model to estimate the association between blood Cd levels and depressive symptoms. A metabolomic and lipidomic analysis based on liquid chromatography-mass spectrometry was conducted on a total of 679 blood samples. The metabolomic data were analyzed using variance analysis and linear mixed effects models.

Results

Blood Cd concentrations were significantly associated with increased severity of depression symptoms [odds ratio (OR) 2.07, 95% confidence interval (CI) 1.04–4.11]. Metabolomics analysis found 93 metabolites with significant statistical differences between the lowest blood Cd level group and the highest Cd level group. Among the 93 differential metabolites, 17 were enriched in 7 differential metabolic pathways.

Conclusions

Blood Cd was associated with increased severity of depression symptoms in Chinese young adults. Cd exposure may affect depressive symptoms by inducing oxidative stress, inflammation, and disrupting amino acid metabolism.

Zeolite – the ‚magic stone' of geology – a benefit for human health

Oral - Abstract ID: 60

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Abstract. The term 'magic stone' was introduced by Frederick Mumpton in 1999 for zeolites, crystalline microporous aluminosilicates with remarkable properties of ion exchange, water adsorption and irreversible fixation of harmful substances. The basic investigations focus on the structure of zeolite as well as the adsorption and desorption properties. On the other hand, the zeolite is clinically tested in various formulations and used both topically and orally. In our investigations we use Cuban zeolite, which consists of a mixture of the medium-pore clinoptilolite and the large-pore mordenite. The Cuban zeolite was used in particle sizes of ~ 40 µm (oral ingestion) and ~ 3 µm (topical use).

The binding capacity of histamine, which performs pleiotropic effects in human beings like histamine intolerance and gastric acid production, is significantly higher for Cuban zeolite than for clinoptilolite alone. Similar results were received with serotonin well known as the 'hormone for fortune' in the brain. The used zeolite adsorbs serotonin in the same range as histamine and was strongly bound independent of pH value and zeolite framework. Thus, the medical use of zeolite has proven to be particularly effective for diseases in which histamine and serotonin play a regulatory role. One example of this is diarrhea in neuroendocrine tumors, which is caused by a greatly increased serotonin level. Cuban zeolite formulation Detoxsan® was able to reduce bowel movements of patients suffering from therapy-refractory diarrhea. The same applies for use in gastritis and heartburn, which are accompanied by an increased histamine level.

Furthermore, a special anhydrous formulation for topical application on skin surface (Detoxsan® Paste) is able to restore damaged skin. This has been shown in particular for intertrigo and mycosis, but also for eczema and other skin diseases. These results show the usefulness of zeolite for maintaining human health.

Zinc Bioaccumulation capacity and driving factors in soil-crop system in China

Oral - Abstract ID: 695

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Both inadequate and excessive zinc intake could pose health risks to humans. Consumption of staple foods contaminated by zinc constitutes a major route of human exposure through the food chain. Therefore, the zinc content of these staple foods is of fundamental importance for human health. This study revealed the characteristics of zinc accumulation from soil to cereal crops across China on a national scale. The order of the median zinc concentrations in staple crops was wheat (26.50 mg/kg) > maize (19.05 mg/kg) > rice (16.73 mg/kg), indicating that wheat had the highest zinc bioaccumulation capacity from soil to grain. Additionally, key factors influencing zinc content in crop grains were quantitatively assessed using a machine learning approach. Random forest modeling results show that species is the primary controlling factor affecting the zinc content in crop seeds, accounting for 45% of all influencing factors. Additionally, annual average precipitation, accumulated temperature above 0 degrees Celsius, soil pH, and soil zinc content are major factors influencing zinc levels in crop seeds. Our findings provide crucial insights for formulating robust crop cultivation management strategies to ensure both food safety and human health in China.

Poster Presentations

A novel pH-responsive multi-component nano-delivery system for siRNA: specific targeting of heat shock protein 70 for effective control of tobacco mosaic virus

Poster - Abstract ID: 364

Prof. Jinguang Yang [1]

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Nanoscale strategies based on RNA interference (RNAi) are rapidly evolving into sustainable platforms for plant disease control. Here, we screened an siRNA that effectively targets the 70-kDa heat shock protein (HSP70), which is closely associated with plant virus infection and replication. By using tetrahedral DNA nanoparticles (TDN), cell shuttling peptide (CPP), and polydopamine hybrid mesoporous silica nanoparticles (PDA-MSN) as nanocarriers for the delivery oft he siRNA, we develop a hierarchical nano-system with a size of about 130 nm. The experimental results show that this delivery system effectively increase the utilization efficiency of siRNA and promote its release in a weakly acidic environment (pH=6). It effectively down-regulate the HSP70 gene by about 56.2% and inhibit tobacco mosaic virus (TMV) and potato virus Y (PVY) infections by about 70.2% and 41.0%, respectively. By skillfully constructing a framework for siRNA inhibition of target genes, this technique broadens the application of RNA silencing in plant diseases management.

A novel tool for tracing water sources of streamflow in a mixed land-use catchment

Poster - Abstract ID: 262

Dr. Junfang Cui [1], ***Mr. Zhixiang Sun*** [1], ***Dr. Jianhua Cheng*** [2], ***Prof. Xiangyu Tang*** [2]

1. *Institute of Mountain Hazards and Environment, Chinese Academy of Sciences,* ***2.*** *Zhejiang A&F University*

Tracing water sources of streamflow in a mixed land-use catchment is critical for predicting pollutant emissions from various human activities to streams but remains a major challenge. A rain event based field monitoring study was conducted in the Jieliu catchment located in the hilly area of central Sichuan Province, southwest China. The ratio of the maximum fluorescence intensities (Fmax) of the two humic-like dissolved organic matter (DOM) components at excitation/emission wavelengths of 255 (315)/415 nm (component 1; C1) and 260 (375)/480 nm (component 2; C2) was proposed as a tracer for quantifying streamflow water sources. Satisfactory performance of using the Fmax(C1)/Fmax(C2) ratio in hydrograph separation of streamflow at the outlet of a forest sub-catchment was verified by through comparison with the hydrograph separation results based on δ18O data. The Fmax(C1)/Fmax(C2) ratio was then applied to estimate the contributions of rainwater and pre-event water sources under different land use types to the streamflow in an agro-forest sub-catchment and the entire catch�ment. The hydrograph separation results using the Fmax(C1)/Fmax(C2) ratio can be used to support the optimization of water resource management and the quantification of pollutant loadings from major water sources to streams at the catchment scale.

Abundance, diversity and physiological preferences of comammox Nitrospira in urban groundwater

Poster - Abstract ID: 940

Dr. Ping Han [1]***, Mr. Xiufeng Tang*** [1]***, Dr. Ye Li*** [1]***, Prof. Lijun Hou*** [1]***, Prof. Min Liu*** [1]

1. *East China Normal University*

Complete ammonia oxidizer (comammox *Nitrospira*), catalyze complete nitrification process in a single organism, are frequently detected in groundwater ecosystem. However, the ecological niches and environmental driving factors of comammox *Nitrospira* in urban groundwater are largely unknown. Here we investigated the communities of ammonia oxidizers in urban groundwater located in Shanghai city, China. Quantitative analysis demonstrated the dominance of comammox *Nitrospira* over classical ammonia oxidizers (ammonia-oxidizing archaea and bacteria, AOA and AOB). Phylogenetic analysis showed clades B and A2 comprise the majority of comammox *Nitrospira* groups. Temperature was one of the most vital factors affecting comammox *Nitrospira* community. Furthermore, clade A comammox *Nitrospira* can be enriched by urea substrate, which was in line with the ability of utilizing urea by the pure clade A comammox culture Nitrospira inopinata. In addition, we observed that relatively low temperature (<20 degrees C) and high copper levels (>0.04 mg L^{-1}) can stimulate the growth of comammox *Nitrospira*. Overall, this study revealed the presence, diversity and physiological preferences of comammox *Nitrospira* in urban groundwater nitrification, shedding insights on the ecological roles of comammox Nitrospira in subsurface environment.

Ambient Air Pollution and Hospital Admission for Interstitial Lung Diseases

Poster - Abstract ID: 355

Ms. Yi Zheng [1], ***Dr. Hong Sun*** [2], ***Dr. Jing Wei*** [3], ***Ms. Xiaohong Jia*** [1], ***Ms. Lu Luo*** [1], ***Ms. Ruijun Xu*** [1], ***Dr. Chunxiang Shi*** [4], ***Mr. Rui Wang*** [5], ***Prof. Yuewei Liu*** [1]

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Rationale: Recent studies have linked ambient air pollution to the acute exacerbation of certain interstitial lung diseases (ILDs), but the evidence remains limited and inconclusive.

Objectives: To investigate the association of short-term exposure to air pollution with hospital admission for ILDs.

Methods: With a multicenter hospital-based case-crossover design, we investigated 9,128 patients who lived in Jiangsu province, China and were admitted for ILDs during 2019-2022. Exposure to particulate matter ≤ 2.5 μm in aerodynamic diameter ($PM_{2.5}$), PM_{10}, sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and ozone (O_3) were assessed using a validated grid dataset at each patient's residential address. Conditional logistic regression models were employed for exposure-response analyses.

Measurements and Main Results: Each 10 $\mu g/m^3$ increase of exposure to ambient SO_2 and NO_2 was significantly associated with a 16.18% (95% confidence interval [CI]: 3.79%, 30.03%) and 4.06% (95% CI: 0.75%, 7.49%) increase in odds of hospital admission for ILDs, respectively. No departures from linearity were detected for these associations. We did not observe effect modifications by sex, age, or season, except that the association between NO_2 exposure and ILD admission was significantly stronger in older adults. We estimated that over 10% of ILD admissions were attributable to ambient air pollution.

Conclusions: We found that short-term exposure to ambient air pollution was significantly associated with an increased odds of hospital admission for ILDs. Our findings suggest that ambient air pollution leads to the exacerbation of ILDs especially in older adults, and the disease burden is considerable.

An adverse outcome pathway framework of PM2.5 and vascular calcification

Poster - Abstract ID: 785

Prof. Zhiwei Sun [1], ***Prof. Junchao Duan*** [1], ***Mr. Ruiyang Ding*** [1], ***Ms. Linyuan Huang*** [1], ***Ms. Kanglin Yan*** [1]

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Despite the air quality has generally improved in recent years, ambient fine particulate matter ($PM_{2.5}$) remains one of the major threats to public health. Vascular calcification is a systematic pathology associated with an increased risk of cardiovascular disease. Although the epidemiological evidence has uncovered the association between $PM_{2.5}$ exposure and vascular calcification, little is known about the underlying mechanisms. The adverse outcome pathway (AOP) concept offers a comprehensive interpretation of all of the findings obtained by toxicological and epidemiological studies. In this review, reactive oxygen species (ROS) generation was identified as the molecular initiating event (MIE), which targeted subsequent key events (KE) such as oxidative stress, inflammation, autophagy, endoplasmic reticulum (ER) stress from the cellular to the tissue/organ level. These KEs eventually led to the adverse outcome (AO), namely increased incidence of vascular calcification morbidity. To the best of our knowledge, this is the first AOP framework devoted to $PM_{2.5}$-associated vascular calcification, which will benefit future investigations on $PM_{2.5}$-related health impacts.

Analysis and Study of Eight Arsenic Forms in Urine by HPLC-ICP/MS

Poster - Abstract ID: 454

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Objective: Arsenic is widely found in nature and has many forms, mainly arsenite (AsIII), arsenate (AsV), monomethylarsenic (MMA), dimethylarsenic (DMA), arsenic choline (AsC), arsenobetaine (AsB), etc. People ingest arsenic through food and water, and it is excreted in the urine after metabolism. Due to the different toxicity of different forms of arsenic, trimethylarsenic (TMAO) and tetramethylarsenic ion (TETRA) have also attracted attention in recent years, but less research has been done. In this study, eight arsenic forms, AsV, AsIII, MMA, DMA, TMAO, TETRA, AsC and AsB, were analyzed in urine by HPLC-ICP/MS.

Method: The urine samples were analyzed and determined by HPLC-ICP/MS after 3-fold dilution with water .The chromatographic column was Shim-pack VP-ODS, and the mobile phase was 10 mmol/L sodium butanesulfonate, 4 mmol/L malonic acid, 4 mmol/L tetramethylammonium hydroxide, and 5 mmol/L ammonium dihydrogen phosphate (1% methanol).

Results：The linear ranges of the eight arsenic forms were 0~100 μg/L, the limits of detection were 0.2~0.5 μg/L. The recoveries of the spiked arsenic forms at different concentrations were between 80% and 120%, the relative standard deviations were less than 5%, and the certified standards were determined to be within the range of the labeled values. The urine samples with different arsenic exposure were analyzed, and it was found that the arsenic forms varied greatly.When certain animal seafood is ingested, it is present mainly in the form of DMA, AsB, MMA, and to a lesser extent AsC, TETRA.

Conclusion：This method is simple, sensitive and accurate for the analysis and determination of eight arsenic forms in urine. The human body is exposed to arsenic from different environments, and the metabolized arsenic forms are of different kinds.

Keywords：HPLC-ICP/MS;Human urine;Arsenic forms

Analysis of the Source and Multimedia distribution for Antibiotics in the Fenhe River Basin

Poster - Abstract ID: 572

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In the 20th century, antibiotics were rapidly and widely used worldwide, not only for the prevention or treatment of bacterial diseases in humans, but also for promoting animal growth in the livestock industry. But the widespread use of antibiotics also poses a great threat to ecological security and human health. As the ultimate destination of antibiotics, the watershed environment contains various different media and plays an important role in the migration and fate of antibiotics. This study focuses on 26 antibiotics in the Fen River Basin, the main sources and spatiotemporal distribution patterns of antibiotic contamination in different media were revealed, and the partition behavior of antibiotics from different sources were calculated.

The PMF results indicated that main sources of antibiotics in the sediments were farmland drainage (31.02%), pharmaceutical wastewater (23.78%), sewage treatment plant (20%), aquaculture (9.93%), domestic sewage (8.57%), and livestock (6.69%). Source-specific Partition Coefficient(*S-Kp*) calculations revealed that SAs, TCs, and CAs had high *S-Kp* values. The antibiotic SQX in SAs had the highest *S-Kp* value of 34740.04 L/kg. Antibiotics from pharmaceutical wastewater and farmland drainage were present in sediments upstream, midstream, and downstream. In contrast, antibiotics were particularly concentrated in midstream and downstream areas in aquaculture.

Analyzing Temperature and Solar Radiation Trend Predictions using data driven Hybrid model

Poster - Abstract ID: 772

Ms. Apoorva Bamal [1], *Dr. Md. Galal Uddin* [1], *Dr. Indiana A. Olbert* [2]

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Hydro-climatic data analysis is crucial for assessing climate change and various interactive features of the environment. To date, a range of tools and techniques are widely used for such analysis, and Machine learning/Deep learning (ML/DL) approaches are one of them. The research aim of this study was to analyze the hydro-climatic variables such as temperature and solar radiation to identify their trends over the years in the context of Ireland. The study utilized 15 ML/AI algorithms inclusive of hybrid models to analyze the prediction trend of these variables. Based on trial and error, two hybrid models: (i) CNN+RNN+DNN (Convolutional Neural Network (CNN) + Recurrent Neural Networks (RNN) + Deep Neural Network (DNN)); and (ii) ANN-MLP (Artificial Neural Networks- MultiLayer Perceptron) outperformed compared to others in terms of performance metrics. Compared to the other models, hybrid model ii (ANN-MLP) outperformed for both temperature and solar radiation (Temperature- training: R^2= 0.68, and testing: R^2 = 0.96; Solar radiation- training: R^2= 0.96, and testing: R^2 = 0.97). The results reveal that the hybrid model was effective and precise as compared to the individual algorithms and the model represented the data with higher accuracy. It also highlighted an upward trend in both temperature and solar radiation that aligned with the global climate data findings. Additionally, the findings of this research revealed that the hybrid machine learning algorithm could be effective for identifying the trend pattern and hidden attributes of hydroclimatic variables in long-term and high-dimensional data. This developed model can be used by researchers, climate practitioners, and policymakers to understand climate data trends and predictions for future policy implications.

Application of Adverse outcome pathway (AOP) network approach to study reproductive toxicity induced by endocrine disruptor Chemicals

Poster - Abstract ID: 576

Prof. Qi Wang [1]

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Endocrine Disrupting Chemicals (EDCs) can induce reproductive toxicity in both humans and animals. Extensive efforts have been directed towards understanding the mode of action (MoA) of these EDCs, which often act in complex chemical environments. Recent advancements in computational tools have significantly enhanced this field, offering high reliability, efficiency, and accessibility. The Adverse Outcome Pathway (AOP) network stands out as a comprehensive method for exploring potential pathways of reproductive toxicity caused by EDCs. This review aims to provide a comprehensive guide for implementing an AOP network to evaluate reproductive toxicity induced by EDCs. We discuss the principles for establishing an AOP network, present widely used software, and toolboxes for its construction, and illustrate several successful case studies of reproductive toxicity induced by EDCs using the AOP network. Additionally, we propose future directions for the development of a quantitative AOP network.

Application of X-ray fluorescence core scanning for high resolution analysis of soil geochemical concentrations.

Poster - Abstract ID: 1013

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X-ray fluorescence (XRF) core scanning is a widely used method for determining geochemical concentrations in high resolution (less than 400μm) in sediments. However, its application in soils has not been thoroughly explored. This study investigates the potential of XRF core scanning in soils by analyzing nine grassland soil cores and calibrating the measured XRF counts against element concentrations obtained through Inductively Coupled Plasma (ICP) analysis.

To assess whether XRF core scanning can achieve higher resolution data in soils, reference measurements were taken at 10cm intervals for the nine cores, and at both 10cm and 1cm intervals for a single core. The single core served as a test set to evaluate the performance of a model trained on 10cm interval data when applied to both 10cm and 1cm interval test sets. Additionally, cross-validation was performed on all cores to further validate the model.

Pressed pellets made from 10cm interval samples were also scanned to assist in variable selection and improve the accuracy of the predictions. Various preprocessing techniques were applied to enhance the data quality.

The study found that elements such as calcium (Ca), phosphorus (P), zinc (Zn), strontium (Sr), and sulfur (S) were very accurately predicted at 1cm intervals, with R^2 values of 0.94, 0.93, 0.93, 0.93, and 0.91, respectively. These results indicate that XRF core scanning has significant potential for providing high-resolution geochemical information in soils, similar to its established use in sediments.

This research demonstrates that XRF core scanning, when calibrated and validated appropriately, can be a powerful tool for soil analysis, offering high-resolution insights that can aid in better understanding soil composition and variability. This could have important implications for soil science, including applications in agriculture, environmental monitoring, and land management.

Assessment of heavy metal contamination in the soil and maize from an agricultural area in Northeast China

Poster - Abstract ID: 195

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The pollution of heavy metals in the environment is a matter of growing public concern, and the contamination of agricultural soil with heavy metals also poses high threats to both the safety of food and public health. The research was conducted in an agricultural area in the northeast of China, and a total of 80 stations and 1 section of soil and maize samples were collected for the analysis of heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn) and Pb isotopic compositions. The values of the geological accumulation index (I_{geo}), pollution load index (PLI), contamination factor (CF), bio-concentration factor (BCF) and translocation factor (TF) were calculated to evaluate the level of heavy metal pollution. The contents of heavy metals on the surface were higher than the local soil background values, with exceeding rates in the order of As>Cd>Cu>Cr>Ni>Hg>Pb>Zn. The heavy metals have accumulated slightly over the past few decades, and the level of heavy metal contamination in the studied area was generally low, with the contamination of As, Cd and Cu being more pronounced. Cd was more likely to get into maize roots from the soil, while Ni, As, Cr and Pb were less likely to build up in maize roots. Zn exhibited the greatest mobility from the root to the grain, whereas more than 90% of the absorbed Cd, As and Cr were maintained in the roots. Even though the heavy metal contents in the grain of the maize were below the Chinese food pollutant limit standards, the potential risk of heavy metal accumulation in the food chain should still be addressed seriously. This work provides a thorough assessment of soil contamination by heavy metals in an agricultural area and could provide a basis for local soil pollution prevention and risk control of heavy metals.

Associations of compound hot extreme in warm season with adults' blood pressure and its potential driving factors: a panel study

Poster - Abstract ID: 358

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Objective This study aimed to explore the associations of compound hot extreme with adults' blood pressure and its potential driving factors. **Methods** A panel study design was used, and 35 adults in Panyu district, Guangzhou city, Guangdong province were followed up during May to October of 2020. Participants were required to carry portable temperature and humidity data recorders during the study period, which was used to collected their real exposure of temperature and humidity. They were also required to measure blood pressure once a month. A randomized effect model with cross-basis function of distribution lag non-linear model was used to explore the association of compound hot extreme with blood pressure, heart rate, aldosterone, angiotensin □ (Ang □), homocysteine, high-sensitivity C-reactive protein (hs-CRP) and alcohol consumption. **Results** Compared to the normal day, independent hot day and hot night were not significantly associated with adults' blood pressure. Compound hot extreme was related to 8.35 (95%*CI*: 2.54 ~ 14.15)mmHg of systolic pressure and 6.55 (95%*CI*: 1.49 ~ 11.60)mmHg increase of diastolic pressure. However, significant associations of independent hot day and independent hot night on blood pressure were not observed. With regard to the physiological drivers, exposed to compound hot extreme was associated with 28.29 (95%*CI*: 1.52 ~ 55.07)pg/mL increase of Ang □ and 1.24 (95%*CI*: 0.25 ~ 2.46)mg/L increase of hs-CRP. With regard to the behavioral drivers, people tended to drink more beer (change of consumption: 200.69 mL, 95%*CI*: 79.16 ~ 322.22)mL when exposed to compound hot extreme. **Conclusion:** With climate change, more attention should be paid on compound hot extreme, and improve the adaption and warning ability, which could alleviate its health impact.

Behavior and fate of short chain chlorinated paraffins (SCCPs) in different oxidation reactions

Poster - Abstract ID: 342

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Short chain chlorinated paraffins (SCCPs) have attracted extensive attention due to their adverse effects on soil organisms and humans. However, comprehensive understanding of the degradation of SCCPs is still limited. In this work, the behavior and fate of SCCPs during advanced oxidation processes (AOPs) in contaminated soil were studied. The concentration and congener profile of SCCPs before and after the oxidations were determined. Results showed that SCCPs (1 mg kg^{-1}) could be effectively degraded within 120 h by four common oxidants, including hydrogen peroxide (H_2O_2), Fenton (H_2O_2/Fe^{2+}), potassium permanganate ($KMnO_4$), and sodium persulfate ($Na_2S_2O_8$). The optimal degradation efficiency followed the order $KMnO_4$ (93.3%) > $Na_2S_2O_8$ (91.9%) > Fenton (90.4%) > H_2O_2 (84.3%). After the oxidation treatment, the relative abundance of $C_{10}Cl_{8\sim10}$, $C_{11}Cl_{8\sim10}$, $C_{12}Cl_{8\sim10}$, and $C_{13}Cl_{8\sim10}$ increased, among that $C_{10}H_{13}Cl_9$ increased the most (1.71% – 2.52%, in mass ratio). While the relative abundance of $C_{10}Cl_{5\sim7}$, $C_{11}Cl_{5\sim7}$, and $C_{12}Cl_{6\sim7}$ decreased significantly, and $C_{11}H_{18}Cl_6$ decreased the most (-3.81% – -6.18%, in mass ratio). Density functional theory (DFT) calculations were used to explain these observations. Compared to carbon atomic percentage, chlorine atomic percentage had greater impacts on the degradation of SCCP congeners, which showed a significant negative correlation. However, four congeners consistently failed to follow this pattern, such as $C_{12}H_{21}Cl_5$, $C_{13}H_{22}Cl_6$, $C_{12}H_{16}Cl_{10}$, and $C_{13}H_{18}Cl_{10}$. This work is expected to provide data and technical support for remediation in typical SCCPs contaminated soil.

Characteristics of geochemical gene in a longevity village of Bama in Guangxi, China

Poster - Abstract ID: 524

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Bama County is recognized as one of the longevity villages in the world. Bama people's longevity is closely related to the geological materials in their living environment. Geochemical gene is a new technique to discriminate and trace the geological materials. Three geochemical genes, including an integrated classification result of lithogenes (LG_CR), gold metallogene (MGAu) and tungsten metallogene (MGW), are applied to stream sediments samples at Bama. The results show that the LG_CR gene is different in the northeast and southwest of Bama. The former is dominated by 2- type (intermediate-like) and 3-type (basic-like), and the latter is mainly 1-type (acidic-like) and 2- type. Typical longevity areas, involving Jiazhuan and Bama Town, are characterized by 2-type and 3-type, indicating that intermediate to basic materials enriched in V, Cr, Co, Ni might be crucial for longevity of Bama. The MGAu and MGW were proposed to determine and trace geochemical anomalies. The value of similarity of MGAu to an ideal ore is varying between 0 and 80%, and northern Bama has higher value than southern Bama. Jiazhuan and Bama Town show relatively high similarity and Bama reaches 80%. The value of similarity of MGW to an ideal ore is varying between 0 and 80%, with mostly around 0-20%. Jiazhuan and Bama Town show relatively high similarity of 20-80% and Bama reaches 80%. Geochemical gene mapping shows obvious spatial zoning and typical longevity areas display unique characteristics of geochemical gene. Although these three genes are proposed for classification of geological materials and mineral exploration, they contain well defined human health nutrient elements (Cu, Zn, Mo, Sn, Pb) and some other elements (W, Sb, Bi, Au, Ag), showing high genetic similarities in longevity regions.

ChemNTP: Advanced Prediction of Neurotoxicity Targets for Environmental Chemicals Using a Siamese Neural Network

Poster - Abstract ID: 988

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Chemicals released into the environment can enter the human body through various exposure pathways, ultimately leading to harmful outcomes. In fact, many detected environmental chemicals have been confirmed to possess neurotoxicity, posing a significant threat to human health. Unfortunately, the molecular mechanisms of neurotoxicity for many environmental chemicals, especially their binding targets, remain unclear. To address this issue, a method for predicting chemical neurotoxicity targets (ChemNTP) was proposed, integrating the structural characterization of environmental chemicals and biological targets. This proposed model overcomes the limitations of traditional prediction methods, which are only applicable to single target and mechanism, enabling rapid screening of 199 potential neurotoxic targets or key molecular initiating events (MIEs). ChemNTP demonstrates superior predictive performance compared to other machine learning algorithms, with an area under the receiver operating characteristic curve (AUCROC) of 0.922 for the validation set. Additionally, the attention mechanism of the ChemNTP model could recognize key residues of binding targets and key functional group or atoms of molecules, revealing the structural basis of complex interactions. Further, in vitro enzyme activity assays and molecular docking confirmed the binding activity of the discovered 8 polybrominated diphenyl ethers (PBDEs) with acetylcholinesterase (AChE). We also provide a software with a user interface to facilitate the rapid discovery of neurotoxicity targets of emerging environmental pollutants, with the potential for application in studies of key MIEs for more types of toxicity.

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China Medical Stone - A special kind of geological material with bidirectional effect on nutrient trace elements

Poster - Abstract ID: 398

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Medical stone is a kind of special geological material in the field of health geology and is gained a reputation for enrichment in nutrient trace elements. However, the harmful trace elements released from this material are also concerned. In order to assess the harmful elements released from the medical stone, a comparison experiment is designed between drink water with China Medical Stone (CMS) and drink water only (or a blank) in standard glass containers enclosed at 25□ under atmospheric pressure. The CMS is collected from the CMS deposit located in the Naiman county of Tongliao city in Inner Mongolia, China which is porous, rich in nutrient trace elements and also has “bidirectional effects” on releasing nutrients and absorbing harmful trace elements. After the soaking experiments lasting for 24 hours, the parallel soak solution and the blank solution were observed and analyzed for 12 harmful trace elements and 10 other items. The results indicate that the concentrations or values of the harmful items are not only comparable between the soaked solution and the blank solution but also all below the limits clearly or meeting the requirements of the standard GB/T17219-1998 promulgated by the People’s Republic of China for drinking water. However, the nutrient trace elements in the soaked solution are clearly enriched with respect to the blank solution which has been proved previously. Therefore, the CMS can be used as a special kind of geological material for drinking vessels with a “bidirectional effect” on human health.

Community-Based Management of Waterborne Diseases and Data-Driven Risk Assessment for Health Policy Interventions

Poster - Abstract ID: 976

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In Pakistan, rural populations face significant health risks due to substandard water quality and insufficient sanitation facilities, leading to prevalent waterborne illnesses including diarrhea, malaria, gastroenteritis, typhoid fever, and hepatitis A. The World Health Organization estimates 16,500 annual fatalities among children under five from diarrhea alone. We conducted a community assessment study to evaluate the empowerment of rural communities (n=437) in the suburban areas of Rawalpindi and Abbottabad districts to manage their water and sanitation needs. Approximately 45% of the population expressed concerns over the inadequate health budget. Our multinomial logistic model identified a high incidence of diarrhea associated with the consumption of unpurified water (odds ratio= 2.4; 95% CI=1.28-4.68) and the use of public tap water (odds ratio=3.16; 95% CI=1.82-5.48). Principal Component Analysis suggested that areas with poor sanitation are more likely to experience high incidence of waterborne diseases, especially in larger families (>5 individuals) and lower-income groups (<$4 a day). In regions where local communities actively engage with district governments, there is a marked increase in awareness of hygiene practices, improved sanitation systems, and waste management. Although variations in estimated Escherichia coli exposure ranged from 108 to 1016 CFU/day across different neighborhoods and age groups, community-centric management strategies have significantly reduced exposure to fecal contamination, resulting in a decrease in child mortality rates from 70 to 56 deaths per 1,000 live births over the last three years. These findings underline the urgent need for policy interventions to enhance public awareness, improve water quality assessments, and ensure access to safe drinking water for rural populations.

Distribution Characteristics, Migration Behavior and Ecological Risk Assessment of Phthalate Esters in Qinzhou Bay, China

Poster - Abstract ID: 867

Prof. liao riquan [1]

1. *liao*

Phthalate esters (PAEs) were a kind of endocrine disruptors. Since PAE was detected in many kinds of seafood, it was significant to study the pollution level and ecological risk of PAEs. However, the specific content and distribution of PAEs were still unclear in Qinzhou Bay, China. In this paper, the distribution, migration behavior and risk assessment of 16 PAEs congeners during the seawater-marine organism-sediment system were investigated in dry season (December, 2021) and wet season (July, 2022). Eleven kinds of PAEs were found in seawater and eight in sediment. The detection frequency of PAEs reached 100% in sample sites. The average concentrations of PAEs in seawater were 1.65μg/L and 3.202μg/L, and in sediment were 2.242mg/kg and 2.748mg/kg in dry and wet season, respectively. The total concentration of PAEs in oyster sample were 0.933mg/kg and 0.666mg/kg in dry and wet season, respectively. DEHP, DIBP, DBP, DEP, DMP and BPP were the dominant PAEs contamination compounds. The result indicated PAEs were ubiquitous contaminants in Qinzhou Bay, mainly distributed in the inlets of river and port. DEHP presented a high risk to algae and crustaceans in seawater, and presented medium risk to fish; DiBP and DBP posed a medium risk to fish; nevertheless, DMP and DEP presented a low risk to the sensitive organisms.

Dynamic response of cadmium immobilization to a Ca-Mg-Si soil conditioner in the contaminated paddy soil

Poster - Abstract ID: 950

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Soil conditioners are often used to immobilize soil heavy metals. Understanding the transfer of Cd in soil-plant system to different application rates and modes of soil conditioners application is essential for food safety. The stabilization persistence of soil conditioners in immobilizing Cd, to date however, is still limited. In this study, the stabilization persistence of a Ca-Mg-Si soil conditioner (SC) was assessed based on a six-year Cd-contaminated paddy field study with growth of two rice local main varieties (Yongyou17-YY and Xiushui14-XS) and four application rates (1500 kg ha^{-1} (low), and 3000 kg ha^{-1} (high) for the first year only, and 1500 kg ha^{-1} and 3000 kg ha^{-1} every year). Results showed that continuous SC application with high rate increased soil pH, simultaneously with more water soluble and exchangeable Cd was transferred to Fe-Mn oxides bound and carbonate-bound Cd in the first 3–4 years; while the low rate was only effective with growth of YY that were applied for a shorter period of time. Statistical analysis indicated that the stability effect of SC was integratedly affected by soil pH, SC application rate, and meteorological factors (precipitation and temperature). Especially, soil fractionation contributed the most changes of Cd availability in soil, while meteorological factors, SC application rate and crop varieties altogether exhibited the great effect on Cd accumulation in grain. Our finding demonstrated the potential long-term stabilization of SC in soil Cd immobilization, with the performance needed for further verification on the basis of different soil types.

Effect and mechanism of activated persulfate degradation for RDX in military contaminated site: Laboratory- and pilot-scale studies

Poster - Abstract ID: 865

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At present, the world situation and geopolitical patterns are undergoing major changes, and the weapons and ammunition used in conflicts are causing serious damage to the ecological environment in the surrounding area and even globally. It is urgent to manage the pollution of energetic compounds (ECs) scientifically and efficiently.

The zero-valent iron (Fe^0) activated persulfate (PS) system was screened by studying the degradation of hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in soil by activating PS in different ways and the changes of physicochemical properties in the system before and after the treatment. The application range of the catalyst material was tested by varying the soil-water ratio, the proportion of PS to Fe^0, the pH value and the reaction temperature. Free radical quenching experiments were carried out to investigate the free radicals and their strengths in the Fe^0/PS system. The experimental results showed that the Fe^0/PS process could remove up to 96.2% of RDX under the optimal reaction conditions (soil-water ratio of 1:5, PS:Fe^0=1:3, pH=6, and temperature of 55 °C). The degradation of RDX was promoted by $SO_4^{\cdot-}$ and ·OH together during the reaction process, and $SO_4^{\cdot-}$ was dominant. The results of the pilot test showed that the degradation rate of Fe^0/PS system for 2,4,6-trinitrotoluene (TNT) , RDX and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) soils in the three ranges in Sanjie all exceeded 86.63%, 82.67% and 71.43%, respectively. As a munitions destruction site, soil contamination with energetic compounds was more serious in the Dunhua site. Still, the remediation effect was relatively limited due to its low reaction temperature, and the degradation rates of TNT, RDX and HMX were 69.53%, 63.77% and 56.67%, respectively. In summary, the Fe^0/PS process has the prospect of large-scale promotion and sustainable development in the remediation of energetic compounds.

Effect of aging on oral bioaccessibility of Cr and Ni in soils with or without changes in practices

Poster - Abstract ID: 399

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Anthropogenic activities result in high levels of Cr and Ni in the environment. To assess a more realistic exposure in case of ingestion of soil by children, it is essential to consider the bioavailable fraction by measuring bioaccessibility, instead of total concentration. Bioaccessibility can naturally reduce over time, raising questions about the relevance and long-term effects of changes in practices on bioaccessibility. Among the practices, the addition of amendments, in particular biochar and compost, is commonly used to reduce mobility of metal(loid)s thereby decreasing their release and bioaccessibility. The present study is aimed at evaluating the effect of aging on the bioaccessibility of Cr and Ni in five contaminated soils under controlled laboratory conditions. The soil samples were amended or not with 5% of biochar or compost and submitted to an aging experiment, simulating drastic environmental conditions. Soil pH, Cr and Ni bioaccessibility and the Cr speciation were measured before and after soil aging experiment. The results showed that artificial soil aging alone was sometimes enough to reduce bioaccessibility in gastric phase. The addition of biochar increased soil pH but had either no effect or a negative effect on bioaccessibility. The addition of compost tended to be slightly beneficial, especially in gastrointestinal phase. Cr VI and Cr bioaccessibility in the gastric phase appeared to be linked, as their variation is similar in response to ageing and amendments. Although the results do not perfectly reflect *in situ* conditions, they give an initial idea of the long-term effects they may have. As the effect of ageing on soil pH, bioaccessibility and Cr speciation was variable, these results can prepare the field for further studies on the relevance of using these amendments to reduce risks to human health.

Effects of Environmentally Relevant Concentration of SCCPs on BV2 Microglia Activation and Lipid Metabolism, Implicating Altered Neurogenesis

Poster - Abstract ID: 340

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Short-chain chlorinated paraffins (SCCPs), a class of persistent organic pollutants, have been found to cause diverse organ and systemic toxicity. However, little is known about their neurotoxic effects. In this study, we exposed BV2 microglia to environmentally relevant concentration of SCCPs to investigate the impact on the nervous system. Our findings revealed that SCCPs induced the activation of BV2 microglia, as indicated by morphological changes, stimulated cell proliferation, enhanced phagocytic and migratory capabilities, and the alterations in phenotype-related genes expression, including those associated with cell proliferation (cenpe, mki67, top2a), phagocytosis (Axl, Itgb2), cell homeostasis/ cell surface receptors (TMEM119, Tgfbr1), cell activation (Iba1, CD11b), lipid metabolism (APOE, LPL). Additionally, exposure to SCCPs induced alterations in immune modulation, resulting in reduced expression of NF-κB and TNF-α mRNA, as well as IL-1β protein. Conversely, it enhanced the expression of TGF-β. Notably, SCCPs caused lipid metabolic changes in BV2 microglia, characterized by the upregulations of long-chain fatty acids and acylcarnitines, reflecting enhanced beta(β)-oxidation. Intriguingly, cell activation coincided with elevated levels of omega-3 polyunsaturated fatty acids. Furthermore, activated microglial medium remarkably altered the proliferation and differentiation of neural stem cells. Collectively, exposure to environmentally relevant concentrations of SCCPs resulted in activation and lipid metabolic alterations in BV2 microglia, which may subsequently impact neurogenesis. These findings provide valuable insights for further research on the neurotoxic effect of SCCPs.

Effects of grazing exclusion on soil microbial diversity and its functionality in grasslands

Poster - Abstract ID: 577

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Grazing exclusion (GE) is seen as an effective strategy for combatting the degradation of overgrazed grasslands on the global scale. However, the impact of grazing exclusion on soil microbial diversity remains uncertain. Here, we performed a meta-analysis utilizing a dataset comprising 246 paired observations from 46 peer-reviewed papers to estimate how GE affects microbial diversity and how these effects vary with climate zones, grassland types, and GE duration. Meanwhile, we addressed the relationship between microbial diversity and its functionality under grazing exclusion. Overall, grazing exclusion significantly increased microbial Shannon, microbial richness compared to grazing group. For microbial groups, GE significantly increased fungal and bacterial richness, but decreased specific microbial richness. Responses of microbial Shannon to GE significantly varied with climate zones, grassland types, and GE duration. Grazing exclusion increased both microbial Shannon and richness in dry sub-humid regions and semidesert grasslands. Long-term (>20 year) GE had greater effects on microbial diversity than short-term (<10 year) GE. In addition, grazing exclusion significantly increased ecosystem multifunctionality. Both microbial and plant Shannon positively correlated with multifunctionality. Overall, our findings highlight that both climate zone, GE duration, and grassland type should be considered for biodiversity conservation and sustainable grassland ecosystem functions.

Effects of K3PO4 and KOH modified biochar on the adsorption and remediation on Cd in water and soil environment

Poster - Abstract ID: 841

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Cadmium (Cd) pollution in waters and soil pose a serious threat to ecological environment and human health. Biochar, as a multifunctional material, has been widely used in the treatment of heavy metal pollution in recent years. However, the capacity of biochar on Cd adsorption and stabilization in water and soils still needs to be improved. Therefore, K3PO4 and KOH modified biochar were produced and batch adsorption experiment were conducted to examine their capacity on Cd adsorption. Besides, pot experiment were performed to simultaneously test the performance of phosphorus and potassium rich biochar for Cd availability in two Cd contaminated soils, and the corresponding Cd accumulation in rice grains. The results showed that P and K were successfully loaded onto the biochar after co-pyrolysis. The initial adsorption rate of K3PO4 modified biochar (PBC), KOH modified biochar (KBC), and unmodified biochar (BC) is BC>PBC>BC. PBC and KBC increased the adsorption capacity of Cd2+ by 69% and 104%, respectively compared with BC. The pot experiment demonstrated that biochar application to low pollution level and high pollution level soils greatly reduced the available Cd content in soil. Modified biochar at 1% application rate had a significantly better effect in reducing Cd in rice grains (95-96%) than the 1% and 2% unmodified biochar. The results indicate that K3PO4 and KOH modified biochar have great potential to be applied to the removal of Cd in water and remediation of soil Cd pollution.

Endocrine disrupting chemicals identification based on high-throughput bioassay and chemical analysis

Poster - Abstract ID: 1015

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A combination of high-throughput bioassay and chemical analysis was used to identify key toxicants from hundreds of known and unknown endocrine disrupting chemicals (EDCs) in the environment. Firstly, based on mechanism of competitive binding assay, reporter gene assay and cell proliferation assay, we conducted computer simulation using molecular dynamics (MD) simulation and molecular docking. In this way, we constructed qualitative- and quantitative-structure relationship on the presence or absence of the activity and the type of activity. We further extrapolated the results of *in vitro* experiments to the individual toxicity endpoints through the male and female reproductive toxicity effect pathways, so as to realize the qualitative and quantitative prediction of male/female reproductive toxicity based on the structure of pollutants. Above virtual screening methods has been adopted by the VEGA HUB platform designated by the European Chemicals Agency (ECHA) as an officially identified method. The method was then introduced into chemical analysis and bioassay to establish target/non-target identification method for EDCs based on effect, revealing the causative toxicants inducing endocrine disrupting effects in source/surface water. Further, a software for evaluating the toxicity contribution by using the probability density function was constructed, realizing rapid quantitative identification of 500 EDCs and the qualitative screening for thousands of EDCs. Then, based on correlation between retention indices and molecular formulae, we realized chromatographic fingerprints identification and structure screening. This study provides a reliable technical support for the identification of key EDCs and the screening of priority control pollutants in aquatic environments with combined pollution.

Enhancing Sonchus oleraceus Growth in Contaminated Mining Soil of Lavrio, Greece: Biostimulants Efficacy in Potentially Toxic Elements (PTEs) Remediation

Poster - Abstract ID: 608

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In PTE-contaminated soil from the mining area of Lavrio, Greece, we investigated the PTE mitigation capacity of various biostimulants (Trichoderma, Phosbactin, Bacillus, Azospir, and Humic substances) in *Sonchus oleraceus* cultivation. We established a pot experiment with 7 treatments (non-contaminated control soil as negative control plus the Lavrio soil as positive control plus 5 added biostimulants to Lavrio) and 15 replicates which lasted for 52 days. We aimed to determine the biostimulants impact on PTE mobility in soil and their accumulation in plant tissues. Significant variations in *S. oleraceus* growth and PTEs concentration were observed. We found, as expected, significant reductions in plant growth and physiological parameters in the contaminated soil (positive control) compared to the negative control. However, no significant differences were recorded with the application of biostimulants, with the exception of humic substances, which resulted in a reduction of plant height and number of leaves compared to the positive control. Moreover, treatments of Bacillus and Azospir exhibited a reduction in plant height. Certain biostimulants derived from microbial components and organic sources lead to increased PTE-DTPA extractability, thus adding biostimulants in our study raised PTEs level in soil. Moreover, *S. oleraceus* was found to accumulate elevated PTE concentrations in its plant tissues, displaying typical behavior of an hyperaccumulator. These findings demonstrate the complex interaction between biostimulant properties, soil characteristics, plant responses and concentration of specific PTEs. This study, highlights the importance of choosing suitable biostimulants for sustainable phytoremediation. However, further investigation is needed to identify the mechanisms of biostimulant action that improve the phytoremediation potential.

Environmental Impact of Lead-acid Battery Recycling Smelters, East Los Angeles, California, U.S.A.: Pb Isotopic and Elemental Compositions of Soils

Poster - Abstract ID: 766

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A survey of lead isotope compositions and metal contents (e.g., As, Cd, Cu, Pb, Sb, and Zn) of soil profiles adjacent to lead-acid battery recycling smelters was done to investigate possible sources of lead contamination. Two lead battery recycling smelters (Exide, recently shut down, and Quemetco/Ecobat, active) in densely populated residential areas (among the top 10% of most environmentally burdened in California) were investigated. Preliminary soil Pb isotopic analyses (TIMS, Thermal Ionization Mass Spectrometry) range from higher radiogenic values (rock-derived) to lower values (potentially anthropogenic). Three groups are recognized based on Pb isotopes and proximity to the Exide smelter. Group 1 includes soils near the Exide smelter and nearby residential sites having low isotopic values (e.g., $^{206}Pb/^{207}Pb$ ~1.1671–1.1755). Group 2 encompasses more radiogenic values (e.g., $^{206}Pb/^{207}Pb$ ~1.1775–1.1897) in residential soils near the Exide smelter. Group 3 is more radiogenic than Groups 1 and 2 (e.g., $^{206}Pb/^{207}Pb$ >~1.1900). Approximately 80% of Pb isotopic analyses in soils from Group 1 match the Exide smelter. Group 2 has about 67% of the Pb isotopic compositions like Exide and soils in Group 3 contain up to about 18%. Soils adjoining Quemetco generally match the Pb isotopic compositions resembling Exide. Soil profiles that resemble Pb isotopic compositions observed near Exide are likely contaminated by recycling activities and can have anomalously high Pb concentrations. Distributions of metal concentrations and Pb isotopic compositions highlight the necessity for baseline and background information on distributions of lead and other metals and Pb isotopic compositions of soils, waters, and air quality prior to the opening of industrial facilities. These operations are frequently situated in underprivileged communities such as in East Los Angeles. The data can help identify sources of contamination, inform decision makers, and assist local, State, and national agencies support of effective cleanup and proper remediation.

ERBB signalling contributes to immune evasion in KRAS-driven lung adenocarcinoma

Poster - Abstract ID: 931

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Immunotherapy is increasingly viewed as treatment of choice for lung cancer, however, clinical responses to immune checkpoint blockade remain highly unpredictable and are largely transient. A deeper mechanistic understanding of the dynamics of tumour:immune interactions is needed to drive rational development of improved treatment strategies. Progress is hampered by a paucity of autochthonous model systems in which to interrogate the 2-way interactions of immune responses to evolving tumours and vice-versa. Specifically, commonly used genetically engineered mouse models typically lack the genetic diversity needed to drive an adaptive immune response. APOBEC mutagenesis signatures are prominent in lung cancer and APOBEC activity is predicted to drive immune visibility through Cytidine deaminase activity, coupled with inaccurate DNA-repair responses. We therefore generated a CRE-inducible APOBEC3B allele, interbred with multiple oncogenic drivers of lung adenocarcinoma, and used the resulting mice to investigate the response to PD1 blockade at single cell resolution.

Using our novel immune-visible model of KRas-driven autochthonous lung adenocarcinoma, we uncovered a surprising increase in tumour-cell expression of EGFR/ERBB ligands following treatment with a-PD1 and present evidence that transient ERBB blockade can restore immune surveillance in KRas mutant LuAd and combine effectively with immune checkpoint blockade.

Evaluation of Heavy Metal Pollution and Health Risk Assessment in the Waters of the Quanzhou Bay Coastal, China

Poster - Abstract ID: 298

Prof. Chunlei Liu [1]

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The study on heavy metal pollution in Quanzhou Bay's coastal waters, heavily influenced by various private enterprises, involved examining 146 water samples. This research aimed to determine the concentration and distribution of different heavy metals and their associated health risks. The metals were detected in the order of Ba (Barium) > Fe (Iron) > Mn (Manganese) > Zn (Zinc) > Cu (Copper) > Cr (Chromium) > Pb (Lead) > As (Arsenic) > Cd (Cadmium). Notably, As slightly contaminated 2.04% of the pore water samples.The study showed that Fe pollution was the most prevalent. Mn was primarily found in surface and pore waters, while Pb appeared mainly in surface and fissure waters. The Nemerow Pollution Index indicated that most surface and fissure waters had low pollution levels, but pore water showed moderate to high pollution levels. According to the Entropy-weighted Water Quality Index (EWQI), the water quality in both surface and fissure waters was rated as 'Extremely Poor', especially in the densely populated Licheng area near the Jinjiang River. The study's cancer risk assessment revealed that for children, the risks were within safe limits. However, for adults, 11.76% of the pore water samples exceeded acceptable risk levels. The heavy metal hazard index (HI) exceeded safe thresholds for adults in 66.67% of surface water, 16.66% of pore water, and 13.16% of fissure water. For children, these figures were 50% for surface water, 14.29% for pore water, and 10.53% for fissure water. The study attributed the heightened risk of heavy metal contamination and related health hazards to Quanzhou Bay's unique geological and hydrological characteristics, such as groundwater rich in Fe, Mn, Ba, and As, and the impact of urban waste, metal smelting, and processing.

Evaluation of minerals, trace elements, and heavy metals in Bulgarian honey and health risk

Poster - Abstract ID: 654

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This study aimed to determine the content of minerals, trace elements, and heavy metals in honeydew, monofloral and polyfloral honey collected from different regions in Bulgaria. A honey samples purchased from apiaries and hypermarkets were tested. 150 honey samples were prepared for analysis by digestion with nitric acid in a microwave system and analyzed with ICP-OES. The mercury content of the honey was determined without sample digestion with a mercury analyzer. The health risk assessment in the consumers due to ingestion of toxic metals via consumption of honey was estimated by calculating the hazard quotient (HQ), total hazard quotient (THQ), and cancer risk (CR).

The content of elements varies among the honey samples. The range of K predominant in all types of honey, followed by Mg, P, Na and Al. In terms of microelements, the content of Zn (and Mn was the highest, followed by Fe, Cu, B and Se. The content of the toxic metals (Pb, Cd, Cr, As and Hg) is low. The composition of the studied honey samples depends mainly on the botanical, geographical and geochemical origin. The content of macro and microelements in honeydew is significantly higher than in nectar honey due to the specific way the honeydew is deposited. Monofloral honey has the lowest content of heavy metals compared to polyfloral honey and honeydew. The heavy metal content tested in honey was found to be low, except for the Pb content in 8 honey samples, due to anthropogenic contamination sources around the hives. The health risk assessment showed that consumers of honeydew, monofloral and polyfloral honey in most regions of Bulgaria are at a safe range.

Exogenous IAA application affects the specific characteristics of fluoranthene distribution in Arabidopsis

Poster - Abstract ID: 729

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Indole-3-acetic acid (IAA) is a crucial growth regulator involved in the accumulation of polycyclic aromatic hydrocarbons (PAHs). However, the precise physiological and molecular mechanisms underlying IAA-mediated plant growth and PAH accumulation are not yet fully understood. In this study, two distinct IAA-sensitive genotypes of Arabidopsis thaliana (wild type and Axr5 mutant) were chosen to investigate the mechanisms of fluoranthene (Flu) uptake and accumulation in plant tissues (roots and leaves) through physiological and molecular analyses. The results revealed that the Flu concentration in Axr5 leaves was significantly higher than that in wildtype (WT) leaves. In roots, the Flu content decreased significantly with increasing IAA treatment, while no significant changes were observed with lower IAA treatment. Principal component analysis demonstrated that Flu accumulation in Arabidopsis roots was associated with IAA concentrations, whereas Flu accumulation in leaves was dependent on the genotype. Moreover, Flu accumulation showed a positive correlation with the activity of glutathione S-transferase (GST) and root length and a positive correlation with catalase (CAT) and peroxidase (POD) activity in the leaves. Transcriptome analysis confirmed that the expression of the ethylenerelated gene ATERF6 and GST-related genes ATGSTF14 and ATGSTU27 in roots, as well as the POD-related genes AtPRX9 and AtPRX25 and CAT-related gene AtCAT3 in leaves, played a role in Flu accumulation. Furthermore, WRKY transcription factors (TFs) in roots and NAC TFs in leaves were identified as important regulators of Flu accumulation. Understanding the mechanisms of Flu uptake and accumulation in A. thaliana provides valuable insights for regulating PAH accumulation in plants.

Expanding the Concerned List of Priority Polycyclic Aromatic Compounds Utilizing High-Resolution Mass Spectrometry Assisted by In Silico Predictions

Poster - Abstract ID: 144

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Polycyclic aromatic compounds (PACs) are ubiquitous in the atmosphere and considered the main toxic component of fine particulate matter ($PM_{2.5}$). A list of 16 priority PAHs was established by the United States Environmental Protection Agency (U.S. EPA) considering their carcinogenicity, teratogenicity, and mutagenicity, and it has served as a global benchmark for the past 40 years. However, focusing on only the few priority PAHs in environmental monitoring and risk assessment may largely underestimate the overall hazard.

To comprehensively illuminate the environmental behavior and hazardous effects, it is crucial to identify as many PAC analogues as feasible. Nevertheless, the limited information in existing libraries hinders an accurate understanding of the composition, behavior, and toxicity. In this study, a total of 350 PACs in 9 categories were successfully identified in fine particulate matter. Using mass spectra and retention indexes predicted by in silico tools as complemental information, the scope of chemical identification was efficiently expanded by 27%. In addition, quantitative structure-activity relationship models provided toxicity data for over 70% of PACs, facilitating a comprehensive health risk assessment. A Toxicological Priority Index approach was applied for relative chemical ranking，and a list of 39 priority analogues was compiled. These priority PACs further enhanced source interpretation, and the highest carcinogenic risk was attributed to coal combustion.

Fe-Mg bimetallic biochar: A novel strategy for stabilization of multi-metal contaminated soils

Poster - Abstract ID: 289

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Soil contamination with heavy metals such as cadmium (Cd), lead (Pb), and copper (Cu) has detrimental impacts on soil stability, presenting a significant challenge to the production of safer food. This study focused on the synthesis and characterization of biochar enriched with a bimetallic combination of iron and magnesium (Fe-Mg-BC). In a pot experiment, both pristine and Fe-Mg bimetallic biochar were applied to soil contaminated with multiple metals at varying rates and spinach (*Spinacia oleracea* L.) was cultivated. Results indicated that the application of Fe-Mg-BC (3%) significantly decreased the mobility of Cd, Pb, and Cu in the soil by 68%, 72%, and 49%, respectively, compared to the control. Plants treated with Fe-Mg-BC (3%) suppressed metal-induced oxidative stress by boosting the levels of super oxide dismutase (SOD), ascorbate peroxidase (APX) and catalase (CAT) in plant roots and shoots by 40.9%, 57%, 54.8%, 55.5%, 65.5%, and 37.4%, respectively. Moreover, the Fe-Mg-BC (3%) treatment resulted in an increased spinach biomass by promoting photosynthesis, transpiration, stomatal conductance, and intercellular CO_2 by 22%, 21%, 103%, and 15.3%, respectively. Soil amendment with Fe-Mg-BC transformed the bioavailable fractions of Cd, Pb and Cu into non-bioavailable fractions, thereby restricted their mobility and uptake by plants. The results illustrated that Fe-Mg-BC (3%) declined the Cd, Pb, and Cu concentration in plants roots and shoots by 34.1%, 79.2%, 47%, 56.3%, 43.3%, and 54.1%, respectively, compared to control. These findings underscore the potential of Fe-Mg-BC as a promising amendment for reclamation of soil contaminated with multiple metals, thereby making a substantial contribution in ensuring safer food production.

Formation of iron plaques on the surfaces of microplastics in wetlands: implications for heavy metal toxicity and microbial communities

Poster - Abstract ID: 883

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Iron (Fe) plaques in coastal wetlands are widely known due to their strong adsorption affinity for natural particles. However, their interaction behaviour and mechanisms with the emerging contaminant microplastics remain unknown. This study aimed to investigate the characteristics of Fe plaques on low-density polyethylene plastic surfaces and their relationship with environmental factors in coastal wetlands dominated by mangrove and *Spartina alterniflora* plants. Coupled with laboratory incubation experiments and microbial analysis, we found that iron plaques increased the adhesive force of the plastic surface from 65.25 to 300 nN and promoted the oxidation of the plastic surface. Fe plaque formation was stimulated by salinity, anaerobic conditions, natural organic matter and a weakly alkaline scenario (pH 8.0-8.3). Fe content showed a stable positive correlation with heavy metal loading (i.e. As, Mn, Co, Cr, Pb and Zn). This suggests that the formation of iron films on microplastic surfaces increases the risk of heavy metals in wetlands. In addition, high-throughput 16S rRNA sequencing analysis revealed that Fe plaque was positively regulated by *Nitrospirae*. Meanwhile, *Verrucomicrobia* and *Kiritimatiellaeota* may act as depressants by consuming salt. This study demonstrated that iron plaques may enhance the role of plastics in the migration of heavy metal contaminants by altering their adsorption performance, providing new insights into plastic interface behaviour and potential ecological impacts in coastal wetlands.

Geochemical Characteristics and Formation Mechanisms of Geothermal Fluids in the north-central part of the Xinding Basin

Poster - Abstract ID: 1005

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Xinding Basin is a typical Cenozoic fault basin, located in the northernmost region of the Fenhe River Graben in Shanxi Province. The study area is located in the central region of the Xinding Basin, which is mostly composed of Yuanping City and Daixian. This work aims to provide a thorough understanding of the genesis mechanism of the deep geothermal system in the basin by synthesizing and analyzing data from hydrogeochemistry, isotope geochemistry, geothermal geology, geothermal heat flow, and geophysical results in the study area. The hydrochemical characteristics and H/O/S isotopic composition of a total of 58 geothermal and non-geothermal water samples, the zircon U-Pb chronology and Uranium, Thorium and Potassium contents of a total of 6 rock samples in the study area have been systematically analyzed. On this basis, the basic characteristics of geothermal fluids were constructed using integrated multicomponent geothermal measurements, and the possible genesis mechanisms of geothermal fluids in the study area were simulated using the hydrogeochemical simulation software PHREEQC. The study's findings demonstrate that the deep groundwater circulation in the Xinding Basin's geothermal system is unrelated to the shallow magma chamber and the decay thermal anomaly of radioactive elements in rocks. In contrast, it occurred as a result of the deep groundwater circulation in a normal heat flow background. The findings indicate that geothermal water from the study area is $Cl \cdot SO_4$-Na type geothermal water with reservoir temperatures of 45.1 to 98.9 °C. The atmospheric precipitation in the recharge area of western Yunzhongshan and Hengshan Mountain infiltrated into the deep underground and migrated to the Xinding Basin with circulation depths between 1615.1 and 3473.9 m.

Geochemical Influences on Soil Carbon Pools in the Jialing River Basin, China

Poster - Abstract ID: 439

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Topsoil (depth<30cm) and deep soil (depth>150cm) were systematically sampled in the 1:250,000 soil geochemical survey of the Jialing River Basin. The sampling density of topsoil was 1 sample/km², analyzed by 1 sample/4km², and the sampling density of deep soil was 1 sample/4km², analyzed by 1 sample/16km². 54 chemical (elemental) indicators such as pH, C_{org}, C, N, CaO were tested for the samples. We found that in deep-shallow soil evolution, the enrichment of C, C_{org}, and N are all more than 2 times, and the enrichment of Cd, Se, S, Hg, P, CaO, Cl, and Br are between 1.83 and 1.23 times. In the deep soil, CaO and C, P, Cd are grouped together, and have a major influence on pH. Meanwhile, these indicators and combination of C_{org}, N, S have a certain degree of similarity. In the surface soil, CaO is not related with C, and shows a negative correlation with C_{org}, but still constraints the environmental pH. C occurs more in the form of C_{org}, and is associated with S, N and other symbiosis, which is clearly related to atmospheric nitrogen deposition. This shows that the oxidative decomposition and re-precipitation of $CaCO_3$ and acid rain are the main controlling factors of environmental pH. $CaCO_3$ and atmospheric nitrogen deposition are the two most important sources affecting soil carbon pools. SiO_2 occurs mainly in the form of coarse sands, which rarely has effect on the chemical environment and the enrichment of other elements. Fe oxides and Al_2O_3 are the main chemical compositions of the fine-grained constituents including silt and clay, and not constitute the major influence factors on the chemical environment. With the huge specific surface area, Fe oxides and Al_2O_3 can adsorb many elements, so the elemental assemblage is very complex, but they have basically no influence on carbon pools.

Heterogeneous activation of peroxymonosulfate by natural chalcopyrite for efficient remediation of groundwater polluted by aged landfill leachate

Poster - Abstract ID: 90

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Natural chalcopyrite (NCP) was used as a low-cost and efficient activator of peroxymonosulfate (PMS) to repair groundwater polluted by aged landfill leachate. The optimal remediation effect of polluted groundwater was achieved at pH 8, PMS concentration 25 mM and NCP dosage 10 g/L via response surface method. The excellent performance of NCP was mainly Fe3+/Fe2+ and Cu2+/Cu+ cycles promoted by sulfur species, which was investigated via XPS analysis. Furthermore, the transformation of SO4 •—, • OH and O2 •— were clarified by quenching experiments and ESR. The conversion of organics was revealed by UV–vis spectra and three�dimensional fluorescence spectra. Moreover, the toxicity of polluted groundwater after remediation was significantly reduced through the growth of Chlorella pyrenoidosa. Finally, the flowing experiment using NCP/ sand column showed that NCP could effectively activate PMS and thereby restore polluted groundwater.

Historical trends of mercury in Nutrias Lagoon, Uruguay

Poster - Abstract ID: 519

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Sediment can be considered the result of the interaction of all the processes that occur in a lacustrine system, being of fundamental importance for the study of its historical evolution. In addition, the affinity of various pollutants to sediment allows them to accumulate, making sediment one of the most important compartments for evaluating pollution in aquatic ecosystems. Given the scarce bibliography on various pollutants in environmental compartments in Uruguay, which is based on current or recent data, it is of great importance to carry out studies of environmental historical reconstruction. This study proposes the paleoenvironmental reconstruction of the Nutrias Lagoon system and its correlation with the distribution of mercury in the system and its basin. Nutrias Lagoon is a coastal lagoon with little anthropogenic intervention, located in an area declared a Protected Landscape by the Uruguayan National System of Protected Areas and a Biosphere Reserve by UNESCO. Sampling was carried out by extracting a sediment core from a floating platform. For sub-sampling, the core was cut longitudinally, and sections were then separated with transverse cuts every 1 cm from the surface to 30 cm depth, and every 2 cm to 65 cm. Each sample was dried, ground, and sealed for at least 4 weeks to achieve secular equilibrium of the natural series of 238U. Then, these samples were measured using a gamma spectrometry system. The results were modeled according to the constant flow model, which was corroborated by studying the temporal distribution of 137Cs. Finally, the mercury was measured by a direct mercury analysis system DMA-80T.M Milestone™. The mercury concentrations along the sediment core were below the threshold effects level, with an average concentration of 75±7ng/g. It was determined that mercury concentrations do not reach toxic levels, and the degree of contamination is insignificant.

Identification of Hydrogeochemical Zonation in Metal Mines and a Remediation Guide for AMD Pollution in Dexing, China

Poster - Abstract ID: 216

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Acid mine drainage (AMD) is mainly generated by the oxidation of metal sulfides in the presence of artificial disturbance factors such as mining fissures. The impact of treating AMD pollution in metal mines by slavishly replicating traditional treatment technology is limited due to its large output and long duration. Refined identification of redox zone is indispensable for AMD remediation in metal mines. In this study, 15 flood and dry periods water samples, and 15 borehole samples were collected for hydrogeological and chemical analysis from surface and groundwater bodies in Causeway Gully, Dexing, China. The water storage medium zone, mineral component zone, and redox zone of the study area were finely divided through vertical analysis of the water storage medium, mineral components, and water chemistry. Among them, the main areas with distinct hydrogeological zone characteristics are the oxidation and transition zones. The degree of fracture development decreases vertically as the formation depth increases, quartz and muscovite display higher proportions in the lower parts, while pyrophyllite becomes dominant in the upper part of the formation. And the chemical component of water in the dry periods, TFe concentration increases vertically first, then decreases, and is greater than in the flood periods. In the dry periods, the concentration of SO_4^{2-} root appears to be significantly lesser vertically than in the flood periods, but the opposite is true at about 15 m. As a consequence, the actual engineering sealing and remediation of No. 23 mine cave was carried out in accordance with the vertical zoning characteristics of the study area and relying on the redox zone. The water quality in the area was significantly improved after the treatment, and the concentrations of TFe, TMn, Ca^{2+}, and SO_4^{2-} were significantly reduced. The study will serve as a guide for AMD pollution remediation from metal mines.

Imbalance of Gut Microbiota Induced By F-53B in Female Mice

Poster - Abstract ID: 660

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Objects: As an alternative to perfluorooctane sulfonic acid (PFOS), 6:2 chlorinated polyfluoroalkyl ether sulfonic acid (F-53B) has been widely used in the Chinese electroplating industry in recent years. F-53B has been frequently detected in both the environment and human body, but its toxic assessment is limited. In this study, we aim to examine the potential disruption of the gut microbiota in female mice induced by F-53B. **Methods:** Female 8-week-old mice were divided into four groups of eight mice each. They were then exposed to control, low, medium, and high doses of F-53B at 0, 0.2, 1.0, and 5.0 mg/kg/d by oral gavage daily. After 28 days, the mice were sacrificed, and stool samples were collected for gut microbial analysis using 16S rRNA sequencing. **Results:** The findings indicate that the administration of a high dose of F-53B has a significant impact on the α-diversity Simpson and Shannon indices. Analysis of the microbiota composition using weighted UniFrac principal co-ordinates demonstrates distinct clustering between the control and treated groups ($p<0.001$). The LEfSe analysis demonstrated that, at the genus level, there was a decrease in the abundance of Muribaculaceae (f-Muribaculaceae, g-Muribaculaceae) and an increase in the abundance of Lachnospiraceae_UCG−001 and 006 in the high dose group. Additionally, the low dose group exhibited an increase in the abundance of Blautia (o-Bacteroidales, c-Bacteroidia, and p-Bacteroidota), while the medium group showed an increase in the abundance of Hungatella. Furthermore, the KEGG pathway enrichment analysis revealed that F-53B significantly upregulated 11 biological pathways, primarily associated with Ribosome function, amino acids (Ala, Asp, Glu, Cys, Met) metabolism and biosynthesis, aminoacyl-tRNA biosynthesis, and homologous recombination. **Conclusion:** Our results revealed that exposure to F-53B influences the gut microbiota of female mice, providing new insight into possible toxicity.

Immobilization of nanoscale zero-valent iron on MIL-101(Cr) for efficient removal of U(VI) and assessment of inactivate against Escherichia coli

Poster - Abstract ID: 553

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nZVI was immobilized on metal-organic frameworks (MOFs, MIL-101(Cr)) and be used for U(VI) removal from aqueous solution and investigation the toxicity to *Escherichia coli* (*E. coli*). The results showed that the synergic effect between MIL-101(Cr) and nZVI, and exhibited an excellent performance in U(VI) removal. The optimum mass ratio of MIL-101(Cr) to nZVI was 1.2:1 and the removal of U(VI) reach 99.6% at pH 7.0. The large specific surface area and porous structure of MIL-101(Cr) provide a controlled anchor point for nZVI loading, enabling nZVI to be uniformly distributed on the MIL-101(Cr) surface. Meanwhile, the adsorption data were well fitted for Freundlich and pseudo-first-order kinetic models, and the maximum removal capacities of M-Fe for U(VI) was 526.32 mg/g at 298 K (pH = 6.0). The removal mechanisms were clarified by the XRD, XANES and EXAFS and reveled that the main removal mechanism was adsorption, and U(VI) was adsorbed on the M-Fe surface through Fe-O and U-O functional groups. Furthermore, immobilized nZVI on MIL-101(Cr) mitigated the biotoxicity to Escherichia coli (*E. coli*). Direct contact is a crucial role in inactivating cells of nZVI/*E. coli* system. While in the M-Fe/*E. coli* system, extracellular ROS play a major role for *E. coli* inactivation, and $OH^{\bullet}$ was the main reactive oxygen species (ROS) species. These findings expand our understanding of the mechanism of U(VI) removal and bactericidal organisms in ZVI-based composites, which can help develop ZVI-based composites for environmental applications and facilitate the environmental risk assessment.

Industrial site pollution identification based on explainable machine learning: A case study of nonferrous metal industrial sites in China

Poster - Abstract ID: 375

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The global issue of soil pollution is exacerbated by the environmental and health risks associated with contaminated sites. China faces a significant challenge due to the presence of numerous industrial contaminated sites, as well as a multitude of active and relocated enterprise sites where potential pollution have not been adequately assessed. However, the lack of comprehensive theoretical research on key drivers of site pollution and their underlying mechanisms, utilizing publicly available data indicators, has hindered the effectiveness and precision of regional site risk management strategies. This study utilized the non-ferrous metal enterprise lands (NMELs) in China as a case study. By integrating multi-source of public data mining and explainable artificial intelligence, the study effectively identified the key drivers of site pollution and their underlying mechanisms in NMELs. According to the measures of random forest variable importance and partial dependence plot, the findings indicated that environmental management level and surface coverage conditions were the primary factors of site pollution, followed by groundwater depth, volatility of characteristic pollutants, production process level, soil erosion intensity, etc. The disordered release of pollutants (sources), inadequate built environment and favourable natural geographical conditions (facilitate pollutant migration), along with the temporal requirements of continuous release and accumulation of pollutants, site pollution thus occurred. Based on the above recognition, combined with the variable selection, performance measures and screening of classifiers, the rapid diagnosis model of site potential pollution based on artificial neural network (ANN) was finally constructed with satisfactory accuracy (83.40%), after greatly improving the efficiency and economics of site pollution assessment. The results in our study were expected to provide theoretical basisfor pollution control paths optimization of contaminated sites, and also be of great value for the precise hierarchical management of regional industrial sites.

Keywords: Contaminated sites; Public data mining; Key drivers; Driving mechanisms; Explainable artificial intelligence

Insights into the effects of natural pyrite-activated sodium percarbonate on tetracycline removal from groundwater: Mechanism, pathways, and column studies

Poster - Abstract ID: 215

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In-situ chemical oxidation based on sodium percarbonate (SPC) has received much attention for remediation of groundwater contaminated with organic pollutants due to the high efficiency, stable reaction, and sustainability of SPC. Currently, metal ions and their composite materials, are mainly employed for the activation of SPC. However, due to its narrow pH range, slow Fe^{3+}/Fe^{2+} circulation, and generation of refractory sludge, its application in groundwater is limited. In this study, SPC was activated with natural pyrite (FeS_2) to remove tetracycline, which was selected as the target pollutant. FeS_2 exhibited excellent catalytic activity and stability towards the degradation of tetracycline. The tetracycline degradation efficiency of SPC/FeS_2 system reached 70% within 10 min, and nearly half of the tetracycline was degraded in the first 5 min of the reaction. The optimum SPC dosage for the tetracycline removal was 8 mM, with FeS_2 dosage of 0.5 g/L. The tetracycline removal efficiency remained above 60 % after 4 cycles, indicating its good recycling efficiency of the system. SPC/FeS_2 system was not significantly affected by the initial pH or the presence of Cl^-, SO_4^{2-}, NO_3^- while, HCO_3^-, Ca^{2+}, Mg^{2+}, and humid acid suppressed the reaction. The electron paramagnetic resonance spectroscopy and quenching experiments demonstrated that •OH and O_2•$^-$ played a dominant role in tetracycline removal by the system. S_2^{2-} , as an electron donor, was able to participate in the Fe^{3+}/Fe^{2+} cycle. In addition, the 13 transformation products were determined by liquid chromatography-mass spectrometry predicted that the degradation pathway of tetracycline consisted of hydroxylation, demethylation, and decarbonylation reactions. Finally, the dynamic simulation experiments of SPC/FeS_2 sand column showed that FeS_2 effectively activated SPC and significantly reduced the toxicity in groundwater after the packed column treatment. This study reveals that FeS_2 can efficiently activate SPC and has good prospects for tetracycline-contaminated groundwater remediation applications.

Insights into the mechanisms underlying the biodegradation of phenanthrene in biochar-amended soil: From bioavailability to soil microbial communities

Poster - Abstract ID: 445

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The dynamic effect of biochar amendment in contaminated soil on the bioavailability of polycyclic aromatic hydrocarbons (PAHs) and microbial communities and how it comprehensively affects PAH biodegradation remain unclear. This study investigated the effects of wheat straw-derived biochars obtained at 300 and 500 °C at different amendment levels (0.03% and 0.3%) on the mineralization kinetics of phenanthrene with different initial concentrations (2 and 20 mg/kg) in soil by indigenous microorganisms. The results revealed that the addition of biochar inhibited both the rates and extents of mineralization in low-concentration phenanthrene-contaminated soil (PLS) by 38.9%~78.3% and 23.9%~53.6%, respectively. This was because biochar amendment in the PLS greatly reduced the bioavailability of phenanthrene to microbes owing to its strong sorption and also decreased that to specific degrading bacterial genera, which hindered their growth and reduced their abundances by 1.37%~36.6%. However, biochar addition into the soil contaminated with high concentrations of phenanthrene (PHS) resulted in its effective mineralization and enhanced mineralization rates and extents at high amendment levels by 32.4%~86.7% and 32.0%~44.7%, respectively. This was due to that biochar amendment in the PHS significantly promoted the abundances of the total bacterial communities (29.9%~80.4%) and potential degrading genera (1.89%~25.9%) by providing nutrients and stimulated the specific PAH-degradative *nid*A gene abundance by 1~2 times. These findings will guide the use of biochar to remediate soil with different PAH pollution levels based on the two roles that they play (i.e., immobilizing PAHs or facilitating PAH degradation).

Investigating ingestion risks from soils and vegetables grown in urban lead-contaminated soil, and mitigation by soil amendments

Poster - Abstract ID: 408

Ms. Jennifer Newell [1], ***Dr. Siobhan Cox*** [1], ***Dr. Rory Doherty*** [1]

1. *Queen's University Belfast*

Community gardens and allotments are being trialled as a nature-based solution to mitigate multiple health and social, economic, and environmental/climate issues in Belfast. However, working closely with urban lead-contaminated soils and ingestion of site-grown produce may pose significant health risks to community growers and consumers. Current research indicates that organic soil amendments adsorb common urban metal contaminants, particularly lead, and thus may limit plant/crop uptake and consequent human health risks after ingestion. This research seeks to investigate health risks associated with ingesting soils and vegetables grown in lead-contaminated and biochar-remediated soils in Lower Botanic Gardens, Belfast using a pot experiment. Soils with relatively high and low lead concentrations were treated with 5% w/w digestate biochar and seeded with leaf (lettuce), bulb (garlic), and root (carrot) vegetables. The pre-vegetable and post-vegetable soils, and vegetables were harvested and tested using the Unified BARGE Method in vitro bioaccessibility methodology to determine the bioaccessible fraction. This will then give an indication of ingestion risk associated with biochar-amended and non-amended lead-contaminated soils, and different soil-grown vegetables. It is anticipated that there may be a mild-moderate risk of lead absorption in the gut after ingestion of non-amended contaminated soils; followed by a reduced risk posed by ingestion of site-grown vegetables with a risk hierarchy of carrot > garlic > lettuce; and a further reduced risk from produce grown in biochar-amended soils. These results would support the use of soil amendments to improve the scope of greening nature-based solutions on typically unfeasible contaminated sites, with the ultimate goal of enhancing health and social, economic, and environmental/climate conditions in urban areas.

Investigating the impact of cannonical tumour suppressor loss on development of malignant pleural mesothelioma.

Poster - Abstract ID: 224

Ms. Jennifer Doig [1], *Dr. Pooyeh Farahmand* [1], *Dr. George Skalka* [1], *Prof. Daniel Murphy* [1]

1. *University of Glasgow*

Malignant pleural mesothelioma (MPM) is a rare and aggressive cancer, originating from the mesothelium lining of the lungs, which is believed to be directly attributed to exposure to asbestos fibres. Loss of the tumour suppressors, Bap 1, Cdkn2a and Nf2 are thought to be responsible for disease onset. A possible explanation for this is that asbestos fibres, unable to be absorbed by phagocytosis, cause chronic inflammation. This leads to genetic changes that ultimately result in MPM. Our aim is to investigate the interaction between these 3 tumour suppressors, the genetic consequences of asbestos exposure and the involvement of the immune system.

We developed 4 novel genetically engineered mouse models (GEMMS) to investigate the roles of BAP1, CDKN2A, and NF2 during development and progression of mesothelioma. Tumourigenesis was induced by Mesothelin-Cre, with or without subsequent exposure to asbestos. The capacity for combinations of mutations to drive development of mesothelioma was assessed by survival. We confirmed development of mesothelioma and assessed tumour characteristics by immunohistochemistry (IHC). In addition, we have used transcriptomics to characterise the signatures associated with these mutational profiles. Finally, we assessed the impact of immune modulation upon the development of mesothelioma in these models.

We observed the double tumour suppressor targeted mice take longer to develop disease than triple targeted mice and cancer penetrance is also reduced. In addition to our existing mouse models, we're exploring the effects of T-cell deficiency and the deficiency of other targets in the pathway. We're doing this by using viral delivery of targeted Cas9, in our established mouse models and others. This allows us to investigate how alterations in the immune system and other pathways impact the development of MPM.

Investigating the Link Between Pleural Effusion and Mesothelioma Development in Genetically Defined Mouse Models Using Ultrasound

Poster - Abstract ID: 283

Dr. Xinya Hong [1], *Dr. Pooyeh Farahmand* [2], *Ms. Danielle McKinven* [2], *Dr. George Skalka* [2], *Ms. Jennifer Doig* [2], *Prof. Daniel Murphy* [2]

1. *University of Glasgow* ; *Zhongshan Hospital Affiliated to Xiamen University*, **2.** *University of Glasgow*

Malignant mesothelioma, originating from the mesothelial lining of the pleural, peritoneal, and pericardial cavities due to prior asbestos exposure, presents a significant challenge in clinical diagnosis, treatment, and poor prognosis. Research indicates that genetic susceptibility also plays a role in the development of this disease. With a focus on pleural malignant mesothelioma (MPM), our team has developed genetically defined mouse models by combining CRE-mediated deletion of relevant tumour suppressor genes, namely Bap1; Cdkn2s; Nf2 and Tp53, with asbestos fibre exposure. This unique approach allows us to study the emergence and progression of pleural effusion in different MPM mouse models, aiming to achieve four primary goals.

Firstly, we endeavour to establish ultrasound-based methods for accurately measuring pleural effusion volume in mouse mesothelioma models. Secondly, we seek to determine the relationship between pleural effusion and disease progression, shedding light on its potential as an early indicator of malignant progression. Additionally, we aim to assess whether different mouse models (histological subtypes) exhibit varying volumes of effusion during the development process. Lastly, we will assess the disparity in effusion volumes between treated and untreated mice, aiming to discern its potential as an indicator of treatment efficacy and to explore the optimal treatment timing.

By achieving these goals, we aim to extend patients' survival by identifying high-risk asbestos-related pleural effusion (ARPE) and offering novel treatments. This research holds promise for improving the understanding and management of malignant mesothelioma, ultimately benefiting those affected by this challenging cancer.

Ion-Mobility Quadrupole Time-of-Flight Mass Spectrometry: A Novel Technique to Characterize the Environmental Organic Micropollutants

Poster - Abstract ID: 909

Dr. Guangbo Qu [1]

1. *State Key Laboratory of Environmental Chemistry and Ecotoxicology, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China*

Environmental organic micropollutants (OMPs) refer to the natural or synthetic chemicals that are detected in environmental samples and cause a potential threat to human health and the ecological environment. Generally, OMPs consist of pesticides, industrial chemicals, veterinary drug, mycotoxins, pharmaceuticals and personal care products, as well as their transformation products. Some OMPs have been proven to disrupt the endocrine system and contribute to reproductive disorders, allergic diseases, and even cancer. GC- and LC-MS are the most commonly used techniques to detect OMPs in environmental and human samples, however, the high complexity of the matrices and the presence of isomers hinder the undoubted identification of OMPs. Ion mobility spectrometry (IMS) is a rapid gas-phase separation technique that achieves the separation of small molecules based on collisions between ions and buffer gases. The IM-derived collision cross section (CCS) can serve as an additional point for the identification of small molecules. In this study, we developed a CCS database containing 675 OMPs, including plasticizers, bisphenols, antioxidants, flame retardants, per-and polyfluoroalkyl substances. This database was used for the suspect screening of migrates from recycled high-density polyethylene. By matching the retention time, m/z, and CCS of detected compounds with those in the database, 58 migrated substances were successfully identified. The most abundant migrated substance was tri(2,4-di-tert-butylphenyl)phosphate, while a significant portion of the detected compounds were polyethylene glycol oligomers. Additionally, this study discusses the advantages of IMS in separating isomers, removing interfering ions, and separating co-eluting compounds in chromatography. With the improvement of resolving power, IMS can further enhance the confidence of qualitative results for OMPs.

Linking lead particulate matter in air filters to metal contamination in soils near a lead-acid battery smelter, East Los Angeles, California, U.S.A.

Poster - Abstract ID: 719

Dr. Nora Foley [1], ***Dr. Robert Ayuso*** [1]

1. *United States Geological Survey*

The health of residents living near the Exide lead-acid battery smelter has been greatly impacted by Pb contamination. Lead isotopes of local soil profiles were measured to survey possible Pb sources. Nanoparticles trapped in air filters designed to monitor smelter effluents were also analyzed to evaluate linkages between smelter emissions and Pb in soils in the surrounding minority group neighborhoods.

Filter paper samples (~1 x 2cm) were mounted on stubs and studied by BSE FE-SEM imaging (20 kV, WD=10 mm) and qualitative EDS at µm to nm scales. The particles range in shape from (A) distinctive spheres consisting of Cu (<3 µm to 100 nm), Si, and Pb (<5 µm), (B) subspherical to irregular shapes of Pb and Pb admixed with silica, and (C) irregular flakes and angular clumps of Fe and other base metals (<5 to >50 µm-wide). Spherical and subspherical metallic shapes of this type are rarely found in nature. The particle shapes are commonly found in fine fractions of metallic dust produced by many smelter operations; coarser fractions of smelter dust can have other shapes (cubes, rods, needles, subrounded) depending on the mineralogical interplay of metals, metalloids, and anions in the smelter stacks. Coarser fractions can include Pb-oxide and Pb-chloride phases.

The distinctive shapes and chemical character of the metal particles suggest a direct link between Pb particle emissions coming from the Exide plant stacks and Pb particles in the air-quality filters. These data trace the path of Pb-bearing emissions coming off the smelter stacks and indicate that atmospheric deposition of Pb emanating from the smelter was distributed to surrounding residential neighborhoods. Thus, mineralogical, elemental, and isotopic data can be used to identify sources of contamination, help inform decision makers, and assist local, State, and national agencies in effective cleanup and proper remediation.

Major Influence of Hydroxyl and Nitrate Radicals on Air Pollution by Environmentally Persistent Free Radicals

Poster - Abstract ID: 985

Dr. Wenxiao Pan [1], ***Dr. Qiao Xue*** [2], ***Dr. Xian Liu*** [1], ***Dr. Jianjie Fu*** [1], ***Dr. Aiqian Zhang*** [1]

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Environmentally persistent free radicals are pollutants recently detected in most environmental matrices such as fly ash, aerosols, soils and sediments. Their generation and transformation is poorly known, notably in the atmosphere. Here we modelled the effect of dioxygen O_2, hydroxyl radical •OH, and nitrate radical NO_3 on Cu(II)O surface-bound phenoxyl radical, using quantum chemical calculations and kinetics analysis. Results show that additional stabilization of the surface-bound phenoxyl radical is provided by the metal-oxide surface, implying that self-decomposition is not likely to occur. The addition reactions of hydroxyl and nitrate radicals with surface-mediated radicals are both thermodynamically and kinetically favourable, whereas the role of O_2 appears negligible. The tropospheric lifetime of the Cu(II)O-based surface-bound phenoxyl radical is only few seconds to about one hour, in agreement with experimental observations from the literature. The results obtained here overturns the long-held belief that EPFRs could persist in the atmosphere with long-lifetime at the orders of several days or even up to several months.

Major Influence of Hydroxyl and Nitrate Radicals on Air Pollution by Environmentally Persistent Free Radicals

Poster - Abstract ID: 989

Dr. Wenxiao Pan [1]**, *Dr. Jianjie Fu*** [1]**, *Dr. Aiqian Zhang*** [1]**, *Dr. Qiao Xue*** [2]**, *Dr. Xian Liu*** [1]

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Environmentally persistent free radicals are pollutants recently detected in most environmental matrices such as fly ash, aerosols, soils and sediments. Their generation and transformation is poorly known, notably in the atmosphere. Here we modelled the effect of dioxygen O_2, hydroxyl radical •OH, and nitrate radical NO_3 on Cu(II)O surface-bound phenoxyl radical, using quantum chemical calculations and kinetics analysis. Results show that additional stabilization of the surface-bound phenoxyl radical is provided by the metal-oxide surface, implying that self-decomposition is not likely to occur. The addition reactions of hydroxyl and nitrate radicals with surface-mediated radicals are both thermodynamically and kinetically favourable, whereas the role of O_2 appears negligible. The tropospheric lifetime of the Cu(II)O-based surface-bound phenoxyl radical is only few seconds to about one hour, in agreement with experimental observations from the literature. The results obtained here overturns the long-held belief that EPFRs could persist in the atmosphere with long-lifetime at the orders of several days or even up to several months.

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Pan, W., X. Chang, J. M. Liu, X. Xue, Q. Fu, J. J. Zhang, A.Q. "Interfacial formation of environmentally persistent free radicals—A theoretical investigation on pentachlorophenol activation on montmorillonite in $PM_{2.5}$", Ecotoxicol Environ Saf, 169: 623–630 (2019).

Mechanism of Soil Selenium Enrichment and the Influencing Factors of its Availability in Jinqu Basin

Poster - Abstract ID: 338

Dr. Chunlei Huang [1], ***Mr. Rui Sun*** [1], ***Dr. Ping Li*** [2], ***Dr. Xinzhe Lu*** [1], ***Ms. Yingchun Wei*** [1], ***Ms. Hanqin Yin*** [1], ***Mr. Ruizhe Guan*** [1], ***Dr. Mingxing Xu*** [1], ***Mr. Geliang Wang*** [1], ***Mr. Xudong Xu*** [1], ***Ms. Yan Zhou*** [1]

1. *Zhejiang Institute of Geosciences,* ***2.*** *China University of Geosciences*

Selenium (Se) is an essential trace nutrient element required for human health. To assess the environmental health effects of soil Se, Jinqu Basin, a typical red basin in central Zhejiang Province, with an average soil Se content exceeding 0.278 mg/kg, was selected. Land geochemical surveys suggest the main sources of Se are the parent materials with abundant Se reserves, and the middle-Pleistocene red soil weathered material is the main parent material in typical Se enriched areas, with an average Se content of 0.34-0.38mg/kg, and the large plinthitic red earth outcroppings were investigated. Systematic analysis of geological structure background, geomorphologic characteristics and accumulation process of Zhijiang Formation reveal the parent rock of plinthitic red earth is pyroclastic rocks of late Jura-Early Cretaceous gritty mountain group or Chencai diamictite in southern Jinqu Basin. The detailed profile analysis indicates soil Se has parent rock inheritance. Strong adsorption capacity of Fe-based clays, enriched in the matrix, captured Se from various source during soil formation, leading to Se enrichment in the matrix. Thus, plinthitic red earth is the Se source in the typical Se enriched areas. It is noteworthy that soil Se bioavailability is the significant factor in health effect, geo-microbes occupied a key role. Selenite-reducing and selenate-reducing bacterial strains were isolated from the soils by using specific biological medium, *Chitinophaga* was the first reported genus capable of selenite reduction. The rice pot experiment demonstrated the selenite-reducing isolates could reduce selenite to nano-Se. The addition of selenite-reducing isolates *Chitinophaga sp.* and *Comamonas testtestoni* promoted rice Se contents increased by 47% and 92%, respectively. Similarly, selenate-reducing isolates *Chitinophaga sp.* and *Comamonas testtestoni* also increased rice Se contents, by 47% and 92%, respectively. Therefore, identifying soil Se source, combining with geo-microbes technology, can scientifically enhance soil Se resources utilization to stimulate health potential of Se enriched land.

Methane Emissions from Paddy Soils is Reduced by Soil Arsenic Content: Insight from Continental Investigation and Laboratory Incubation

Poster - Abstract ID: 485

Prof. Xianjin Tang [1]

1. *Zhejiang University*

The coupled pathway of anaerobic methane (CH_4) oxidation and arsenate reduction increases the risk of arsenic (As)-releasing from soils. However, how the biogeochemical processes of As influence CH_4 consumption and generation remains unclear. Here, 141 paddy soils were collected from 47 sites with different As-level gradients in China to investigate the abundances and activities of functional genes involved in CH_4-cycling using metagenomic sequencing approaches and quantitative polymerase chain reaction analysis (RNA level). The results revealed that total soil As was a crucial factor affecting the key functional gene and genera related to CH_4 metabolisms. Further microcosm incubations showed that 30 mg kg^{-1} As addition reduced CH_4 emissions by 68.5%, and resulted in a 10 times increase in the transformation of $^{13}CH_4$ to $^{13}CO_2$. The following two aspects induced the inhibition mechanism of As on CH_4 emissions: (1) the toxicity of As decreased the abundance and transcriptions of *mcrA* gene and the abundance of indigenous soil methanogenic archaea (i.e., *Methanobacterium* and *Methanomassiliicoccus*); (2) the increased arsenate acted as an alternative electron acceptor to strengthen the coupled anaerobic CH_4 oxidation and reductive As mobilization, enhancing the ability of paddy soils to diminish CH_4 emissions endogenously. These findings contribute to understanding the interactions and coupling of As transformation and CH_4 cycling in soils, and provide new insights into improved evaluation of rice paddies' contribution to global warming.

MtDNA copy number in oral epithelial cells severs as a potential biomarker of mitochondrial damage under neonicotinoids exposure: a cross-sectional study

Poster - Abstract ID: 96

Dr. Quan Zhang [1], ***Ms. Sijia Gu*** [1], ***Ms. Lili Fu*** [1], ***Ms. Ximing Wang*** [1], ***Dr. Meirong Zhao*** [1], ***Dr. cui wang*** [2]

1. *Zhejiang University of Technology,* ***2.*** *Zhejiang Chinese Medical University*

As the mitochondrial DNA copy number (mtDNAcn) had been reported to be a biomarker for mtDNA damage in honeybees when exposed to sublethal neonicotinoids, the feasibility of human mitochondria as a predictor upon neonicotinoid exposure remains elusive. This study investigated the association between the urinary neonicotinoid and the relative mtDNAcn (RmtDNAcn) of oral epithelial cells collected in a cross-sectional study with repeated measurements over six weeks. The molecular mechanism underlying neonicotinoid-caused mitochondrial damage was also examined by *in vitro* assay. Herein, the average integrated urinary neonicotinoids (IMI_{RPF}) concentration ranged from 8.01 to 13.70 μg/L (specific gravity-adjusted) during the sampling period. Concomitantly with an increase in urinary IMI_{RPF}, RmtDNAcn significantly increased from 1.20 (Low group) to 1.93 (High group), indicating potential dose-dependent mitochondrial damage. Furthermore, the linear regression analysis confirmed the significant correlation between IMI_{RPF} and RmtDNAcn. Results from *in vitro* assays demonstrated that neonicotinoid exposure led to the inhibition of genes encoding mitochondrial oxidative phosphorylation (OXPHOS) complex I and III (*e.g., ND2, ND6, CytB, and CYC1*), accompanied by increased reactive oxygen species (ROS) production in SH-SY5Y cells. Conjointly, neonicotinoid exposure led to mitochondrial dysfunction and the resulting increase in RmtDNAcn, which may serve as a plausible biomarker for humans.

Multiomics sequencing and AlphaFold2 analysis of the stereoselective behavior of mefentrifluconazole for bioactivity improvement and risk reduction

Poster - Abstract ID: 382

Prof. Tong Liu [1], ***Prof. Xiuguo Wang*** [1]

1. Tobacco research institute of chinese academy of agricultural sciences

Pesticides will inevitably cause harm to the environment while ensuring agricultural production. Chiral pesticides may be an important breakthrough to realize the efficient utilization and risk reduction of pesticides. Mefentrifluconazole is a new generation of chiral triazole fungicide developed by BASF. In this study, the stereoselective stability, bioactivity, fate, and biotoxicity were systematically investigated using multiomics sequencing and AlphaFold2 analysis. The main purpose of this study is to elucidate the differences and molecular mechanisms of mefentrifluconazole enantiomers in bioactivity, environmental fate and biotoxicity, which could provide a theoretical reference for bioactivity improvement and risk reduction. Our results indicated that the stability of mefentrifluconazole enantiomers differed between environmental media, and they were stable in water and sediment in the dark. The bactericidal activity of *R*-mefentrifluconazole against the four target pathogens was 4.6–43 times higher than that of *S*-mefentrifluconazole. In the water-sediment system, *S*-mefentrifluconazole dissipated faster than *R*-mefentrifluconazole in water; however, its accumulation capacity was higher than that of *R*-mefentrifluconazole in sediment and zebrafish. *S*-mefentrifluconazole induced more differentially expressed genes (DEGs) and differentially expressed proteins (DEPs) in zebrafish than did *R*-mefentrifluconazole. Multiomics sequencing results showed that *S*-mefentrifluconazole enhanced the antioxidant, detoxification, immune, and metabolic functions of zebrafish by interacting with related proteins. Based on AlphaFold2 modeling and molecular docking, mefentrifluconazole enantiomers had different binding modes with key target proteins in pathogens and zebrafish, which may be the main reason for the stereoselective differences in bioactivity and biotoxicity. Based on its excellent bioactivity and low biotoxicity, the *R*-enantiomer can be developed to improve the bioactivity and reduce the risk of mefentrifluconazole.

Nano zerovalent iron supported on chitin microspheres for the removal of combined pollutants

Poster - Abstract ID: 56

Prof. Yao Huang [1]

1. *China University of Geosciences*

Compared to single pollutant, the remediation of combined pollutants (such as heavy metals and organic pollutants) remains challenging. Nano-zero-valent iron (nZVI) is a versatile remediation material, but the tendency of particle agglomeration limits its practical application. In the present work, chitin microspheres fabricated from natural resources were used as supporting material for nZVI and the removal performance of combined pollutants (Cr(VI) and nitrobenzene as representatives) of the supporting material was evaluated. The best removal performance of the combined pollutant was achieved at a Fe/Chi-M mass ratio of 1:1. Further increasing the nZVI loading amount led to particle aggregation and decreased removal efficiency. The influences of different factors (initial concentration, dosage, pH, DO, bimetallic modification) on removal efficiency was further studied. The removal of Cr(VI) and nitrobenzene was competitive, but under the same concentration gradient, the inhibition of Cr(VI) on nitrobenzene removal was more significant than that of nitrobenzene on Cr(VI) removal. Intermediate analysis and spectra characterization results indicated that the removal of single nitrobenzene was a instant chemical reductive transformation while the removal of single Cr(VI) was a slower complex process of adsorption, reduction, and co-precipitation. While in the combined solution, the removal of Cr(VI) by adsorption accounted for a larger proportion, and the resultant Fe(III)/Cr(III) co-precipitates on the material surface might impede the contact of nitrobenzene and nZVI and therefore inhibited its removal. The present work reveals the potential of natural polymer resources in the fabrication of highly reactive nanoparticle composites and hopefully contributes new thoughts to the remediation of combined pollutants.

Nanoscale Mechanisms of Arsenic Sequestration and Vertical Distribution in Soils with Natural High Backgrounds

Poster - Abstract ID: 1009

***Dr. Yang Lu* [1], Ms. Qingmei Song [1], Dr. Qianying Sun [1], Dr. Yingxin Wu [2], Prof. Wencheng Wu [3]**

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In regions with geological high-background sites, the presence of naturally elevated heavy metal levels often complicates environmental remediation and risk assessment. This study investigates arsenic (As) distribution and stabilization mechanisms within such a site in South China, focusing specifically on As due to its prevalence as a major contaminant. Arsenic content and speciation were determined at various soil depths across three zones distinguished by varying As contents, high (H), medium (M), and low (L), to elucidate the vertical distribution patterns of As and its environmental implications. Advanced analytical methods such as X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), and spherical aberration-corrected scanning transmission electron microscopy (Cs-STEM) were employed to explore the soil's mineral composition and As valence states, along with the nanoscale sequestration mechanisms. Findings revealed that As was primarily distributed in the 4-6m soil profile and occurred in chemically stable fractions associated with Fe(III) minerals. As is mainly presented in the As(V) form. Cs-STEM provided direct evidence for the incorporation of As into Fe(III) oxide nano particles. The As chemical fraction and nano scale sequestration patterns reduced its mobility and minimizing its impact on groundwater quality, which generally adheres to or approaches Level III standards (50 μg/L) in China. This study enhances our understanding of arsenic's environmental behavior in soils with high natural backgrounds and underscores the importance of tailored, site-specific investigations for effective risk assessment and remediation strategies, thereby providing critical insights for the safe utilization of these challenging environments.

National mortality burden attributable to the unprecedented heatwaves in 2022 in China

Poster - Abstract ID: 261

Dr. Jianxiong Hu [1]

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Objective: To assess the heatwave-related mortality burden in 2022 in China through in comparison with that during 2000-2021.

Methods: We collected daily number of non-accidental deaths in 364 counties/districts across China from 2006–2017 and obtained daily maximum temperatures at city-level during 2000–2022 from ERA5 reanalysis. Heatwave defined by 2 or more consecutive days with daily maximum temperature exceeding the 92.5th percentile during 2006-2017, and the cumulative excessive degree-day (CEDD) of heatwave defined as the sum of daily maximum temperatures exceeding the heatwave threshold. A two-stage approach, including a distributed lag nonlinear model (DLNM) and a multivariate meta-analysis, was used to estimate exposure-response associations of heatwave with mortality in 364 counties/districts during 2006-2017 across China, which were then applied to assess the mortality burden attributable to heatwave exposures.

Results: During the warm season of 2022, mainland China experienced 2,795 heatwaves at the city level, resulting in a CEDD of 31,626 degree-days, which marked the highest values recorded during 2000–2022. The 2022 heatwaves were associated with 76,957 [95%CI (confidence interval):67,158–86,062] deaths across China, of which 48,653 (95%CI:42,182–54,566) were from cardiovascular diseases, 41,807 (95%CI: 35,982–48,363) were females, and 66,838 (95%CI: 58,929–75,301) were in people over 65 years. Spatially, greater heatwave-related mortality in 2022 was observed in Eastern-Central China. Compared with 2000–2021, the attributable fraction(AF) of heatwave-related deaths in 2022 increased by 62.9% (95%CI: 37.5%–91.2%).

Conclusion: This study highlights the unprecedented nature of the 2022 heatwaves, underscoring their substantial impact on mortality. The prospect of more intensive and frequent heatwaves in the future, driven by climate change and an aging population, poses a significant threat to public health in China.

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Nitrogen cycle in Tokyo's Sewage System: Assessing the Potential of Recycling Nitrogen Resource

Poster - Abstract ID: 346

Ms. Yue Zhang [1], ***Prof. Bin-Le LIN*** [2], ***Dr. Yuki Ichisugi*** [2], ***Prof. Tsunemi Kiyotaka*** [2], ***Prof. Tahara Kiyotaka*** [2], ***Prof. Tomohiko Ihara*** [1]

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In response to the Colombo Declaration's goal of halving N waste by 2030, there is a critical need to focus on reducing the reactive nitrogen (Nr) losses. Our previous studies have identified sewage sludge N as the most critical contributor to the urban environment, representing 57% of the total N inflow in the Tokyo metropolitan area (Tokyo)—a direct byproduct of the urban sewage system. This study aims to quantify N inflow, stock, and outflow from industrial and agricultural activities in the producer and consumer sectors within Tokyo's sewage system. Based on the Mass Balance method, we proposed a new framework that focuses on a finer scale of analysis for estimation. This framework subdivided the industrial and agriculture activities of Tokyo into specific products and services, utilizing statistical data as the activity data and the Inventory Database for Environmental Analysis (IDEA) as parameters to estimate the N flows. Our preliminary results indicated that N from food sector was dominant in the Tokyo's sewage system. These findings elucidate the contribution of N input from various products and services in Tokyo to the sewage system (at a finer scale), along with their Nrs emissions, for further assessing the potential of N recycling N resource in the urban sewage system. Simultaneously, provides valuable recommendations for N management in urban sewage system.

Novel therapeutic strategies for malignant mesothelioma

Poster - Abstract ID: 602

Ms. Dominika Lubawska [1], ***Dr. George Skalka*** [2], ***Dr. Sarah Laing*** [1], ***Ms. Danielle McKinven*** [1], ***Dr. Nikolaos Kanellakis*** [3], ***Prof. Daniel Murphy*** [1]

1. *School of Cancer Sciences, University of Glasgow,* ***2.*** *University of Glasgow,* ***3.*** *University College Oxford*

Importance of the work and objectives

Mesothelioma arises predominantly due to asbestos exposure. Despite a total ban of asbestos products, the UK population is amongst those with the highest incidence worldwide with 2,718 diagnoses every year. Mutations affecting the Hippo pathway, including loss of function mutations in tumour suppressors *NF2*, *LATS1* and *LATS2*, are common in mesothelioma. These tumour suppressors function to inhibit the activity of YAP/TAZ transcription co-factors, and their loss results in YAP/TAZ hyperactivity. NUAK1 & NUAK2 are AMPK related kinases that participate in feed-forward YAP activation and are both transcriptionally induced by YAP. Our hypothesis is that NUAKs may present a targetable vulnerability in Hippo pathway mutant mesothelioma.

Methodologies

Primary mesothelioma cell lines were treated with single and dual inhibitors of NUAK1/2, as well as the dual G9A/EZH2 inhibitor HKMTi-1-005 in increasing concentrations over 72 hours each. Confluence and cell death were visualised and quantified using Incucyte® live-cell analysis and annexin-V and PI staining apoptosis assay.

Main results and conclusion

NUAK1 inhibition with HTH-01-015 proved less effective in suppressing the growth of mesothelioma cell lines compared with dual NUAK1/2 targeting, which significantly decreased confluence at 72 hours post-treatment at 0.5μM concentration (unpaired t-test; 91.06% vs 72.79%: $t(2) \approx 5.6$, $p \approx 0.03$) and increased the total fraction of apoptotic cells as per the FACS assay at 1 μM (9.67% vs 52.74%: $t(4) \approx 3.86$, $p \approx 0.02$). Treatment with HKMTi-1-005 was not as effective and only decreased the confluence of mesothelioma cell lines at 5 μM (86.17% vs 63.5%: $t(36) \approx 2.6$, $p \approx 0.01$). Those results, along with other work from the Murphy lab, suggest that inhibiting NUAK1/2 makes mesothelioma cell lines susceptible to apoptosis – a mechanism we plan to investigate further on a molecular level and in an *in vivo* setting.

PFOS causes HK-2 cell injury through ferroptosis and endoplasmic reticulum stress pathways

Poster - Abstract ID: 257

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Perfluorooctane sulfonate (PFOS) is a synthetic persistent organic pollutant that is widely used in everyday and industrial products. Studies have shown that PFOS can accumulate in environment and organisms, including human beings. As the kidney is the major excretory organ of PFOS, it is important to study the damage of PFOS to the kidney to investigate the toxicity of PFOS.

Human proximal tubular epithelial cell (HK-2) were treated with 200 μM PFOS or 1 μM Fer-1. We used the CCK-8 method to detect cell viability; lab kits to detect the levels of MDA, GSH, intracellular iron ion, and GPX-4; Western blot to detect endoplasmic reticulum stress and cell damage related proteins.

PFOS can cause HK-2 cell damage, the expression levels of KIM, a marker of renal tubular injury, were significantly increased in HK-2 cells exposed to PFOS. PFOS could induce ferroptosis in HK-2 cells through triggering lipid peroxidation, the levels of intracellular total iron ion and MDA were significantly increased while the levels of GSH and GPX-4 were significantly decreased, which further leads to cell damage; we also found that PFOS caused the cell damage by causing the development of endoplasmic reticulum stress (ERS), the expression levels of ERS-related proteins, GRP78, ATF6, IRE1,and PERK, were significantly increased.

PFOS can cause damage to HK-2 cells through ferroptosis and endoplasmic reticulum stress. Although PFOS is present in the environment at low concentrations, the health risk of PFOS to humans cannot be ignored.

PM2.5-induced cardiac hypertrophy via iron homeostasis imbalance and ferroptosis

Poster - Abstract ID: 787

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Exposure to $PM_{2.5}$ is correlated with cardiac remodeling, of which cardiac hypertrophy is one of the main clinical manifestations. However, the potential mechanism of $PM_{2.5}$-induced cardiac hypertrophy through ferroptosis remains unclear. This study was aimed to explore the molecular mechanism of cardiac hypertrophy caused by $PM_{2.5.}$ The results showed that $PM_{2.5}$ could induce cardiac hypertrophy and dysfunction in mice. Meanwhile, the characteristics of ferroptosis were observed, such as iron metabolism disorder, lipid peroxidation, mitochondrial damage and abnormal expression of key molecules. Subsequently, mitophagy was activated and provided an additional source of labile iron, enhancing the sensitivity of AC16 cells to ferroptosis. In addition, NCOA4 knockdown reversed the iron mobilization disorder and lipid peroxidation caused by $PM_{2.5}$, thereby alleviating ferroptosis. In summary, our study found that iron mobilization disorder-mediated ferroptosis played an important role in and $PM_{2.5}$-induced cardiac hypertrophy.

Pollution characteristics and Risk Assessment of antibiotics in Fenhe River

Poster - Abstract ID: 230

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Antibiotics are widely used in medical treatment, livestock and poultry breeding, aquaculture and other fields because of their good clinical therapeutic effect and promoting body growth. However, the excessive use of antibiotics will lead to antibiotics and their metabolites can eventually flow into the river basin. Antibiotics in the basin can cause harm to the microbial community and aquatic organisms, improve the drug resistance of bacteria, and eventually bring risks to the ecology and human health.

This study investigated 26 antibiotics of five classifications in surface water and sediment samples at 23 sites in wet season and dry season of Fenhe River. Then, the distribution of seasonal variation of antibiotics were studied, the ecological risk was evaluated. In general, the content of antibiotics of Fenhe River was higher in dry season than that in wet season. In wet season, 21 antibiotics were detected, with the total concentration range of 113.8-1106.0ng/l. In dry season, 25 antibiotics were detected, with the concentration range of 130.41-1614.88ng/L. SAs were the main species of wet season and dry season. Spatially, the concentrations of antibiotics were the highest in the middle stream in the wet season and dry season.

The results of ecological risk assessment based on assessment factor (AF) method showed that antibiotics in Fenhe River was medium risk level in wet season and dry season. In terms of specific antibiotic substances, sulfamethoxazole and roxithromycin were the high risk level in wet season and dry season, while the five antibiotic substances of QNs were the medium risk level. In addition, tetracycline in wet season and sulfadiazine, thiamphenicol, clarithromycin in dry season also were the medium risk level. In terms of spatial distribution, the upper stream of the main stream were low risk in dry season and wet season.

Prenatal Exposure to Emerging Plasticizers and Synthetic Antioxidants and Their Potency to Cross Human Placenta

Poster - Abstract ID: 801

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Gestational exposure to environmental chemicals and subsequent permeation through placental barrier represents potential health risks to both pregnant women and their fetuses. In the present study, we explored prenatal exposure to a suite of 46 emerging plasticizers and synthetic antioxidants (including five transformation products of 2,6-di-*tert*-butyl-4-hydroxytoluene, BHT) and their potency to cross human placenta based on a total of 109 maternal and cord serum pairs. Most of these chemicals have rarely or never been investigated for prenatal exposure and associated health risks. Eleven of them exhibited detection frequency greater than 50% in maternal blood, including dibutyl fumarate (DBF), 2,6-di-*tert*-butylphenol (2,4-D*t*BP), 1,3-diphenylguanidine (DPG), methyl-2-(benzoyl)benzoate (MBB), triethyl citrate (TEC), BHT and its five metabolites, with a median concentration of 0.05 to 3.1 ng/mL. The transplacental transfer efficiency (TTE) was determined for selected chemicals with valid measurements in more than 10 maternal/cord blood pairs, and the mean TTEs exhibited a large variation (i.e., 0.29 – 2.14) between chemicals. The determined TTEs for some of the target chemicals were comparable to the predicted values by our previously proposed models developed from molecular descriptors, indicating that their transplacental transfer potency could be largely affected by physicochemical properties and molecular structures. However, additional biological and physiological factors may influence the potency of environmental chemicals to cross human placenta. Overall, our study findings raise concern on human exposure to an increasing list of plastic additives during critical life stages (e.g., pregnancy) and potential health risks.

Preparation of fluopyram-loaded nanofiber nematicide and its biological activity against Meloidogyne incognita

Poster - Abstract ID: 990

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Root-knot nematode disease causes huge economic losses in agricultural production per year. In order to improve the control effect of the nematicide flupyram on disease. This study is based on the electrospinning technique to prepare the fluopyram-loaded nanofiber nematicide against *Meloidogyne incognita*. In order to enrich the types of effective nematicides for controlling root knot nematode disease of crops, expand the application field of nanofiber agents and provide a new kind of green pesticide. Two kinds of fluopyram-loaded nanofiber nematicide (Flu@NF) were prepared by coaxial electrospinning technology with different biodegradable materials, polyethylene glycol (PEG)/polycaprolactone (PCL) and cellulose acetate (CA), as shell. The morphology, structure, elemental composition, functional components and thermal stability of PEG/PCL-Flu@NF and CA-Flu@NF were characterized by SEM, EDS, FTIR and TGA. The average diameters of two kinds of agents were 316 nm and 440 nm, the nematicides of pesticide loading rates were 15.32% and 20.37%, respectively. Moreover, the thermal stability of fluopyram was significantly improved after shell coating by coaxial electrospinning. Compared with fluropyram suspension, the slow-release performance of fluopyram-loaded fibers was significantly improved, and the mortality of J2 was significantly increased with the extension of treatment time. The mortality rate of the two fibers against J2 was higher than 98% after 24 h treatment. The two kinds of nematicides had a good inhibition effect on the hatching of nematode eggs. Based on coaxial electrospinning technology, the nanofibers prepared with PEG/PCL and CA as shell materials have excellent coating effect on fluopyram, and the fluopyram-loaded fibers have high biological activity on *Meloidogyne incognita* through slow-release action, which has great potential to prevent and control root-knot nematode disease through crop root protection. This nanofiber nematicide can reduce the frequency of pesticide application, reduce the harm of pesticide residues to the environment and the threat to human health.

Protonated carbon nitride elicits microalgae for water decontamination

Poster - Abstract ID: 223

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Comprehending the effects of synthetic nanomaterials on natural microorganisms is critical for the development of emerging nanotechnologies. Compared to artificial inactivation of microbes, the up-regulation of biological functions should be more attractive due to the possibility of discovering unexpected properties. Herein, a nanoengineering strategy was employed to tailor g-C_3N_4 for the metabolic regulation of algae. We found that surface protonated g-C_3N_4 (P-C_3N_4) as a nanopolymeric elicitor enabled the reinforced biological activity of *Microcystis aeruginosa* and *Scenedesmus* for harmful substances removal. Metabolomics analysis suggested that synthetic nanoarchitectures induced moderate oxidative stress of algae, with up-regulated biosynthesis of extracellular polymeric substances (EPS) for resisting the physiological damage caused by toxic substances in water. The formation of oxidative $\cdot O_2^-$ contributed to over five-fold enhancement in the biodecomposition of harmful aniline. Our study demonstrates a synergistic biotic-abiotic platform with valuable outcomes for various customized applications.

Replication of cabbage and spinach certified reference materials for biochemical analysis

Poster - Abstract ID: 702

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In order to meet the needs of agricultural product analysis and improve the ability of element detection in the agricultural field, the replication of two national first-class certified reference materials, cabbage powder GBW10014 and spinach powder GBW10015, has been carried out. They were prepared by coarse crushing, drying, fine crushing, sifting, mixing after collection at the original sampling sites, packed with 25g sample in each polyethylene bottle, irradiation with ^{60}Co and then stored at 4-8 °C for long-time. The homogeneity test of more than 30 representative components was conducted, and the long-term stability test of 32 volatile and representative components was carried out at 5 time points in 1 year. The samples were mainly determined by inductively coupled plasma spectrometry (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS). The results showed that the sample homogeneity and stability were fairly good. A total of 11 laboratories were selected to implement sample analysis. A reasonable quantity traceability chain was established. Various methods were used to determine the value of 60 components. After suspicious value test and elimination, normal distribution test, arithmetic mean value is used as the certified value. The uncertainty is evaluated in detail, and the final synthetic uncertainty includes the uncertainty introduced by the analysis process, homogeneity and stability. 56 elements in Chinese cabbage powder and 58 elements in spinach powder were determined, and most of the elements concentration were the comparable to those in the original batch. The number of certified values was more than that in the original batch, and the uncertainty level was increased. The replication process meets the requirements of the standard, and the national first-class standard material certificate is obtained after examination.

Research on New Substances and Potential Health Impacts in the Pharmaceutical Industry Based on High-Throughput Methods

Poster - Abstract ID: 817

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Halogenated hydrocarbon pollution is widely distributed in the environment, present in soil, air, and any type of river medium. However, research on the identification, toxicity, and persistence of such pollutants in the gaseous environment, especially those arising from industrial emissions, remains to be further developed. This study selected representative pharmaceutical industries in East China and investigated organized emissions of atmospheric pollutants from workshops and sewage treatment plants through sampling. In the laboratory, high-throughput analytical methods were used to identify hundreds of new atmospheric substances emitted by the pharmaceutical industry, including several newly detected halogenated hydrocarbons. Based on health impact data reported in the literature, combined with machine learning and other methods, the potential health impacts of these new substances were studied, and their persistence in the atmosphere was analyzed, laying the foundation for research on new pollutants in the atmospheric medium. Our results highlight the environmental and particularly health impacts of organized and unorganized emissions of halogenated hydrocarbons in the pharmaceutical industry, underscoring the need for further attention. This provides technical support for research on new pollutants in the pharmaceutical industry, contributes to the improvement of national standards for organized emissions in the pharmaceutical industry, and offers a new perspective for global attention to the sustainable development of the pharmaceutical industry.

River health assessment reveals the effectiveness of watershed management in a pre-urban river

Poster - Abstract ID: 214

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River health assessment, as a management tool, was widely applied in the assessment and management of aquatic ecosystems in recent years. A large number of river health assessment cases have emerged at home and abroad. Given that, this study taken the Muli River in Huizhou as the study area and constructed a health assessment index system suitable for pre-urban watersheds. The river health assessment index system consists of 16 specific indicators in 6 aspects: land use, physical structure, comprehensive water quality, hydrology and water quantity, biological status and social satisfaction. The weight of indicators was calculated by the method of analytic hierarchy process, and the status of river health was determined according to the fuzzy comprehensive evaluation. The results showed that after the implementation of integrated watershed management, 90% of the river sections were basically healthy or above in the wet season, while 70% in the dry season. In general, the water quality of Muli River has been improved significantly, and the black-odorous waters have been completely eliminated. However, there are still some problems in some sections of Muli River, such as narrow and heavily disturbed riparian zone, poor biological status and water quality. In the future watershed management, on the one hand, it is necessary to strengthen the construction of riparian ecological infrastructure, control urban non-point source pollution in watershed, and improve the diversity of aquatic habitat; On the other hand, it is necessary to strengthen the management of sewage pipe network, prevent the overflow of sewage wells, rebuild aquatic vegetation, improve the diversity of water flow state, and carried out further sediment dredging in aquaculture area to avoid continuous pollution of waters by aquaculture residual pollutants. In addition, intelligent watershed management platform need be built to provide scientific and technical supports for the follow-up management of the watershed.

Secondary pollution in northwest China

Poster - Abstract ID: 526

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Through the analysis of 7 years (2015-2021) of surface monitoring of the air pollutants in Xi'an (the largest city in the northwest China) we show that roughly 2/3 of the days exceeded either the $PM_{2.5}$ or the O_3 level-1 air quality standard, highlighting the severity of air pollution. Moreover, an increase in O_3 pollution in the winter haze was also revealed, due to the constantly elevated reactive oxygenated volatile organic compounds (OVOCs), and in particular formaldehyde with ozone formation potential of over 50 μg m^{-3} in combination with the reduced NO_2. The abrupt decrease of NO_2, as observed during the lockdown in 2020, provided real-world evidence of the control measures, targeting only NO_x (70% decrease on average), were insufficient to reduce ozone pollution because reactive OVOCs remained constantly high in a VOC-limited regime. Model simulation results showed that with NO_2 reduction from 20-70%, the self-reaction rate between peroxy radicals, a pathway for SOA formation, was intensified by up to 75%, while the self-reaction rate was only reduced with a further reduction of VOCs of >50%. Therefore, a synergic reduction in $PM_{2.5}$ and O_3 pollution can only be achieved through a more aggressive reduction of their precursor gases. This study elucidates the status of ozone and $PM_{2.5}$ pollution in one of the most polluted regions in China, revealing a general trend of increasing secondary pollution i.e., ozone and SOA in winter haze. Controlling precursor gas emissions is anticipated to curb both ozone and SOA formation which will benefit not just the Fenwei Plain but also other regions in China.

Soil and groundwater contaminated with short-chain chlorinated paraffins and microbial responses

Poster - Abstract ID: 345

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The distributions of chlorinated paraffins (CPs) in soils and groundwater, and their ecological effects attract much attention, while site-scale data are scarce. In this study, an investigation was performed to address the issues at a CP production plant brownfield site. Short-, medium- and long-chain CPs (SCCPs, MCCPs, LCCPs) were detected in most soil samples ranging ND-5,090, ND-6,670, and ND-1,450 ng g^{-1} (dw), respectively. A hotspot was observed 10 m beneath the synthesis workshop, indicating the downward migration of CPs. The consistence of soil SCCP congener profiles with commercial product CP-52 suggested the leakage of CP products as the contamination source. SCCPs in groundwater ranged from not detected to 70.3 μg/L, with C_{13}-CPs (11.2–65.8%) and Cl_7-CPs (27.2–50.6%), in mass ratio, as the dominant groups. Similar to that in soils, SCCPs in groundwater were distributed in hotspot pattern. The entire contamination plume significantly migrated downgradient, while there was an apparent hysteresis of C_{13}-CP migration.

Soil microbial community composition and diversity were significantly influenced by SCCPs despite their lower contents compared to other contaminants. Microbial network indicated nonrandom co-occurrence patterns, with *Acinetobacter*, *Brevibacterium*, *Corynebacterium*, *Microbacterium*, *Stenotrophomonas*, and *Variibacter* as the keystone genera. Genera from the same module showed significant ecological links ($p < 0.05$) and were involved in the degradation of chlorinated organic contaminants. Meanwhile, groundwater microbial community was likely shaped by both hydrogeological condition (pH and depth) and SCCPs. Specifically, the microbial community responded to the contamination by forming a co-occurrence network with "small world" feature. Furthermore, it is indicated that the microbial community might cooperate to dechlorinate and mineralize SCCPs through anaerobic organohalide respiration mainly functioned by the keystone taxa, or cometabolic degradation processes functioned by *Aquabacterium* and *Hydrogenophaga*. Results of this study provide a better understanding of the environmental behavior and effects of SCCPs in soil and groundwater.

Soil Fe dynamics and isotope fractionation under agricultural soils

Poster - Abstract ID: 367

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Soil erosion affects the fate of nutrient elements in soils and further influences the growth and development of crops. Four soil sites under cultivated land and abandonment were chosen from the Mun River basin. Fe content and its isotopic composition were studied to investigate the migration and transformation processes and influencing factors. Soil Fe contents in cultivated land are much higher than those in abandoned cultivated land. Severe soil erosion occurs during the early phase (about one year) of agricultural abandonment, which leads to the loss of fine particles carrying Fe minerals. Soil erosion caused the preferential migration of light Fe isotope in abandoned cultivated land, and the heavy Fe isotopes were enriched in the residues. Although Fe contents increased to some extents with the short-term vegetation restoration, it is still far from returning to pre-abandonment content. It indicates soil erosion rapidly leads to Fe loss in cultivated land soils, and the restoration of Fe needs a long period of soil evolution, so the protection of cultivated land is an effective way to maintain sufficient Fe in soils.

Soil microbial respiration and its driving factors in four subtropical forests

Poster - Abstract ID: 501

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Soil microbial respiration is the key to the carbon cycle process of underground ecosystem and the assessment of global carbon budget. It has an important impact on soil carbon emission from forest ecosystems. However, the characteristics and driving mechanism of soil microbial respiration in subtropical forests remain poorly understood. Here, we explored the potential influence path and key driving factors of vegetation, soil, microbial community structure on microbial respiration in four typical subtropical forests-Camphor tree(*Cinnamomum camphora*), Beautiful sweetgum (*Liquidambar formosana*)，Masson pine(*Pinus massoniana*), and mixed Camphor tree and Masson pine forests. Results showed that the annual average soil microbial respiration rates of Camphor tree forest, Masson pine forest, mixed forest and Beautiful sweetgum forest were 2.57 $\mu mol \cdot m^{-2} \cdot s^{-1}$ 、1.51 $\mu mol \cdot m^{-2} \cdot s^{-1}$ 、1.73 $\mu mol \cdot m^{-2} \cdot s^{-1}$ 、1.57 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Soil temperature and moisture explained 51.1% ~ 72.9% and 24.8% ~ 47.1% of soil microbial respiration variation, and the interaction of soil temperature and moisture could explain 66.7% ~ 84.9% of soil microbial respiration variation. Vegetation (Shannon-Wiener diversity index and Simpson dominance index of plant community), soil basic properties (soil water content, pH, C: N, soil temperature) and microbial community structure (MBC: SOC, MBN, microbial community composition) had significant direct effects on soil microbial respiration. Vegetation and soil basic properties can also indirectly affect microbial respiration by affecting microbial community structure. Soil C: N and soil temperature (T) significantly affected microbial community structure, and then had a significant indirect impact on microbial respiration. Microbial entropy (MBC: SOC) and microbial biomass nitrogen (MBN) had the greatest effect on soil microbial respiration, followed by C: N, pH, microbial community composition, soil water content (SWC), soil temperature and vegetation. Our study revealed the relations between vegetation, soil, microbial community structure and microbial respiration, which had important scientific implications for understanding soil carbon losses.

Soil mineralogy in support of a regional geochemical baseline study in Greece

Poster - Abstract ID: 687

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The mineralogical composition of soils is of high significance when studying the distribution of potentially toxic elements, since their mobility is controlled by reactions related to mineral surfaces. In the context of constructing a regional geochemical soil database in Greece, the mineralogy of selected soil samples was also examined. The dataset includes 117 top soil samples (0-20cm) collected within an area of ~2500km^2 of varying geology in Greece. Following the geochemical analysis of the soils, the mineralogical composition was also examined in selected 24 top soil samples of the dataset. The selection of the samples was based on their uniform spatial distribution, the different land uses, and lithogeological types of the area. Supplementary mineralogical analyses were also conducted in specified samples based on their magnetic susceptibility, as well as in the solid residue of selected samples, which underwent sequential extraction procedures.

Powder x-ray diffraction was used for the mineralogy study. Soil samples were manually grinded in an agate mortar and pressed lightly in back-loaded sample mounts. Diffracton data were collected continuously from 3^o to 70^o 2θ (scanning speed 0.02^o/sec, rotation speed 30rpm) on a Bruker D8 Advance X-ray Diffractometer, using Cu-kα radiation. Data Diffrac.Eva Plus software was used for data processing using ICDD PDF-2 2004 database.

Mineralogical analysis showed the predominance of quartz (>50% w.w.), followed by plagioclase, K-feldspar, carbonate and phyllosilicate minerals (>10% each), in all soil samples. Pyroxene, amphibole, spinel and Fe-oxides were also identified in trace amounts in specific areas. The magnetic soil fraction consists primarily of hematite and maghemite. After sequential extraction, the main remaining mineral phases identified were quartz, serpentine, and Fe-oxides.

The integration of mineralogical, geochemical and geospatial information enabled the delineation of relatively homogeneous lithological domains in the area and supported the realistic assessment of soil background threshold values for future risk-assessment purposes.

Studies on the Bioaccessibility of Arsenic in Different Wild Edible Mushrooms

Poster - Abstract ID: 451

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Objective： As edible mushroom have high nutritional value and delicious flavor, they are loved by people, and meanwhile, they are easy to enrich heavy metals such as arsenic in the environment. Different arsenic forms have different toxicity, and the toxicity of inorganic arsenic is much greater than that of organic arsenic.It was found that arsenic forms in different kinds of edible mushrooms are also different, so the health risk of arsenic in edible mushrooms needs to be assessed by considering both its arsenic form and bioaccessibility. In this experiment, we studied the bioaccessibility of arsenic and arsenic forms in two wild edible mushrooms (Pleurotus citrinipileatus and Agaricus blazei Murill), so that we can more accurately express the health risk of arsenic in edible **Method**: Bioaccessibility was studied by in-vitro physiologically based extraction test (PBET), total arsenic was determined by ICP-MS, and arsenic forms were determined by HPLC-ICP/MS.

Results: Arsenic and arsenic forms in Pleurotus citrinipileatus and Agaricus blazei Murill had high bioaccessibility, the bioaccessibility of total arsenic was 78.2% and 98.1%, respectively, and that of different arsenic forms ranged from 81.3% to 104.8%, and arsenic bioaccessibility in gastrointestinal fluids was greater than that in gastric fluid fractions.

Conclusion: In this study, the bioaccessibility of arsenic and arsenic forms in different wild edible mushrooms were investigated via PBET, and it was found that both arsenic and arsenic forms in edible mushrooms showed high levels of arsenic and arsenic bioaccessibility varied among different edible mushrooms, and this study may provide support for a better evaluation of the health risks of ingesting edible mushrooms.

Keywords: Edible mushrooms; Arsenic and arsenic forms; Bioaccessibility

Study on spatial analysis of geological environment and long-lived villages , southern section of Taihang Mountain, Xingtai-Handan, China

Poster - Abstract ID: 945

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The relationship between geological environment and health and longevity is concerned by more and more scholars, who are engaged in the research of geology, medicine, environment and other disciplines. This study analyzed the spatial relationship between various geological elements and the health index, then evaluated the livable index. The analysis is qualitative and quantitative through ArcGIS software, based on health index, remote sensing, geographic, geological and geochemical information. The study results show that the long-lived villages mainly exist in the Great Wall sandstone zone and the Archeean Metamorphic rock zone. Because of the water quality in the sandstone and metamorphic rock areas, their health index is higher than that in other areas; the suitable vegetation coverage is between 68% -84%; the suitable altitude is between 453-476 m and between 575-630 m; the suitable slope of mountains is around 16 and 13 degrees; and the distance and direction between the macrobian village and the surrounding ridge are special. The applied research results established a livable (suitable for health and longevity) index, and selected 62 villages in three levels as good for health and longevity, through quantitative analysis and calculation. This information can be used as a scientific basis for the construction of the health care base.

Tempo-spatial controls of total coliform and E. coli contamination in a subtropical hilly rural watershed without sewage treatments

Poster - Abstract ID: 942

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Waterborne microbial pollution remains poorly understood in developing countries, especially in rural areas. The transport of point (e.g. untreated domestic wastewater) and non-point sources of fecal bacteria such as Total coliform (TC) and Escherichia coli (*E. coli*) and their spatial and temporal patterns were identified in a typical small agricultural watershed in a hilly area of subtropical China. Over the sampling area, 460 water samples from 24 sites were collected during a period of 12 months, and a remediation option using an existing ecological ditch was evaluated. The results showed that 70% surface water samples exceeded the guideline of 1000 TC MPN-100 ml^{-1} in the watershed. Also, 90% of groundwater samples exceeded the guideline of 10 MPN *E. coli*100 ml^{-1} for safe drinking water. Higher concentrations of TC and *E. coli* occurred both in the warm and rainy season in surface water and groundwater. TC and *E. coli* concentrations in surface water tributaries and groundwater near residential areas were greater than those in downstream water bodies. A 300 m long vegetated ecological ditch greatly reduced average concentrations TC of 97.7% and *E.coli* of 99.5%. TC and *E. coli* concentrations were significantly correlated with electrical conductivity and turbidity, both in surface water and groundwater, indicating that mixtures of organic colloids and sediment were the most important transport vector for pathogens. However, temperature only showed a controlling effect on bacteria concentration in groundwater in this particular watershed. The current research could help establish integrated management strategy to improve water quality in the hilly agricultural watersheds with certain urbanization activities.

Temporal dynamics of Iron and Manganese distribution: Insights from a multi-year analysis using Canonical (MANOVA)-Biplot

Poster - Abstract ID: 113

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The release of more than 50 million cubic metres of iron (Fe)-rich mine tailings from the Fundão dam in Brazil resulted in a severe environmental disaster affecting the Rio Doce basin and its surroundings. Understanding changes in the distribution of iron (Fe) and manganese (Mn) forms over time is critical for effective environmental management. This study used canonical (MANOVA) biplot analysis to investigate the composition of Fe and Mn forms over three years (2015, 2017 and 2021), focusing on exchangeable (EX), carbonate-associated (CA), ferrihydrite-associated (FR), lepidocrocite-associated (LP), crystalline oxide-associated (OX) and pyrite-associated (PY) forms. The sequential extraction analysis was conducted on soils collected from the *Doce* River estuary from the 0-5 cm layer. Eigenvalues and variance explained by the analysis showed that two axes accounted for 100% of the total variance, with the first axis contributing 67.5% and the second 32.5%. Global contrast based on Wilks' Lambda indicated significant differences in variable composition between years ($p < 0.001$). Significant differences in the composition of Fe and Mn forms were observed over the three-year period. Fe-OX and Fe-PY had the greatest influence on group separation ($F = 33.8$ and 37.9, respectively; $p < 0.001$) and squared correlations (61.6% and 59.3%, respectively). These variables showed strong associations with the canonical axes and contributed significantly to the observed variation. In 2015, Fe-OX and Fe-CA were the main variables representing the group, followed by Mn-EX. In 2017, Fe-FR and Mn-FR played a primary role, while in 2021, Fe-PY emerged as the primary variable, together with Fe-LP, Mn-LP and Fe-EX. Mn-CA had minimal influence on the group representation. Temporal variations in Fe and Mn form distributions were notable, with Fe-OX and Fe-PY playing key roles, possibly reflecting environmental or geochemical changes.

The bioavailability of soil selenium in high geological background areas

Poster - Abstract ID: 336

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Selenium (Se) is one of the essential elements for life, and despite its low abundance in the human body, it is indispensable for maintaining normal physiological activities. The intake of Se in the human body is closely related to the Se content in the soil. In areas with high geological background, the soil Se content is high, but its bioavailability is influenced by various factors, posing challenges to the development and utilization of unique land resources.

We conducted a systematic study in the high geological background area of Ankang, Shaanxi, collecting 80 sets of samples of crops and root soil. The results revealed that rice, corn, and other crops have abundant trace element content, but at the same time, there is a safety issue with a certain proportion of rice and corn exceeding heavy metal standards.

Correlation studies were conducted on the elements such as Se in rice and corn seeds, as well as their content in DGT, $CaCl_2$, EDTA, and seven-phase states in the research area. It was found that the mentioned elements' quantities cannot characterize the bioavailability of elements. A systematic study was conducted on the factors influencing the Se bioaccumulation factor in rice and corn, confirming that a large number of elements in the soil, such as Ca, Fe, Mn, P, S, Al, and the degree of soil weathering, as well as pH, TOC, and other physicochemical properties, have a significant impact on the absorption of trace elements by rice and corn.

This research laid the theoretical foundation for using soil survey data and adopting machine learning methods to establish models predicting the content of trace elements in rice and corn seeds.

The co-addition of attapulgite and biochar mitigates ammonia and nitrous oxide emissions and shortens composting cycle during Enteromorpha prolifera composting

Poster - Abstract ID: 566

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This study explored the effects of attapulgite (A) and biochar (B) added individually or combinedly on ammonia and nitrous oxide emissions, maturity and bacterial community during seaweed (*Enteromorpha prolifera*) composting. Compared with control, co-addition of A and B accelerated the heating process and increased the peak temperature, thereby improving maturity, and shortening composting cycle (shortened from 60 to 15 days). In addition, co-adding A and B significantly decreased NH_3 and N_2O cumulative emissions by 34.60% and 19.98%, respectively, resulting in a 14.35% increase in the total nitrogen content of compost product compared with control. Addition of attapulgite and biochar reshaped the bacterial community composition, increased the complexity of the co-occurrence networks and the proportion of negative links, suggesting that the composting system was more stable after amended with attapulgite and biochar, which might be attributed to the keystone taxa, especially *Bacillus*. Furthermore, PICRUSt 2 functional prediction also confirmed a higher relative abundance of genes affiliated to amino acid metabolism, carbohydrate metabolism and energy metabolism. Overall, co-adding A and B can effectively mitigate ammonia and nitrous oxide emissions, improve maturity and shorten composting cycle. This study provides a promising strategy for resource utilization of organic wastes such as *Enteromorpha prolifera*.

The economy-employment-environmental health transfer and embedded inequities of China's capital metropolitan area

Poster - Abstract ID: 179

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Background

Metropolitan areas have complex trade linkages internally and externally. This complexity stimulates the unequal spatial transfer of environmental health consequences, economy, and employment embodied in internal trade or trade with the outside regions, resulting in unequal exchange. Existing research has rarely discussed this issue at a refined scale, hindering targeted inequity alleviation policies.

Methods

The study couples a nested Multi-Regional Input-Output model table containing data from 13 Beijing-Tianjin-Hebei cities and 28 outer provinces in 2017 with a bottom-up emission inventory, value added and employment statistical data, the Weather Research and Forecasting-Comprehensive Air Quality Model with Extensions, the Global Exposure Mortality Model, and human capital methods. We also constructed two indices measuring unequal exchanges between PM2·5-related deaths and economic and employment gains embodied in trades.

Findings

The Beijing-Tianjin-Hebei region as a single entity shifted 14985 net deaths to regions outside the Beijing-Tianjin-Hebei through trade, most of which occurred in the central region of China. While gaining equivalent local jobs, these industrial-based peripheral cities had 250% higher PM2·5-related deaths than core cities and 57·7% higher PM2·5-related deaths than agricultural-based peripheral cities. While gaining equivalent value added, industrial-based peripheral cities had 50·6% higher PM2·5-related deaths than core cities and 67·4% higher PM2·5-related deaths than agricultural-based peripheral cities.

Interpretation

Treating metropolitan areas as a single entity obscured internal heterogeneity, potentially misleading policy makers into imposing strict regulations on the whole metropolitan area to alleviate the inequities it posed on outside regions. However, several peripheral Beijing-Tianjin-Hebei cities were disadvantaged in their trade with core Beijing-Tianjin-Hebei cities and outside regions. Therefore, policies should be tailored for particular cities within metropolitan areas. Future targeted policies should include, but not be limited to, making ecological compensations and incorporating the environment and health costs into the price of pollution-intensive goods and services.

The fate, acute, and subchronic risks of dinotefuran in the water-sediment system: a systematic analysis at the enantiomer level

Poster - Abstract ID: 991

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Environmental risks associated with neonicotinoid insecticides have attracted considerable attention. This study systematically investigated the stereoselective behavior of dinotefuran in a water-sediment system. The results showed that *S*-dinotefuran accumulated more easily in sediment and zebrafish. Although dinotefuran enantiomers and metabolites present a low risk to aquatic organisms, the risk of dinotefuran enantiomers to sediment organisms should be considered. Additionally, *S*-dinotefuran induced more remarkable oxidative damage in zebrafish than that of *R*-dinotefuran. Nevertheless, *R*-dinotefuran remarkably activated antioxidant and detoxifying enzymes. Multi-omics analyses revealed that *S*-dinotefuran induced more differentially expressed genes (DEGs) and differentially expressed proteins (DEPs) in zebrafish. In particular, *S*-dinotefuran inhibited the expression of ribosome- and proteasome-related genes and proteins, affecting the synthesis and degradation of proteins in zebrafish. *R*-dinotefuran remarkably activated peroxisome-related genes and proteins, thereby enhancing antioxidant and detoxification abilities of zebrafish. The stereoselective interactions between dinotefuran enantiomers and key DEPs were elucidated using AlphaFold2 modeling and molecular docking techniques, which may serve as the main reason for stereoselective subchronic toxicity. The present study is beneficial for the correct use of dinotefuran and provides an effective means for elucidating the mechanism of the stereoselective behavior of chiral compounds.

The impact of atmospheric N deposition and N fertilizer type on soil nitric oxide and nitrous oxide fluxes from agricultural and forest Eutric Regosols

Poster - Abstract ID: 453

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Agricultural and forest soils with low organic C content and high alkalinity were studied over 17 days to investigate the potential response of the atmospheric pollutant nitric oxide (NO) and the greenhouse gas nitrous oxide (N2O) on (1) increased N deposition rates to forest soil; (2) different fertilizer types to agricultural soil and (3) a simulated rain event to forest and agricultural soils. Cumulative forest soil NO emissions (148–350 ng NO-N g−1) were ~ 4 times larger than N2O emissions (37–69 ng N2O-N g−1). Contrary, agricultural soil NO emissions (21–376 ng NO-N g−1) were ~ 16 times smaller than N2O emissions (45–8491 ng N2O�N g−1). Increasing N deposition rates 10 fold to 30 kg N ha−1 yr−1, doubled soil NO emissions and NO3− concentrations. As such high N deposition rates are not atypical in China, more attention should be paid on forest soil NO research. Comparing the fertilizers urea, ammonium nitrate, and urea coated with the urease inhibitor ‘Agrotain®,’ demonstrated that the inhibitor significantly reduced NO and N2O emissions. This is an unintended, not well-known benefit, because the primary function of Agrotain® is to reduce emissions of the atmospheric pollutant ammonia. Simulating a climate change event, a large rainfall after drought, increased soil NO and N2O emissions from both agricultural and forest soils. Such pulses of emissions can contribute significantly to annual NO and N2O emissions, but currently do not receive adequate attention amongst the measurement and modeling communities.

The relationship between Environment pollutions and serum IgE level in Chinese school age children

Poster - Abstract ID: 575

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Objectives：Environment pollutions are considered to play a significant role in the globally increasing incidence of allergic diseases these decades. This study aims to investigate the association between total serum IgE concentration and environment pollution exposure in chinese school-age children.

Methodologies：Serum total IgE concentration is measured in children with high levels of self-reported food allergy by immunoCAP system. Concentration of Per- and polyfluoroalkyl substances （PFAs）in plasma (26 species, detection rate >50%) are measured by Triple Quad LC-MS. Phthalate Esters (PAEs) in urine(12 species, detection rate >70%) are detected by Orbitrap ID-X Tribrid MS.

Main results：In univariate linear regression models, MEP, PFDA and PFBs were associated with serum total IgE levels in children ($p<.05$). In multivariate models assessing single and combined exposures to PFAs and PAEs, removing collinearity effects, MEP and PFBs ($p<.05$) showed strong correlations with IgE levels. The positive correlations remained significant ($p<.05$) after adjusting for the covariates of age, gender, family income, number of family members, mode of delivery, breastfeeding, etc.

Conclusion：Therefore, it is believed that exposure to PFBs may be associated with increase in allergic reactions in school-age children. These findings reveal the potential health risks of environment pollutions including PFAs and PAEs on children during critical developmental stages.

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The role of NLRP3 in pyroptosis of hepatocyte induced by PS-MPs

Poster - Abstract ID: 442

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Objectives: To explore the role of NLRP3 in PS-MPs inducing pyroptosis of hepatocyte, and to provide a scientific foundation for preventing liver damage induced by PS-MPs.

Methods: Rats were exposed to 0.5 μm PS-MPs (0, 0.5, 5 and 500mg/kg/day) though irrigation. The L-02 cells were treated with 0, 25, 5 and 100μg/mL PS-MPs for 48h. The siRNA was used to specifically inhibit the expression of NLRP3 gene in L-02 cells. Histopathological changes were observed with HE staining. The levels of liver function indicators were tested by colorimetry. ELISA was used to detect the level of inflammation. Q-PCR and Western Blot were used to detect the mRNA and protein expression of Caspase-1 and GSDMD.

Results: After exposure to PS-MPs, rats' hepatocytes were swollen and the arrangement of hepatocyte cords was disordered. The serum level of ALT and liver levels of IL-1β and IL-1 in rat exposed to high-dose PS-MPs was obviously increased, and IL-1 was increase in L-02 cells (P<0.05). After exposure to PS-MPs, the mRNA and protein expression levels of Caspase-1 and GSDMD were gradually increased in rats' livers and L-02 cells, and the mRNA and protein of NLRP3 were increased in L-02 cells (P<0.05). And the increased levels of Caspase-1 and GSDMD were reversed after inhibiting the expression of NLRP3 in L-02 cells (P<0.05).

Conclusion: PS-MPs lead a pathological damage of rat liver. Inflammation and pyroptosis were also found in rat and L-02 cell. NLRP3 played an important role in the hepatocyte pyroptosis caused by PS-MPs, and it may be involved in the harmful effects of PS-MPs on liver.

The roles of ERBB Signalling in Epithelioid Malignant Pleural Mesothelioma

Poster - Abstract ID: 275

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Malignant Pleural Mesothelioma (MPM) is an aggressive malignancy that arises from the transformation of mesothelial cells lining the pleural cavity and is casually linked to asbestos inhalation. Mesothelioma pathogenesis remains elusive with current knowledge failing to define the underlying molecular mechanisms driving disease. The end stage genetic landscape of MPM is well established; asbestos induced chronic inflammation results in the accumulation of acquired genetic events resulting in inactivation of multiple tumour suppressor genes (TSG). The most commonly lost TSGs in humans are Cdkn2a, Bap1, Nf2 and Tp53. There are currently no identified activating mutations in MPM and so the mechanisms that sustain cell proliferation are unknown. The loss of TSGs does not provide an immediate explanation for the aggressive progression seen in this cancer, nor does TSG loss provide clear therapeutic targets. Using genetically engineered mouse models combined with patient derived cell lines (PDCL), we aim to better understand the underlying molecular biology of MPM and identify potential therapeutic targets. The mouse model used in this study combines sporadic loss of Cdkn2a, Nf2 and Tp53 with asbestos injection yielding a predominantly epithelioid cancer phenotype. Transcriptional profiling has shown increased ERBB ligand expression and correlated RAS pathway activation in human and mouse epithelioid mesothelioma. We aim to determine the importance of ERBB signalling in sustaining cell growth in epithelioid MPM and assess the therapeutic potential of ERBB pathway blockade. Immunoblotting shows tyrosine phosphorylation of EGFR and ERBB2 alongside phosphorylation of the RAS pathway effector ERK in PDCLs. Afatinib, a multi-ERBB inhibitor, suppresses this phosphorylation and reduces proliferation of MPM PDCLs. Drug screens and further transcriptomic analysis have the potential to identify compounds to be used in conjunction with Afatinib to increase therapeutic efficiency. This study provides an opportunity to identify novel therapeutic targets for epithelioid MPM.

Theoretical principle, project practice, and research progress of forestry schistosomiasis control in China

Poster - Abstract ID: 795

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Abstract: The construction of forestry schistosomiasis control is a unique ecological project that combines forestry and health in China. The theory of forestry schistosomiasis control originated from the concept of "Promoting Forests and Eliminating Snails" based on the scientific assumption of "Replacing *Phragmites australis* (Cav.) Trin. ex Steud. with Forests" and "Eliminating Snails and Preventing Diseases." The conclusion was drawn that ecological snail control was the fundamental measure. In order to give full play to the practical value of the theory, based on implementing the major project of promoting forests and controlling snails, the concept of "Controlling Snails and Preventing Diseases Forest" and the thought of ecological schistosomiasis prevention were put forward systematically, In 2006, the national forestry schistosomiasis control project was launched and achieved world-renowned achievements. This paper expounds on the prevention and control strategy and engineering practice of forestry schistosomiasis control, analyzes the existing problems, and looks forward to the prospect of forestry schistosomiasis control research. It has the guiding significance for developing our country's forestry schistosomiasis control theoretical research and ecological engineering construction. Besides, the discussion is made on the main technical routes and measures of improving the quality and increasing the profits on forestry schistosomiasis control, enhancing the multi-effect function and comprehensive benefits of the snail control and schistosomiasis prevention forest from the stand level, and improving the quality of forestry schistosomiasis control project from the level of ecological security system in China.

Keywords: Forestry schistosomiasis control; Snail control and schistosomiasis prevention forest; Ecological security system; Afforestation.

Thermal comfort investigation of 4-6 years old children by repeated measurement

Poster - Abstract ID: 222

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The research of children's thermal comfort mostly adopt children who aged 7 to 11, due to the younger children have imperfect intellectual development and limited cognitive ability, it's difficult to get the relatively accurate thermal comfort result, this study tried to improve the the accuracy of survey by using repeated measurement method. This study try to study the thermal comfort of 4-6 years old children by repeated measurement method. The thermal sensation vote (TSV) was divided into 5 point scale, the thermal comfort status were investigated following the natural fluctuation of temperature, there were total 427 children attended and 10986 TSV results were got. Calculate the arithmetic average of these operating temperatures(Top) to get the corresponding Top of all children under five thermal comfort states, then, the Top was divided into several groups at intervals of 0.5 , at the same time, the skin temperature and the teachers judgment also been divided accordingly, then , the median of each interval of above parameters were calculated as variables. Taking the average Top in each temperature range as the independent variable and the average thermal sensing voting value in this temperature range as the dependent variable, the relationship between TSV and Top were obtained by linear regression analysis. Comparing with the original data set, the standard deviation, inter group and intra group variance are reduced within each thermal comfort classification, which showed the data stability was improved and the correlation between Top and TSV had been greatly improved, which indicates that using the processed data set to calculate the thermal comfort temperature of children aged 4-6 years will get more accurate results.

Three-dimensional distribution characteristics of multiple pollutants in the soil at a steelworks mega-site based on multi-source information

Poster - Abstract ID: 929

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Soil pollution at steelworks mega-sites has become a severe environmental issue worldwide. However, due to the complex production processes and hydrogeology, the soil pollution distribution at steelworks is still unclear. This study scientifically cognized the distribution characteristics of polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and heavy metals (HMs) at a steelworks mega-site based on multi-source information. Specifically, firstly, 3D distribution and spatial autocorrelation of pollutants were obtained by interpolation model and local indicators of spatial associations (LISA), respectively. Secondly, the characteristics of horizontal distribution, vertical distribution, and spatial autocorrelations of pollutants were identified by combining multi-source information such as production processes, soil layers, and properties of pollutants. Horizontal distribution showed that soil pollution in steelworks mainly occurred in the front end of the steel process chain. Over 47% of PAHs and VOCs pollution area were distributed in coking plants and over 69% of HMs in stockyards. Vertical distribution indicated that HMs, PAHs, and VOCs were enriched in the fill, silt, and clay layers, respectively. Spatial autocorrelation of pollutants was positively correlated with their mobility. This study clarified the soil pollution characteristics at steelworks mega-sites, which can support the investigation and remediation of steelworks mega-sites.

Towards Local Thinking in Environmental Data Analysis

Poster - Abstract ID: 5

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The European Union Commission adopted the EU Action Plan: 'Towards Zero Pollution for Air, Water and Soil' and Soil Strategy for 2030, requiring that by 2050, pollution is reduced to levels no longer considered harmful to health and natural ecosystems. It is widely acknowledged that soil pollution is a severe hazard to human and soil health. However, due to spatial heterogeneity, the precise sources and the status of soil pollution remain largely unclear, making it a challenge to effectively implement the action plan.

With the rapid development of soil database construction at the regional, national, and international scales, there are opportunities to have the data analyzed at the local level, instead of the traditional 'global level', due to the availability of data. Two concepts are explored to move towards local thinking: 1) local descriptive statistics and 2) local correlation coefficient. Descriptive statistics are often used to reveal the overall features of environmental data, and correlation analysis has been widely used to reveal the relationship between two variables. Such analyses can be performed at the local level using moving windows.

In this study, geochemical databases from the UK, Ireland and Europe have been used to demonstrate these concepts. It has been found that local coefficient of variation is effective in showing spatial variation of metal concentrations in soils of Northern Ireland which is linked to the controlling factor of geology. Local correlation coefficient is effective in revealing hidden special relationships between soil organic carbon (SOC) and elevation in Ireland, SOC and pH in Europe, lead, and aluminum in soils of London and Ireland.

In the big data era, local thinking with such techniques plays important roles in revealing patterns and special features hidden in environmental databases, providing essential decision support for assessments of hazards from soil pollution.

Tracing the source of pollutants via digital technology

Poster - Abstract ID: 500

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Air pollution is a notable environmental health risk in China, which has been estimated to cause ~1.1 million premature deaths annually. To improve air quality and protect human health, China government has developed a series of strict air pollution control actions since 2013 with the goal to reduce the emissions of air pollutants (i.e., ambient particulate matter with aerodynamic diameter < 2.5 μm (PM2.5) and < 10 μm (PM10), sulfur dioxide (SO2), and nitrogen oxides (NOx)) across the country. In the current air pollution control in China, one of the biggest challenges is the contradiction between the regional imbalance and the one-size-fits-all policy. Here, we developed a digital-based method for budgeting and source tracing of air pollutants. For instance, we decoupled the effect of meteorology on air pollution, and built an isotopic-based source tracing web. Moreover, we used machine learning technique to budget the emissions of specific air pollutants. Overall, the technique provides a unique tool for big-data-driven policymaking for mitigation on air pollution.

Urban agglomerations as an environmental dimension of antibiotics transmission through the "One Health" lens

Poster - Abstract ID: 314

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The spatiotemporal distributions of antibiotics in different media have been widely reported; however, their occurrence in the environmental dimension of the Chinese urban agglomerations has received less attention, especially in bioaccumulation and health risks of antibiotics through the "One Health" lens. The review presents the current knowledge on the environmental occurrence, bioaccumulation, as well as health exposure risks in urban agglomerations through the "One Health" lens, and identifies current information gaps. The reviewed studies suggested antibiotic concentrations in water and soil were more sensitive to social indicators of urban agglomerations than those in sediment. The ecological risk and resistance risk of antibiotics in water were much higher than those of sediments, and the high-risk phenomenon occurred at a higher frequency in urban agglomerations. Erythromycin-H2O (ETM-H2O), amoxicillin (AMOX) and norfloxacin (NFC) were prioritycontrolled antibiotics in urban waters. Tetracyclines (TCs) posed medium to high risks to soil organisms in the soil of urban agglomerations. Health risk evaluation based on dietary intake showed that children had the highest dietary intake of antibiotics in urban agglomerations. The health risk of antibiotics was higher in children than in other age groups. Our results also demonstrated that dietary structure might impact health risks associated with target antibiotics in urban agglomerations to some extent.

Variable climatic conditions dominate decreased wetland vulnerability on the Qinghai-Tibet Plateau: Insights from the ecosystem pattern-process-function framework

Poster - Abstract ID: 357

Prof. Xing Wu [1]

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Wetlands are of global importance in providing essential ecosystem services but are also sensitive to climate change and human activities. Monitoring and assessing wetland vulnerability are crucial for ecological conservation and management strategies. However, the framework of wetland vulnerability assessment and the underlying mechanisms have not been well studied. In this study, the spatiotemporal variations in wetland vulnerability on the Qinghai-Tibet Plateau (QTP) between 1990 and 2020 were investigated based on the ecosystem pattern-process-function framework. The key driving factors were identified by partial least squares structural equation modelling (PLS-SEM) and multiscale geographically weighted regression (MGWR) models. Our results showed that the wetland ecosystem pattern index (EPI), ecosystem process index (EPOI), ecosystem function index (EFI), and wetland vulnerability index (WVI) all demonstrated an increasing pattern from northwest to southeast. Between 1990 and 2020, the mean WVI values gradually decreased from 0.616 to 0.588, indicating a steady improvement of the wetland ecosystem on the QTP. Rapid urbanization increased the EPOI, while rugged topography elevated both the EPI and EPOI, and the hydrological abundance enhanced the EFI, which in turn contributed to an increased WVI. Conversely, climatic conditions led to a reduction in the EPI, which in turn resulted in a significant decrease in WVI. Therefore, although urbanization, topographical, and hydrological factors have somewhat exacerbated the WVI on the QTP, variable climatic conditions have driven the decline in wetland vulnerability in the last three decades. Furthermore, our results indicated that the proposed framework could provide a comprehensive approach for wetland vulnerability assessment and useful implications for wetland conservation and management.

Viral and Bacterial Communities Collaborate through Complementary Assembly Processes in Soil to Survive Organochlorine Contamination

Poster - Abstract ID: 726

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The ecological drivers that direct the assembly of viral and host bacterial communities are largely unknown, even though viral-encoded accessory genes help host bacteria survive in polluted environments. To understand the ecological mechanism(s) of viruses and hosts synergistically surviving under organochlorine pesticide (OCP) stress, we investigated the community assembly processes of viruses and bacteria at the taxon and functional gene levels in clean and OCP-contaminated soils in China using a combination of metagenomics/viromics and bioinformatics approaches. We observed a decreased richness of bacterial taxa and functional genes but an increased richness of viral taxa and auxiliary metabolic genes (AMGs) in OCP-contaminated soils (from 0 to 2,617.6 $mg \cdot kg^{-1}$). In OCP-contaminated soils, the assembly of bacterial taxa and genes was dominated by a deterministic process, of which the relative significance was 93.0% and 88.7%, respectively. In contrast, the assembly of viral taxa and AMGs was driven by a stochastic process, which contributed 83.1% and 69.2%, respectively. The virus-host prediction analysis, which indicated *Siphoviridae* was linked to 75.0% of bacterial phyla, and the higher migration rate of viral taxa and AMGs in OCP-contaminated soil suggested that viruses show promise for the dissemination of functional genes among bacterial communities. Taken together, the results of this study indicated that the stochastic assembly processes of viral taxa and AMGs facilitated bacterial resistance to OCP stress in soils. Moreover, our findings provide a novel avenue for understanding the synergistic interactions between viruses and bacteria from the perspective of microbial ecology, highlighting the significance of viruses in mediating bioremediation of contaminated soils.

Whether cattle and horse manure in pastural area will deteriorate water quality of local lakes?

Poster - Abstract ID: 994

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Free range for cattle and horse is becoming a popular breeding type for the organic agricultural production supply. However, the influence of their manure during depasture has caught lots of attention, especially for the ecological health and environmental safety. In pastural area, it is estimated that cattle and horse manure may greatly deteriorate the water quality of local lakes, but the evidence is still unclear. The purpose of this work is to recognize the potential pollution contribution from cattle and horse manure in a pastural area in China. Dried and fresh manure samples from cattle and horse in a typical pasturing area were collected in Xinjiang, China. Water samples in pastural lake and soils were collected simultaneously. The different fractions of nitrogen and phosphorus in cattle and horse manure were determined using the continuous flow analysis method after pretreatment. The potential nitrogen and phosphorus release from dried and fresh dung was investigated as well. The results indicated that the leachable nitrogen and phosphorus mass per gram of the dry horse dung and dry cattle dung respectively reached 1.1537 and 0.1286mg with the pasturing area water. As for ultrapure water, the corresponding release quantities dramatically reach nearly twice over the former. Besides, based on the contents of organic carbon, total nitrogen and total phosphorus, the soil presented high adsorption capacity for leachable nitrogen and phosphorus released from cattle and horse manure. It suggested that the most released nitrogen and phosphorus from manure could be fixed by soils, their pollution contribution to water quality were lower than general estimation. Because of high nutrients in the manure, so they can be utilized to maintain a healthy pasturing area. Therefore, the resource utilization of cattle and horse manure for aquatic feedstuff as valuable resource was attempted successfully in this work.

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