

ENVP2026

ENVIRONMENTAL POLLUTANTS

ENVP 2026 CONFERENCE

ABSTRACT BOOK

28 September 2026

Eigtveds Pakhus
Copenhagen, Denmark

ENVP 2026 CONFERENCE

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Practical information

The day at a glance

09:00-10:00	Registration and coffee
09:00-10:00	Poster mounting - boards will be ready
10:00-10:40	Welcome and morning keynote
10:40-11:10	Coffee and poster exhibition
11:10-12:25	Morning parallel sessions
12:25-14:25	Lunch and poster exhibition
14:25-15:40	Afternoon parallel sessions
15:40-16:10	Coffee and poster exhibition
16:10-17:00	Afternoon keynote
17:00-18:00	Reception
18:30	Optional dinner at Spiseloppen (ticket required)

Good to know

Venue	Eigtveds Pakhus, Strandgade 25D, 1401 Copenhagen K, Denmark
Food and coffee	Served in the exhibition area – please visit our exhibitors while you are there.
Posters	Boards are ready from 09:00. Please take your poster down before the reception ends at 18:00.

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Environmental Pollutants 2026 PROGRAMME

Monday, September 28th, 2026

Eigtveds Pakhus

09:00-10:00	Registration & Coffee, bread with cheese and jam		
09:00-10:00	Poster Mounting		
10:00-10:40	Welcome & Morning Keynote		
	Meeting room III		
10:00	Opening address by Danish Partnership for Environmental Pollutants Board Member Carsten Suhr Jacobsen, Aarhus University		
10:05	Keynote introduction: Nanna Bloch Hartmann, DTU		
10:10	Keynote: Marlene Ågerstrand, Stockholm University <i>Is science enough: Evidence and decision-making in chemical regulation.</i>		
10:40-11:10	Coffee & exhibition		
11:10-12:25	Morning parallel sessions		
	Meeting room II	Meeting room III	Meeting room IV
11:10	Session: Plastics and Micro Plastics Chair: Jes Vollertsen , Department of the Built Environment, Aalborg University Chair introduction: Nanna Bloch Hartmann , DTU	Session: PFAS Chair: Katrin Vorkamp , Department of Environmental Science, Aarhus University Chair introduction: Anders Baun , DTU	Session: NonTarget Screening Chair: Selina Kornelia Tisler , Department of Plant and Environmental Sciences, University of Copenhagen Chair introduction: Pedro Carvalho , Aarhus University
11:15	Martin Wagner , NTNU <i>Chemical complexity of plastics: Mapping hazards to support safer design</i>	Katrin Vorkamp , Department of Environmental Science, Aarhus University <i>PFAS – a global environmental problem</i>	Selina Kornelia Tisler , Department of Plant and Environmental Sciences, University of Copenhagen <i>Contaminants along the drinking water system evaluated by non-target screening</i>
11:35	Alvise Vianello , Department of the Built Environment, Aalborg University <i>The Many Faces of Plastic Pollution: An Integrated Analytical Perspective</i>	Christian Nyrop Albers , Department of Geochemistry, GEUS <i>Rising TFA concentrations in groundwater: Atmospheric and agricultural sources</i>	Martin Hansen , Department of Environmental and Resource Engineering, DTU <i>National large-scale soil health study: High-throughput robotics sample preparation and non-target chemical analysis</i>
11:50	Elvis Genbo Xu , Department of Biology, University of Southern Denmark <i>Beyond Counting Particles: Linking Environmentally Relevant Micro- and Nanoplastic Exposure to Biological Effects</i>	Pál Weihe , Department of Research, The National Hospital of Faroe Islands and Faculty of Science and Technology, Faculty of Health Sciences, University of the Faroe Islands <i>PFAS and human health</i>	Linyan Zhu , Department of Environmental Science, Aarhus University <i>Identification of Chemicals of Emerging Arctic Concern with Suspect and Non-Target Screening Approaches</i>
12:05	3*5 min Plastics and Micro Plastics flashtalks	3*5 min PFAS flashtalks	3*5 min NonTarget Screening flashtalks
	Giorgia Dassiè , Università di Brescia <i>P008 – What are we looking at? Spectroscopic and statistical approaches to evaluate the digestion pre-treatment step impact on true-to-life microplastics.</i>	Paula Guedes , Aarhus University, Department of Environmental Science (MITO) <i>P016 – Fluorotelomer Alcohols (FTOHs) in Dust from Danish Schools: Implications of Different Sampling Techniques for Indoor Exposure Assessment</i>	Pere Colomer-Vidal , Aarhus University <i>P006 – From methodological gaps to harmonized PFAS suspect and non-target screening: the PFAS SUSPECT project</i>
	Antonia Kellner , Eawag <i>P022 – Microplastic in Snow from Remote Alpine and Arctic Regions</i>	Elisabeth Elfrink , National Food Institute, Technical University of Denmark (DTU) <i>P011 – PFAS and Female Reproductive Health: Integrating Evidence Across Evidence Streams</i>	Amir Gholipour , Aarhus University <i>P013 – Characterizing the Pharmaceutical "Cocktail" in European Wastewaters: Baseline Screening from the NBS4AQUAMMISSION Project</i>
	Claudia Lorenz , Roskilde University <i>P031 – Potential ecotoxicological effects of leachates from offshore wind turbine coating erosion</i>	Eva Højgaard Jensen , University of Copenhagen <i>P019 – Nothing is forever: Analogue enrichment on acetate yields a microbial consortium that defluorinates the ultra-short-chain PFAS trifluoroacetate</i>	Alba Rodriguez Otero , University of Copenhagen <i>P043 – Micropollutant and Phosphorus Removal Using Pile Cloth Media Filtration and Powder Activated Carbon: Process Performance and Design Considerations</i>

12:25 – 14:25	Lunch & exhibition		
14:25 – 15:40	Afternoon parallel sessions		
	Meeting room II	Meeting room III	Meeting room IV
14:25	Session: Treatment of contaminated water Chair: Kai Bester , Department of Environmental Science, Aarhus University Chair introduction: Peter Roslev , Aalborg University	Session: Ecotoxicology Chair: Nina Cedergreen , Department of Plant and Environmental Sciences, University of Copenhagen Chair introduction: Carsten Suhr Jacobsen , Aarhus University	Session: Air Pollution Chair: Matthew Stanley Johnson , Department of Chemistry, University of Copenhagen Chair introduction: Jes Vollertsen , Aalborg University
14:30	Kai Bester , Department of Environmental Science, Aarhus University <i>Environmental pollutants (MFS) in wastewater, occurrence and abatement</i>	Nina Cedergreen , Department of Plant and Environmental Sciences, University of Copenhagen <i>Risk assessment of 2nd generation biocontrol agents</i>	Matthew Stanley Johnson , Department of Chemistry, University of Copenhagen <i>Photochemical Methane Mitigation: From Barn Ventilation Air to Atmospheric Oxidation Enhancement</i>
14:50	Elena Torresi , Envidan (Ramboll) <i>Removal of Micropollutants in Wastewater and the Status of Quaternary Treatment in Denmark</i>	Lucas Horstmann , Department of Environmental Science, Aarhus University <i>Tracking environmental impacts of chemicals in soil by using TotalRNA-seq</i>	Jakob Nis Klenø Nøjgaard , Department of Environmental Science, Aarhus University <i>The origin of atmospheric particles in North Greenland – apportionment of natural and anthropogenic sources</i>
15:05	Peter Roslev , Department of Chemistry and Bioscience, Aalborg University <i>Mitigation of Environmental Pollutants in Water and Air using UV treatment</i>	Henrik Holbech , Department of Biology, University of Southern Denmark <i>Assessment and regulation of endocrine disrupting chemicals</i>	Louise Bøge Frederickson , Department of Environmental Science, Aarhus University <i>Low-cost sensors for personal air pollution exposure assessment: The DonorSense study</i>
15:20	3*5 min Treatment of contaminated water flashtalks	3*5 min Ecotoxicology flashtalks	3*5 min Air Pollution flashtalks
	Alba Martinez i Quer , Aarhus University <i>P032 – Are Danish mini-wetlands micropollutant sinks or buffering zones? Insights from a decade of operation</i>	Anna Kjerstine Rosenmai , National Food Institute, Technical University of Denmark <i>P044 – Endocrine disruptive potential of Quaternary ammonium compounds in vitro</i>	Marc Bello Pintor , Aalborg University <i>P002 – UV based Photochemical Oxidation of Methane in Water and Air</i>
	Prasad Phapale , Aarhus University <i>P042 – Spatial Mapping of Benzalkonium Biotransformation Pathways in Wastewater Biofilms</i>	Paolo Taborelli , Aalborg University <i>P047 – Comparison of solar and vacuum UV-based advanced oxidation processes for degradation and toxicity mitigation of benzalkonium chloride</i>	Stephanie Hammel , National Research Centre for the Working Environment (NFA) <i>P017 – Using silicone wristbands as screening tools for occupational exposure to chlorinated paraffins</i>
	Laurine Leray , Aarhus University <i>P030 – A first step toward characterizing Danish groundwater microbiomes as a baseline in bioremediation studies</i>	Pernille Ambus Kjær , University of Southern Denmark <i>P023 – A window into the developing brain: Detecting Thyroid Hormone System (THS) mediated Developmental Neurotoxicity (DNT) in zebrafish (Danio rerio)</i>	Marianna D'Amico , Aarhus University <i>P007 – In-situ seasonal mass absorption cross section (MAC) values for equivalent black carbon reporting in the High Arctic.</i>
15:40 – 16:10	Coffee, cake & exhibition		
16:10 – 17:00	Keynote		
	Meeting room III		
16:10	Keynote introduction: Nina Cedergreen, University of Copenhagen		
16:15	Keynote: Hans Jørgen Nielsen, Slotsholm ApS <i>Dangerous – how they fuel your fear</i>		
17:00 – 18:00	Reception		
18:30	Optional dinner at Spiseloppen (Tickets must be purchased)		

ENVP2026

ENVIRONMENTAL POLLUTANTS

Welcome to the first Environmental Pollutants Conference (ENVP 2026)

Environmental pollutants represent a complex challenge for society, with implications for both the environment and human health. Substances such as PFAS and other industrial chemicals, pesticides, pharmaceutical residues, microplastics, heavy metals, and many other contaminants are found throughout our water, air, soil, and ecosystems. While scientific advances have greatly improved our ability to assess, identify and monitor these substances, uncertainties remain regarding their long-term impacts on human health, biodiversity, and environmental quality.

Addressing these challenges requires more than excellent research. It requires dialogue, collaboration, and the sharing of knowledge between researchers and the many stakeholders who rely on scientific evidence to make decisions. Municipalities, regions, government agencies, national authorities, utilities, industry, and civil society all play important roles in understanding, managing, and mitigating the risks associated with environmental pollutants.

The Environmental Pollutants Conference was established to help create this dialogue. Our ambition is to open Danish research on environmental pollutants to a broader audience, showcasing the breadth and quality of ongoing research while creating opportunities for exchange between science, policy, regulation, and practice. By bringing together researchers and stakeholders from across sectors, the conference provides a forum for discussing current challenges, identifying knowledge gaps, and exploring solutions to emerging environmental issues.

This conference also represents a milestone for the Danish research community. In parallel with the planning of ENVP 2026, researchers from the six of Denmark's universities with established research in environmental pollutants have joined forces to establish a national partnership on environmental pollutants. The partnership aims to strengthen collaboration across institutions and disciplines, develop a shared national research agenda, and increase the visibility and societal impact of Danish research in this field.

In many ways, this conference marks the first tangible step in that journey. The enthusiasm and engagement demonstrated by participants highlight both the strength of the Danish research community and the interest among stakeholders in accessing and contributing to the latest scientific knowledge. We hope that the discussions initiated here will lead to new collaborations, stronger connections between research and practice, and a shared commitment to addressing the challenges posed by environmental pollutants.

On behalf of the emerging Danish Partnership on Environmental Pollutants, we thank all participants, presenters, sponsors, and supporters for helping make this conference possible.

We hope you find inspiration in the abstracts collected in this book and look forward to continuing the conversations that begin here.

The ENVP 2026 Organising Committee

The ENVP 2026 Organising Committee

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Pedro Carvalho

Environmental Chemist
Aarhus University

Peter Roslev

Environmental Toxicologist
Aalborg University



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Is science enough: Evidence and decision-making in chemical regulation

Morning keynote speaker

Marlene Ågerstrand¹

¹Stockholm University

Marlene Ågerstrand is a researcher at Stockholm University whose work explores how science informs decision-making and how chemical regulation operates in practice. In her talk, she will discuss the role of science in the management and regulation of chemicals, highlighting both its strengths and its limitations. She will examine situations in which scientific evidence alone is insufficient and explore why science may fail to provide clear answers for policy and regulatory decisions. The talk will offer insights into the challenges of translating scientific knowledge into effective chemical management and the factors that shape decisions beyond the scientific evidence itself.

Dangerous – how they fuel your fear

Afternoon keynote speaker

Hans Jørgen Nielsen¹

¹Slotsholm ApS

We are constantly told that we live in the most dangerous times in history. The evidence says otherwise. Hans Jørgen Nielsen, co-author of *Frygtens Karrusel* (The Fear Carousel), takes us behind the headlines and into the machinery that makes the world seem far scarier than it is. Through concrete cases, from mobile phone scares to the myths around Chernobyl, he shows why facts alone rarely win the argument, and what to do about it. His message is uncomfortable but liberating: you have no god-given right to be heard. You must earn it. For anyone who works with risk, communicates science, or wonders why solid evidence so often loses to a scary story.

*Hans Jørgen Nielsen is an author, speaker, director, and teaches political and economic communication. His book *Frygtens Karrusel* explores how we are wired for fear, and how easily that is exploited.*

Chemical complexity of plastics: Mapping hazards to support safer design

Plastics and Micro Plastics session

Martin Wagner¹

¹*Department of Biology, Norwegian University of Science and Technology (NTNU)*

In this presentation, I will share insights from a large-scale exercise to map the known chemicals in plastics that resulted in the creation of the PlastChem database and then move on to discuss approaches to characterize unknown plastic chemicals.

Reviewing the existing evidence that associates chemicals with plastics, I will discuss the identities, functions and presence of known plastic chemicals as well as the question how chemicals of concern in plastics can be identified. I will also highlight information gaps and the associated challenges.

Since our work on PlastChem only addresses the known part of the issue, I will share results from our research to understand the chemical complexity of plastics holistically, including case studies on non-target high-resolution mass spectrometry to elucidate all plastic chemicals and effect-based approaches to understand the toxicity of plastic leachates.

I will wrap up the presentation by reflecting on pathways towards creating safer plastics, a key prerequisite for a sustainable plastics economy. I will also reflect on the role the scientific community can play in this transition.

The Many Faces of Plastic Pollution: An Integrated Analytical Perspective

Plastics and Micro Plastics session

Alvise Vianello¹, Sanchez L.¹, Liu F.¹, Mitsutake H.¹, Nielsen A.¹, Vollertsen J.¹

¹*Department of the Built Environment, Aalborg University*

Plastic pollution is a widespread environmental challenge affecting most abiotic and biotic compartments. These multifaceted particulate pollutants span orders of magnitude in size and vary in physical properties and composition, with polymer matrices often incorporating additional organic and inorganic components. Moreover, these characteristics evolve through environmentally driven physical, chemical and biological processes. Such heterogeneity, compounded by limited harmonisation across the analytical workflow, challenges characterisation and requires approaches capable of capturing occurrence while preserving information on material complexity and environmental transformation.

We address this complexity through integrated workflows spanning sampling, preparation and complementary analytical approaches. Sampling is tailored to the environmental compartment, from pump-based collection of small microplastics in aquatic systems to breathing-manikin approaches for airborne exposure. Our sample extraction follows a multi-step workflow tailored to matrix and target size range. Microplastic identification combines μ FTIR imaging and μ Raman spectroscopy across a broad particle-size range; 3D Raman imaging extends particle-resolved analysis directly into biological tissues while preserving spatial context. Py-GC-MS analysis adds a mass-based dimension to polymer characterisation and overcomes limitations of vibrational spectroscopies for materials such as tyre-wear particles (TWPs). Identification and quantification are only part of the picture: plastics continue to transform in the environment, as weathering and biological colonisation alter surface properties and molecular structure. AFM and Raman can provide complementary insight into these changes across physical and chemical scales.

Future work will expand towards spatially resolved elemental fingerprinting to support identification of complex polymer-based particles through inorganic additives, pigments and fillers.

Beyond Counting Particles: Linking Environmentally Relevant Micro- and Nanoplastic Exposure to Biological Effects

Plastics and Micro Plastics session

Elvis Genbo Xu¹

¹*Department of Biology, University of Southern Denmark*

Micro- and nanoplastics (MNPs) are widely detected in the environment, yet major uncertainties remain in linking particle occurrence to biologically relevant exposure and effects. Particle counting alone is insufficient to characterize exposure because size, surface properties, aging, formulation, environmental transformation, and exposure conditions can strongly influence toxicity. This presentation highlights recent studies on environmental occurrence, pristine versus aged and real-world plastics, experimental confounding, and biological responses across organisms. Our findings show that different particles are not interchangeable, formulation artifacts can affect toxicity interpretation, and limited acute mortality may coexist with chronic, developmental, neurobehavioral, molecular, and gut-related effects. Responses vary substantially with particle properties and species. These results support moving beyond particle counts toward exposure characterization that integrates particle properties, environmental realism, exposure duration, and biological susceptibility to strengthen MNP ecological risk assessment.

PFAS – a global environmental problem

PFAS session

Katrin Vorkamp^{1,2}, Baun A.^{3,2}

¹Department of Environmental Science, Aarhus University ²Danish PFAS Research Centre ³Department of Environmental and Resource Engineering, Technical University of Denmark

Per- and polyfluoroalkyl substances (PFAS) are often called “forever chemicals”, referring to their high environmental persistence. This persistence favours the global distribution of PFAS far beyond their original emission sources, making them also “everywhere chemicals” that occur in the most remote areas of the globe, such as the Arctic, the Antarctic and the deep sea. In addition, their use in many consumer products as well as firefighting foams has led to PFAS emissions closely related to all human activity.

As some PFAS are highly bioaccumulative and biomagnify in food chains, human exposure occurs far away from original emission sources, via consumption of fish, eggs and marine mammals. In general, PFAS accumulation in food is considered the main exposure source in a global perspective. Less bioaccumulative PFAS are often classified as “mobile”, describing their high water solubility and lack of sorption to solids, creating a risk of human exposure via drinking water. Furthermore, exposure can occur to volatile PFAS via air, to PFAS in consumer products via direct contact and in occupational settings.

The comprehensive PFAS definition proposed by an OECD expert group in 2021 includes fluorinated compounds used for other purposes than the originally studied PFAS, e.g. pesticides, pharmaceuticals and refrigerants, which are also considered problematic as parent compounds of trifluoroacetic acid (TFA). While not necessarily covered by the PFAS definition, fluorinated ionic liquids are receiving increased attention as well.

This complexity might benefit from more nuanced approaches and sub-categorisation to account for the wide spectrum of PFAS molecular structures, use categories, emission sources, environmental fate processes, exposure pathways, and, potentially, health effects. While “forever” and “everywhere” might be a common denominator for PFAS as a group, efficient solutions need a better understanding of sub-group chemistry and replacement options.

Rising TFA concentrations in groundwater: Atmospheric and agricultural sources

PFAS session

Christian Albers¹, Johnsen A.²

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TFA is an ultrashort-chain PFAS that is widespread in the environment, including in groundwater, where it is found in concentrations typically hundreds of times higher than any other PFAS. Due to its high chemical and biological stability and its low sorption to soil, TFA can be considered to move conservatively with groundwater. Under these assumptions, we have demonstrated that the concentration of TFA in groundwater has risen from non-detectable levels in Danish groundwater formed before 1960 to detectable levels in all Danish groundwater formed after 1980, with a consistent increase that appears to be ongoing.

There are likely two major sources contributing to this rise in TFA, and in both cases TFA is a degradation product – either from fluorinated gases in the atmosphere or from pesticides used in agriculture. In Denmark, the latter source has been considered somewhat hypothetical, since only a few pesticides have been shown to form TFA during degradation, none of which have been used in Denmark. We therefore conducted a degradation study using seven common pesticides that contain a C-CF₃ group, all of which were found to form TFA in three agricultural soils.

Taken together, the available evidence suggests that atmospheric input currently contributes up to 1 µg/L and more typically around 0.5 µg/L TFA to Danish groundwater but this seems to be quickly rising. In areas with conventional agriculture, there is an additional TFA input from pesticides, with a magnitude similar to or greater than the atmospheric input. This source has also been increasing over the past decades but is expected to decline in the future due to a recent ban of many C-CF₃ pesticides.

PFAS and human health

PFAS session

Pál Weihe¹

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Over the past decades, epidemiological and toxicological research has strengthened the evidence linking exposure to certain PFAS with adverse health outcomes. Among the most consistently observed associations are increased serum cholesterol, reduced antibody responses to some vaccinations, alterations in liver enzymes, small reductions in birth weight, and pregnancy-induced hypertension or preeclampsia. Reduced vaccine antibody responses, particularly in children, provide important evidence of PFAS-related immunotoxicity.

In 2023, the International Agency for Research on Cancer (IARC) classified perfluorooctanoic acid (PFOA) as carcinogenic to humans (Group 1) and perfluorooctanesulfonic acid (PFOS) as possibly carcinogenic to humans (Group 2B). For PFOA, IARC found limited evidence in humans for renal cell carcinoma and testicular cancer, together with sufficient evidence in experimental animals and strong mechanistic evidence. For PFOS, evidence for cancer in humans was considered inadequate, while strong mechanistic evidence supported its Group 2B classification.

Pregnancy, infancy, and childhood may represent particularly sensitive periods of exposure. Maternal exposure to certain PFAS exposure has been linked to pregnancy-induced hypertension, preeclampsia, and small reductions in birth weight. Possible associations with other developmental, metabolic, endocrine, and neurodevelopmental outcomes have also been reported, although the evidence is less consistent and causal relationships remain under investigation.

Associations have also been investigated for thyroid dysfunction, metabolic and cardiovascular outcomes, kidney disease, and impaired fertility. However, findings for many of these outcomes remain less consistent, and the magnitude and nature of risk may vary substantially according to the individual PFAS, exposure level and duration, life stage, and individual susceptibility.

Major challenges include understanding mixture effects, characterizing newer and replacement PFAS, identifying particularly vulnerable periods of exposure, and establishing health-based exposure limits. Despite remaining uncertainties, the available evidence supports efforts to reduce unnecessary PFAS exposure as an important public-health measure.

Contaminants along the drinking water system evaluated by non-target screening

NonTarget Screening session

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This presentation shows how non-target screening (NTS), combining liquid and supercritical fluid chromatography with high-resolution mass spectrometry, can be used to evaluate contaminants in the drinking water. These contaminants may be introduced at any stage of drinking water production, from source and treatment to storage and distribution. Three case studies will be presented. The first applies NTS to activated carbon and resin filtration used to remove PFAS from groundwater: while both technologies effectively remove regulated target PFAS, NTS reveals previously unidentified pollutants in the groundwater and, notably, that resin filters can leach new contaminants such as tributylamine derivatives into the treated water. The second case investigates concrete used for drinking water storage, showing that superplasticizer additives such as alkanolamines leach from concrete into the water. In the third case study the distribution system is investigated, testing materials such as HDPE pipes and rubber seals: compounds including antioxidant transformation products, plasticizers, and rubber-related substances are shown to migrate from these materials, with especially rubber seal chemicals leaching into the water. Together, these cases demonstrate that drinking water contamination does not originate solely at the source. NTS helps to identify overlooked compounds throughout the drinking water system, whereas their toxicity remains mostly unknown.

Identification of Chemicals of Emerging Arctic Concern with Suspect and Non-Target Screening Approaches

NonTarget Screening session

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Long-range transport and local emissions expose the Arctic to a rapidly changing mixture of anthropogenic chemicals. Drawing on three studies, this presentation demonstrates how high-resolution mass spectrometry (HRMS)-based suspect and non-target screening can advance the identification of Chemicals of Emerging Arctic Concern (CEACs) beyond conventional target analysis and contribute to preliminary risk assessments or fate studies of these CEACs.

Complementary gas and liquid chromatography coupled with HRMS (GC- and LC-HRMS) are complementary approaches to detect a broad spectrum of chemicals. Screening of marine mammals, Arctic air and Faroese serum tentatively identified 64 CEACs. Of these, 37 had persistent, mobile and toxic properties, while four were persistent, bioaccumulative and toxic. A focused analysis of per- and polyfluoroalkyl substances (PFAS) across five wildlife species detected 32 unregulated PFAS in a combination of target and non-target analysis, with highest concentrations and greatest chemical diversity in polar bears. Semi-quantification indicated that emerging PFAS may constitute a substantial fraction of the total PFAS burden in several species. Plastic chemicals are a group of CEACs with growing importance. To move beyond occurrence and explore a possible source pathway, plastic chemicals were screened in paired stomach plastics and tissues from northern fulmars, together with ringed seal liver. Initial HRMS results indicate distinct chemical patterns for chemicals with and without documented plastic exposure. This design will generate hypotheses about plastic-associated exposure versus other possible exposure pathways.

Together, the studies connect broad chemical discovery with prioritisation and exposure assessment, providing empirical evidence of CEAC occurrence and guiding next steps towards confirmation, quantification and inclusion in future Arctic monitoring and risk assessment.

Environmental pollutants (MFS) in wastewater, occurrence and abatement

Treatment of contaminated water session

Kai Bester¹

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This contribution will give an introduction to the session, giving an overview on current knowledge on presence of organic micropollutants (OMPs) in wastewater and stormwater, link to risks and toxicity and mitigation measures.

The focus on wastewater pollution is currently on pharmaceuticals, as little other mitigation is possible than removal with advanced technology from centralized wastewater treatment. However, while the concentrations of pharmaceuticals in wastewater are high (up to tens of µg/L), this does not mean that all the other compounds an industrialised society is using (flame retardants, cosmetics, corrosion inhibitors, biocides, PFAS etc.) are irrelevant. Opposite to the pharmaceuticals, some industrial chemicals can preferably be tackled at source. However, even when focusing only on pharmaceuticals, emissions of several compounds exceed effect levels in the environment (diclofenac, several antibiotics, some antidepressants).

Also, recent data show that stormwater is not as clean as the regulations expect: especially biocides used on the outside of buildings (roofcleaners, woodprotection agents and compounds added to paint) result in a heavy environmental burden.

The new urban wastewater directive is demanding 80% removal of micropollutants to be demonstrated with a list of 13 compounds. In the talk we will present a way of establishing solutions for this, which resulted in a national approach of combining ozone with activated carbon.

Removal of Micropollutants in Wastewater and the Status of Quaternary Treatment in Denmark

Treatment of contaminated water session

Elena Torresi¹

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Micropollutants from municipal wastewater, including pharmaceutical residues, personal care products, industrial chemicals, and pesticides, are increasingly recognised as a threat to aquatic ecosystems. Their removal is therefore becoming a key focus for the wastewater sector across Europe.

On 5 November 2024, the revised European Urban Wastewater Treatment Directive (UWWTD) was adopted, requiring the implementation of quaternary treatment for micropollutant removal at larger wastewater treatment plants by 2045. In Denmark, compliance with the UWWTD is expected to be combined with national regulations based on environmental quality standards, which may in many cases require higher removal efficiencies than those specified in the directive.

Several full-scale facilities for micropollutant removal have already been implemented in Switzerland and Germany, while the first Danish projects are now entering the construction phase. Available treatment technologies include oxidation processes such as ozonation, adsorption technologies based on granular activated carbon (GAC) and powdered activated carbon (PAC), biological treatment processes, and combinations of these technologies.

This presentation provides an industry perspective on micropollutant removal and quaternary treatment implementation. It reviews the main drivers influencing technology selection in Danish projects, including treatment performance, footprint, operational complexity, energy use, CO₂ footprint, site constraints, costs, and regulatory requirements. Furthermore, it presents an overview of the Danish projects currently under design and construction and discusses how the sector is preparing to meet future European and national requirements for micropollutant removal.

Mitigation of Environmental Pollutants in Water and Air using UV treatment

Treatment of contaminated water session

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A range of organic and inorganic pollutants are frequently detected as contaminants in groundwater, wastewater and surface waters due to extensive societal use. Advanced oxidation processes (AOPs) and advanced reduction processes (ARPs) can potentially be applied to abate some of these pollutants and transform them into less harmful products. AOPs and ARPs generate different reactive species that can interact and transform the target compounds. Here we present examples from studies using UV based AOPs and ARPs to mitigate organic and inorganic pollutants in water and air. In many cases, the AOPs and ARPs also changed the toxicological profile and attenuated the potential ecotoxicity. Target compounds included pesticides, biocides and naturally occurring compounds such as ammonia, nitrate and methane. The results showed that UV based AOPs can facilitate catalyst-free rapid degradation of common pesticides and biocides. The degradation was affected by the UV dose (fluence), dissolved gases and composition of the water matrix. Water treatment included monochromatic UV-C and combined vacuum UV (185 nm) and UV-C irradiation (VUV-UVC) in combination with different oxidant precursors. The toxicity of non-treated and UV-treated aqueous solutions was examined using a battery of test organisms from different trophic levels. Several trophic levels were included to better assess adverse effects of different bioactive compounds in the UV treated samples. UV AOPs were also successfully applied to oxidize methane in air and water. Methane was removed at ambient conditions at atmospheric concentrations and above. UV ARPs may potentially be used to remove nitrate from drinking water, but transformation products should be monitored. Overall, the study suggests that direct and indirect photolysis facilitated by UV AOPs and UV ARPs can be applied for treatment of many organic and inorganic pollutants.

Risk assessment of 2nd generation biocontrol agents

Ecotoxicology session

Nina Cedergreen¹

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Second generation biocontrol agents are new technologies developed to combat pests and diseases in agriculture, without having the negative properties of chemical pesticides in terms of harming also beneficials and non-target organisms and leaving persistent metabolites in the environment. They are characterised as being of biological origin but being designed to target specific pests and diseases without harming the non-target organisms. The two large groups consist of peptides and double stranded RNA (dsRNA), and there are currently >60 dossiers on peptides and >four on dsRNA pending for registration in EU. But how do we risk assess such compounds? What data do we need to be able to address safe use? Can we use similar data demands as for chemicals or do we need to develop new assays and data demands? This talk will introduce the group of 2nd generation biocontrol, highlight similarities and difference compared to chemicals, and how we in the project ENSAFE address the knowledge gaps.

Tracking environmental impacts of chemicals in soil by using TotalRNA-seq

Ecotoxicology session

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Microbial communities drive essential biogeochemical processes that underpin ecosystem functioning and society, from regulating the global climate to sustaining productive soils and food production. Despite their fundamental importance, traditional ecotoxicological assays still focus primarily on higher organisms, largely overlooking the effects of chemical contaminants on microbial communities. This represents a critical gap, particularly in soils, where microorganisms mediate many of the processes that determine soil health.

Here, we propose total RNA sequencing as a comprehensive tool for simultaneously assessing target and non-target impacts on microbial communities, capturing not only changes in active community structure but also responses of both known and unknown microbial functions to chemical exposure. We demonstrate its potential across two studies: under controlled conditions, we use mRNA signatures to resolve transient functional responses to fungicide exposure in soil microcosms at unprecedented detail, while under field conditions, we identify targeted microbial responses to environmentally relevant concentrations of nitrification inhibitors.

Together, these applications demonstrate the versatility of total RNA sequencing for detecting environmental impacts across scales, from controlled laboratory experiments to field trials. Looking forward, total RNA sequencing could provide a powerful tool for incorporating microbial responses into the environmental risk assessment of chemicals in soils.

Assessment and regulation of endocrine disrupting chemicals

Ecotoxicology session

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Endocrine disrupting chemicals (EDCs) present a major challenge for the protection of human health and the environment because they disturb hormone systems that control and regulate important functions such as development, reproduction, and metabolism. EDCs are defined as chemicals causing adverse health effects via endocrine modes of action, often at exposure concentrations below those causing systemic toxicity.

This talk will highlight the status of scientific assessment methods for identification of EDCs with focus on OECD Test Guidelines and outline recent progress, current gaps, and future goals. Much is known about effects of chemicals on the steroid hormone (estrogens and androgens) and thyroid hormone systems, but several other relevant endocrine systems are not well covered as for example, the vertebrates metabolic and immune systems and almost all of the diverse invertebrates' endocrine systems.

The regulatory frameworks covering EDCs in the EU will be presented and discussed in relation to the protection of human- and environmental health. One major challenge is the planned transition from *in vivo* animal testing of chemicals to New Approach Methodologies (NAMs) like *in silico* and *in vitro* methodologies without a clear scientific understanding of the complex endocrine systems including crosstalk between different endocrine axes.

A "One Health" approach to identification of EDC will be presented together with supporting tools such as Adverse Outcome Pathways (AOPs).

Photochemical Methane Mitigation: From Barn Ventilation Air to Atmospheric Oxidation Enhancement

Air Pollution session

Matthew Johnson¹

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Methane is responsible for approximately one third of current anthropogenic warming and remains one of the most attractive targets for near-term climate mitigation. While methane emissions from concentrated sources can often be collected and utilized, emissions from naturally ventilated livestock buildings and the atmosphere itself occur at concentrations too low for conventional thermal oxidation technologies to be practical.

This presentation describes the development of the Methane Eradication Photochemical System (MEPS), a UV-driven chlorine radical process designed to oxidize methane in dilute air streams. Field trials at a commercial dairy barn in Denmark have demonstrated efficient methane removal from ventilation air at concentrations down to approximately 25 ppm, while simultaneously reducing ammonia, hydrogen sulfide, and odorous volatile organic compounds. These experiments have provided valuable insight into reactor design, mass transfer, energy efficiency, operational robustness, and scale-up to full-scale livestock facilities.

The presentation will also discuss how the same fundamental atmospheric chemistry can be applied in a different context through atmospheric oxidation enhancement (AOE), in which reactive chlorine species are introduced into methane-rich plumes or, potentially, the background atmosphere to accelerate natural methane oxidation. Laboratory studies, atmospheric modelling, and techno-economic analyses illustrate both the opportunities and the scientific challenges associated with these emerging approaches.

Together, these examples demonstrate how advances in atmospheric chemistry can be translated into practical technologies for reducing methane emissions across a range of environmental applications, from agricultural point sources to broader atmospheric mitigation strategies.

The origin of atmospheric particles in North Greenland – apportionment of natural and anthropogenic sources

Air Pollution session

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Atmospheric particles play an important role in transport of environmental contaminants to the Arctic as well as being a significant source of uncertainty in regional-to-global climate change. In North Greenland, volatile precursors from local sources nucleate to form particles, typically in the Spring, whereas crustal sources and marine sea-spray are primarily emitted and form mechanically generated coarser particles. Natural sources of particles show a strong seasonal dependency, which depends upon e.g. availability of open water, ice and snow cover and complicated transport mechanisms within and into the Arctic. The latter also applies to long-range transport of anthropogenic sources of environmental contaminants. Apportionment of particulate matter is important for understanding transport mechanisms in the Arctic, changing source strength and their regions, and identifying polluting elements, but also quantifying the contribution from natural sources, which is required for assessment of the impact on ecosystems and climate. Previous source apportionment studies concluded that long-range transported anthropogenic emissions dominate aerosol composition during Arctic haze in the Winter/Spring season. Moreover, a secondary marine source demonstrated an important role in the Spring/Summer season, where ambient particle levels are low. This work presents an updated source apportionment analysis based on time series from 2011-2024 combined with back-trajectory analysis on a comprehensive dataset. In addition to natural sources and such originating from northern Russia, emissions from mining activities are transported over both high-latitude Canada and Greenland's west coast.

Low-cost sensors for personal air pollution exposure assessment: The DonorSense study

Air Pollution session

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Traditional exposure assessment based on fixed-site ambient monitoring or modeling may not adequately represent personal air pollution exposure, as individuals move between different indoor and outdoor environments and experience short-term exposure peaks throughout the day. Low-cost sensors offer the possibility of measuring multiple pollutants at high spatial and temporal resolution.

In the DonorSense study, 200 plasma donors (46% female; aged 21–72 years) were recruited for personal air pollution monitoring. Between October 2024 and April 2025, participants carried a portable low-cost sensor node capable of measuring nitrogen dioxide, carbon monoxide, fine particulate matter and carbon dioxide, together with temperature, relative humidity, light and GPS. Prior to the campaign, the sensor nodes were evaluated and calibrated through co-location with reference and higher-grade instruments in both an urban street environment and an inhabited apartment, representing contrasting conditions encountered during personal monitoring.

The sensor nodes successfully captured personal exposure under real-life conditions and revealed substantial temporal and inter-individual variability. Exposure profiles varied across pollutants, demonstrating that measurements of a single pollutant cannot fully characterize personal air pollution exposure. The campaign further demonstrated the feasibility of deploying low-cost multi-pollutant sensor nodes in a relatively large population, although personal monitoring remains resource-intensive.

Low-cost sensors provide a valuable tool for characterizing personal air pollution exposure across locations and activities. The sensor node measurements will subsequently be linked to blood biomarkers and compared with modeled exposure estimates to investigate how personal monitoring can improve exposure assessment in air pollution epidemiology.

[P001] DeFluorX: Discovering FAcDs for PFAS Defluorination

Keywords: *DefluorX, Perfluoroalkyl substances, Fluoroacetate dehalogenase, Microbial biodegradation*

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Per- and polyfluoroalkyl substances (PFAS) are persistent environmental pollutants due to the exceptional stability of the carbon–fluorine (C–F) bond. Microbial fluoroacetate dehalogenases (FAcDs) provide a potential biocatalytic route for PFAS transformation; however, naturally occurring variants are largely limited to simple monofluorinated substrates. Understanding the mechanistic limitations underlying this substrate specificity remains a key barrier to advancing PFAS bioremediation. Here, we present DeFluorX, a multi-tiered “Mechanism-First” computational framework to identify and evaluate FAcD variants with potential activity toward highly fluorinated compounds. We integrate the Boltz-2 biomolecular foundation model with docking, molecular dynamics simulations, and hydration thermodynamics analysis to systematically assess enzyme–ligand compatibility across 27 major perfluorinated pollutants. Candidate complexes were evaluated based on mechanistic and structural criteria, including catalytic geometry, active-site interactions, and stability. Top-ranked variants were further validated through long-timescale simulations and binding free-energy estimation, while WaterMap analysis revealed that the displacement of high-energy active-site water molecules is a key thermodynamic driver of substrate binding. This workflow yields a data-driven shortlist of FAcD candidates with predicted activity toward diverse PFAS structures. Ongoing experimental validation aims to confirm degradation potential and refine mechanistic insights. More broadly, this approach provides a generalisable framework for mechanism-guided discovery of next-generation enzymes for environmental bioremediation.

[P002] UV based Photochemical Oxidation of Methane in Water and Air

FLASH PRESENTATION • Air Pollution session

Keywords: *Anthropogenic methane, Photochemical mitigation, UV AOPs, Methane Scrubber*

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Methane (CH₄) is the second most important anthropogenic greenhouse gas after CO₂ and about two-thirds of global CH₄ emissions can be attributed to human activities. CH₄ is a stable gas with strong C–H bonds that is difficult to oxidize under ambient conditions. However, UV based advanced oxidation processes (AOPs) are promising technologies for the oxidation of persistent molecules because they generate different highly reactive species that can oxidize recalcitrant compounds.

A UV based oxidation system for mitigation of CH₄ at atmospheric levels and above has previously been established for catalyst-free removal at ambient temperature and pressure (Iversen and Roslev 2025). Here, we present results documenting efficient CH₄ removal in both water and air with and without the addition of different oxidant precursors (OPC). Experiments were performed under different irradiation regimes with both monochromatic and polychromatic UV irradiation.

The results showed that CH₄ was oxidized in both water and air by indirect photolysis at both low and high initial CH₄ concentrations (0-100%). CH₄ from the atmosphere could be removed within seconds to well below ambient concentrations (<2 ppm). The final transformation products in the process included H₂O and CO₂. CH₄ removal in environmental samples with mixed gas composition (ventilation air from a pig barn, natural gas from the North Sea) was comparable to mitigation of pure CH₄. Addition of OPCs may further increase the removal% and the oxidation rate constants. For example, some OPCs reduced the time required to achieve 90% CH₄ removal and approximately doubled the oxidation rates. Oxidation kinetics in UV LED based systems were somewhat comparable to removal in systems with conventional UV-irradiation when evaluated based on fluence (J/m²). Overall, the study documented catalyst-free CH₄ mitigation based on different UV regimes that could sustain removal of CH₄ in different matrices at ambient conditions.

[P003] Experimental evaluation of predicted PFAS defluorinating enzymes in *Microcystis aeruginosa*

Keywords: PFAS biodegradation, defluorinating enzymes, *Microcystis aeruginosa*

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Per- and polyfluoroalkyl substances (PFAS) are persistent environmental contaminants for which few microbial degradation pathways are known. A recent comparative genomics analysis identified candidate defluorinating enzymes in the cyanobacteria *Microcystis*, including fluoroacetate dehalogenase (FACD) homologs. The genomic organization suggests positive selection of these genes, reflecting an adaptive response to alleviate PFAS-driven photosynthesis inhibition.

Building on this hypothesis, candidate FACD genes were heterologously expressed in *E. coli* and tested for defluorination activity against perfluorooctanoic acid (PFOA) and trifluoroacetic acid (TFA). Despite confirmed protein expression, no fluoride release was detected for any of the tested candidate enzymes. Furthermore, growth of *Microcystis aeruginosa* exposed to 0, 50, 100, and 150 µM perfluorooctanoic acid (PFOA) was monitored, but the expected dose-dependent growth inhibition reported in literature was not observed, and no fluoride release was measured. This suggests either tolerance, limited PFOA uptake or bioavailability under these conditions, or that light was not intense enough to kickstart a significant photosynthesis inhibition.

Together, these negative results contrast with the comparative genomics analysis and previous reports of partial PFOA degradation by other cyanobacterial strains. We discuss several possible explanations, including the relatively high resistance of PFOA to defluorination compared to smaller PFAS, suboptimal defluorination assay conditions (pH, temperature, incubation time), and the possibility that the tested compounds do not match the substrate range determined by natural selection. We propose that future work should test a broader range of PFAS structures to better align experimental compounds to those possibly encountered by cyanobacteria in contaminated environments, and to optimize growth to the highest possible light intensity to test inhibition of photosynthesis.

[P004] MALDI-MSI detection of structurally diverse micropollutants: MALDI matrix screening toward spatial mapping of biotransformation

Keywords: *Micropollutants, MALDI-MSI, wastewater treatment*

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Micropollutant removal in wastewater treatment plants (WWTPs) occurs through physical, chemical, and biological processes, including biotransformation and sorption onto activated sludge and biofilms. Understanding micropollutant fate requires detection of parent compounds and transformation products, while their spatial distribution can reveal localized patterns of accumulation and transformation within heterogeneous environmental matrices. MALDI mass spectrometry imaging (MALDI-MSI) combines molecular detection with spatial information, offering the potential to map micropollutants and their biotransformation products and thereby identify spatially resolved patterns of their fate and transformation. However, MALDI performance strongly depends on matrix selection and ionization polarity.

In this study, six MALDI matrices were evaluated for the detection of 23 structurally diverse micropollutant standards, including pharmaceuticals, pesticides, industrial chemicals, fragrances, surfactants, and biocides. Measurements were performed in positive and negative ion modes, and matrix performance was assessed based on analytical coverage and signal intensity. Considerable differences in detection performance were observed among matrices and ionization modes. CHCA provided the highest analytical coverage in positive-ion mode, detecting 17 of the 23 compounds. In negative-ion mode, MALDI-2 substantially improved detection, with NEDC providing the highest analytical coverage and strong signal intensities across multiple micropollutant classes.

These findings demonstrate that matrix selection and ionization conditions are critical for detecting structurally diverse micropollutants by MALDI-MSI. The optimized approach provides a foundation for subsequent MALDI-MSI studies to spatially resolve micropollutants and their biotransformation products, enabling better understanding of their fate and transformation pathways in complex environmental matrices.

[P005] Ozonation for Chlorinated Contaminants Removal in Pharmaceutical Leachate from a Superfund Site

Keywords: Ozonation, pharmaceuticals, industrial pollution, vinyl chloride

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At Grindsted city, the Grindsted Å is impacted by contaminations from the discontinued pharmaceutical production at Grindstedværket. Owing to high toxicity and concentrations, particularly vinyl chloride, which exceeds environmental quality standards, the presence of other chlorinated ethenes, sulphonamides, and various other pollutants illustrates the need for a complete solution.

A proposed pump-and-treat system could intercept the contamination at the brink of the stream. However, vinyl chloride is difficult to remove because it is highly volatile and exhibits poor sorption to activated carbon. Therefore, an alternative treatment train based on no-off-gas ozonation was tested on groundwater samples collected along Grindsted Å, along with the option to polish with activated carbon.

Vinyl chloride, trans-DCE, and sulfamethazine were reduced by 90% with an ozone dose of 4.4 mg O₃/L. However, a dose of 21 mg O₃/L was required to reduce vinyl chloride below the environmental quality criterion (0.05 µg/L), and this removed contaminants with low ozone reactivity. The required dose was strongly influenced by ozone scavenging by the production reactant sulfanilic acid, which occurs infrequently up to ppm concentrations.

At pilot scale, vinyl chloride and trans-DCE were below the quantification limit after 9 minutes of residence time (23.7 mg/L theoretical delivered ozone dose). By the end of the ozonation experiment, only Nikethamide remained (1.02 µg/L) among the analysed sulphonamides, and it was fully removed by subsequent GAC treatment, alongside cis-DCE, PCE, and residual barbiturates. These results demonstrate that the combined application of ozonation and GAC filtration has strong potential for future full-scale remediation of the contaminated groundwater at Grindsted.

[P006] From methodological gaps to harmonized PFAS suspect and non-target screening: the PFAS SUSPECT project

FLASH PRESENTATION • NonTarget Screening session

Keywords: PFAS, SS/NTS, HRMS, Semi-quantification, Fluorine mass balance

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Per- and polyfluoroalkyl substances (PFAS) comprise a diverse chemical space that cannot be adequately characterized by conventional targeted analyses. Suspect and non-target screening (SS/NTS) using high-resolution mass spectrometry (HRMS) can investigate the unknown fraction of Σ PFAS. However, a systematic review of 160 studies from 2015-2025 shows that current approaches remain biased toward aqueous samples analysed by solid-phase extraction and reversed-phase liquid chromatography (RP-LC)-HRMS. This methodological convergence limits chemical coverage, particularly for ultra-short-chain, highly polar, neutral and volatile PFAS. Differences in sample preparation, data processing and quality assurance and control (QA/QC) hinder comparability and identification confidence, while the challenge of selecting suitable surrogates for semi-quantification introduces substantial uncertainty, limiting the use of SS/NTS for fluorine mass-balance assessment.

Building on these findings, the PFAS SUSPECT project of the Danish PFAS Center aims to develop and harmonize SS/NTS methods for identifying unknown or overlooked PFAS. Approximately 50 environmental and food samples have been collected, including ground- and surface water, sludge, soil, biota, air, dust, and vegetable- and animal-based foods. Matrix-specific extraction and clean-up strategies are under development, balancing generic approaches with matrix removal requirements for LC-HRMS workflows. A subset, likely to include neutral PFAS, will also be analysed by gas chromatography (GC)-HRMS. Semi-quantification of identified PFAS will enable fluorine mass balances, including conventional target analysis and PFAS Total determined as Extractable Organic Fluorine (EOF). By linking methodological assessment with method development and validation, the project seeks to expand PFAS chemical coverage, improve SS/NTS confidence and comparability, and assess integration into routine environmental and food monitoring.

[P007] In-situ seasonal mass absorption cross section (MAC) values for equivalent black carbon reporting in the High Arctic.

FLASH PRESENTATION • Air Pollution session

Keywords: mass absorption cross section, equivalent black carbon, Arctic, Greenland

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The mass absorption cross section (MAC) is a key parameter for the indirect quantification of black carbon (BC) as equivalent BC (eBC) using optical instruments like aethalometers and multi-angle absorption photometers (MAAP). Studies show that the MAC varies with BC aging including characteristic parameters as particle size, mixing state, coating, and morphology. This variation should be considered when estimating equivalent eBC concentrations, particularly in the Arctic, where environmental conditions are different from those at lower latitudes. This study presents the first observational estimates of MAC values at Villum Research Station (VRS), Greenland, from an 8-year dataset and investigates its seasonal variability. The goal is deriving in-situ, season-dependent MAC values for improved eBC calculations. Observational MAC values (MAC_{obs}) were derived from measurements of absorption coefficient (b_{abs}) at 880 nm obtained with an Aethalometer AE33, and elemental carbon (EC) concentrations measured with an EC-OC analyzer during 2017-2024. MAC_{obs} showed significant seasonal variability, with the highest average value in spring ($9.68 \text{ m}^2\text{g}^{-1}$) and the lowest in summer ($5.59 \text{ m}^2\text{g}^{-1}$). Trend analysis revealed significant increases in MAC_{obs} during winter and autumn, while no significant trends were observed in spring and summer. These results suggest season-dependent changes in the optical properties of carbonaceous aerosol, especially during cold and transition seasons.

The observed seasonal variability is consistent with processes such as aerosol aging, changes in mixing state, and source variability. Seasonal differences in EC concentrations, air mass origin, and meteorological conditions may contribute to the variability in MAC_{obs}. The pronounced seasonal dependence observed at VRS suggests that the use of seasonally resolved site-specific MAC values will provide more reliable eBC estimates compared to the application of a single constant MAC throughout the year.

[P008] What are we looking at? Spectroscopic and statistical approaches to evaluate the digestion pre-treatment step impact on true-to-life microplastics.

FLASH PRESENTATION • Plastics and Micro Plastics session

Keywords: *microplastics, pre-treatment, FTIR spectroscopy*

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According to the type of samples, there is a wide knowledge about the availability to pre-treat the matrices to isolate microplastics. These can be differentiated in terms of applicability, efficiency and cost: researchers can recover microplastics of different sizes and analyse them, confirming their nature as emerging pollutants. Starting from this important point, this study provides a different perspective: these methods are not only analytical tools, but also a series of steps and treatments we are applying to a material which is not inert at all, but capable of interacting with the chemicals we are choosing, at different temperatures.

Knowing that each protocol can be differentiated in several mechanical and chemical steps, the digestion step has been selected because in most cases is the first step microplastics are facing after being sampled in the environment.

To understand how much and in which way microplastics are changing their nature before lying down on a filter for micro-FTIR spectroscopy, this research sets a way to observe and investigate the interaction of three different types of microplastic fragments with different types of digestion in controlled conditions.

This experimental observation, together with the statistical picture, can define a starting point to implement library matches in the everyday life of microplastics studies and, in a broader view, to build awareness about what is the material we are monitoring and studying in the environment and what effect we are unavoidably inflicting on it.

[P009] From Sludge to Soil: Investigating the Fate and Ecological Risks of Emerging PFAS

Keywords: PFAS, sewage sludge, sludge treatment reed beds, non-target screening, ecotoxicity

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SafeSludge addresses critical environmental challenges associated with sewage sludge reuse, with a particular focus on per- and polyfluoroalkyl substances (PFAS), highly persistent contaminants that remain insufficiently regulated. Although sludge treatment reed beds (STRBs) are increasingly used in Europe, particularly in Denmark, the occurrence, transformation, and ecological risks of PFAS in STRB-treated sludge and amended agricultural soils remain poorly understood. This knowledge gap limits robust risk assessment and evidence-based regulation.

The project aims to (i) characterize the occurrence, diversity, and variability of emerging PFAS in STRB-treated sludge using targeted and non-targeted screening; (ii) investigate their environmental fate, transformation, and potential biological effects in sludge–soil systems through controlled microcosm experiments involving wheat, earthworms, and soil microbial communities; and (iii) develop ecotoxicological thresholds and predictive risk models to support safe sludge reuse.

The research will integrate advanced chemical analysis (LC-HRMS and LC-MS/MS), MALDI-MSI, ecotoxicological bioassays, molecular microbiology, and environmental risk modelling. By linking PFAS occurrence and transformation with biological responses, SafeSludge aims to improve understanding of emerging PFAS in STRBs, identify potentially overlooked contaminants, and generate mechanistic evidence on their environmental relevance. The project is expected to contribute to science-based risk assessment and regulatory approaches for sustainable sludge reuse while supporting the protection of soil health.

[P010] Environmental disruption of retinoic acid signaling in fetal testis development: from *ex vivo* models to human organoids

Keywords: Fungicides, reproduction, toxicology

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Retinoic acid (RA) signaling is a highly conserved pathway that regulates essential developmental processes, including gonadal development and differentiation. Evidence indicates that several plant protection products, including azole fungicides, can interfere with this pathway, yet the consequences for fetal reproductive development remain poorly understood.

We investigated whether azole fungicides disrupt RA signaling during fetal testis development using *ex vivo* rat and mouse fetal gonad cultures. Exposure to selected azoles induced molecular changes consistent with altered retinoid signaling, including increased expression of the RA-responsive genes *Rarb*, *Rbp1*, *Cyp26a1*, and *Cyp26b1*. Effects on somatic cells of the testes were also observed, including reduced expression of *Amh* and *Cyp11a1* and marked upregulation of *Dax1*. In mouse fetal testes, azoles triggered ectopic activation of RA-responsive reporter systems and induced the meiotic gatekeeper gene *Stra8*, indicating inappropriate germ cell responses to RA and premeiotic entry. These findings demonstrate that environmentally relevant fungicides can perturb molecular pathways critical for fetal testis development, highlighting RA signaling as an important mechanism to consider in developmental toxicity.

These observations provide the basis for the newly funded INNATE project (funded by the Danish Environmental Protection Agency), which aims to establish human-induced pluripotent stem cell-derived fetal testis organoids as a human-relevant platform for studying the reproductive effects of plant protection products and biocides. By integrating human organoid models, *ex vivo* rat fetal testis cultures, and adverse outcome pathway (AOP) development, the project will advance mechanistic understanding of how environmental pollutants disrupt male reproductive development and deliver new tools for next-generation chemical hazard assessment.

[P011] PFAS and Female Reproductive Health: Integrating Evidence Across Evidence Streams

FLASH PRESENTATION • PFAS session

Keywords: PFAS, female reproductive health, quantitative weight-of-evidence

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Per- and polyfluoroalkyl substances (PFAS) are a large group of persistent, bioaccumulative chemicals widely used in industrial processes and consumer products. Due to their persistence, PFAS are ubiquitous in water, food, and the human body, leading to continuous exposure. A growing body of epidemiological, animal, and mechanistic evidence suggests that PFAS may act as endocrine disruptors and be associated with female reproductive health outcomes, including polycystic ovary syndrome, endometriosis, menstrual disorders, and impaired fertility. However, while epidemiological evidence exists, it remains limited and heterogeneous, and underlying biological mechanisms are not fully understood.

The aim of this study was to conduct a systematic review of epidemiological, animal, and mechanistic studies investigating associations between PFAS exposure and female reproductive health outcomes and to propose and apply a complementary framework for assessing risk of bias, study quality, and overall confidence in the body of evidence across evidence streams, resulting in a quantitative weight-of-evidence (WoE) score.

We systematically searched for epidemiological, animal, and mechanistic studies through structured database searches, and screened the literature using predefined PECOS criteria.

Preliminary results indicate heterogeneity in study design, exposure metrics, and outcome definitions, as well as inconsistencies in findings across evidence streams. The WoE approach will be used to quantitatively weigh the evidence for a potential association between PFAS exposure and female reproductive health effects, ensuring transparency in the uncertainty of the overall WoE.

If an association is supported by the available evidence, the approach may be applied to estimate the probability of causation, which can inform environmental health risk assessments and burden of disease studies to support transparent evidence-based public health decision-making.

[P012] Defluorination or apparent loss? An evidence framework for PFAS biodegradation

Keywords: PFAS, Defluorination, Microbial Biodegradation

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Per- and polyfluoroalkyl substances (PFAS) are extremely persistent pollutants, and microbial degradation is increasingly explored as a complement to physicochemical remediation. Yet reports of PFAS biodegradation often fail to distinguish genuine microbial cleavage of the carbon-fluorine bond from sorption, volatilization, bioaccumulation, or analytical artifact. We compiled 86 studies (1989-2025) testing microbial transformation or defluorination of fluorinated compounds and assessed how they were designed and reported. Fewer than half quantified fluoride release, and even fewer analyzed biomass-associated PFAS or gas-phase intermediates, measurements essential for separating true defluorination from apparent loss. Microorganisms clearly alter PFAS speciation, but full defluorination of persistent compounds such as PFOA and PFOS remains rare, while partial transformation of fluorotelomer precursors is more common and usually stalls at persistent perfluorinated end products. We define the experimental requirements for a defensible defluorination claim: sterile, sorption, and no-substrate controls to exclude abiotic loss; fluoride quantification; targeted and non-target metabolite screening; and analysis of biomass and headspace compartments. Building on this, we propose a five-tier evidence hierarchy ranking claims from no evidence to definitive proof, plus a minimum reporting checklist covering inoculum history, substrate provenance, and replicate design. Applying these criteria retrospectively, no published study of a fully perfluorinated PFAS yet meets the standard for definitive proof, indicating that the main obstacle is a shortage of rigorously designed and controlled studies, not a shortage of candidate organisms or reported activity. This framework gives microbiologists a shared vocabulary and a practical roadmap for designing PFAS biodegradation experiments that can be compared and built upon.

[P013] Characterizing the Pharmaceutical "Cocktail" in European Wastewaters: Baseline Screening from the NBS4AQUAMMISSION Project

FLASH PRESENTATION • NonTarget Screening session

Keywords: *Organic micropollutants, Suspect screening, Nature-based Solutions (NbS)*

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Pharmaceutical products (PPs) and organic micropollutants (OMPs) pose a growing threat to aquatic biodiversity, as conventional treatment plants fail to fully remove these compounds. The NBS4AQUAMMISSION project investigates Nature-based Solutions (NbS) for PP removal across European demonstration sites. This study presents baseline suspect screening results characterizing PP/OMP pollution at pilot-scale NbS systems in Denmark (DK), Norway (NO), and Spain (SP). Samples from inlets and outlets were analyzed using LC-HRMS against a suspect list of >500 compounds, including pharmaceuticals, antibiotics, pesticides, and transformation products. Hundreds of features were detected across all sites, revealing both common cross-site markers and site-specific pollution signatures.

A consistent group of eight compounds was identified across DK, NO, and SP: tilmicosin (veterinary macrolide antibiotic), tetroxoprim (antibacterial agent), dipyridamole (antiplatelet/vasodilator), protionamide (antitubercular agent), etofenprox (pyrethroid insecticide), chlorcyclizine (antihistamine), diclofenac (NSAID), and DEET (insect repellent). Of these, only diclofenac and DEET are currently covered by routine targeted monitoring. The remaining six compounds are recommended as priority additions for future targeted analysis, with tilmicosin and tetroxoprim designated as Tier 1 due to their high signal intensities and relevance to antimicrobial resistance surveillance. These fingerprints define the baseline "chemical cocktails" needed to evaluate NbS removal efficiency and interpret ecotoxicological responses. These findings establish a robust chemical baseline for the NBS4AQUAMMISSION sites, identify critical analytical gaps, and demonstrate the necessity of suspect screening to inform NbS performance assessment. The recommended expansion of targeted methods will enable accurate tracking of PP removal and support biodiversity protection strategies across European water systems.

[P014] PFAS and Pharmaceuticals in Danish Sludge Treatment Reed Beds

Keywords: *PFAS, Pharmaceuticals, Sludge Treatment Reed Beds*

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Sludge Treatment Reed Beds (STRBs) are a widely adopted nature-based solution for sludge dewatering and stabilization in Denmark, yet the accumulation of persistent organic contaminants threatens the agricultural reuse of the final product. This study presents the first comprehensive nationwide assessment of per- and polyfluoroalkyl substances (PFAS) and pharmaceuticals in 11 full-scale Danish STRB systems, some operating since the 1990s. A summer 2025 sampling campaign collected over 1,400 sludge samples, including high-resolution depth cores, plant material, and earthworms. Target compounds were quantified using LC–MS/MS (SCIEX 7500/7500+). Preliminary pharmaceutical data revealed distinct stratification patterns, with benzotriazole increasing from ~60 µg/kgDS at 120 cm depth to 124 µg/kgDS at 20 cm, while propranolol showed a similar trend (40 to 104 µg/kgDS). Hydrophobic compounds (e.g., BAC-C14: 1800 µg/kgDS) showed stronger association with the solid matrix, while hydrophilic compounds (sulfamethoxazole: 0.44 µg/kgDS; atenolol: 0.31 µg/kgDS) remained more mobile. These depth-dependent trends suggest progressive mineralization of certain micropollutants in older sludge layers. PFAS analysis is ongoing and will enabling comparison across sites and formulation of a preliminary risk assessment for soil application. The findings will inform strategies for producing STRB-derived biosolids compatible with circular economy objectives and emerging regulatory constraints on PFAS and pharmaceuticals in agricultural soils.

[P015] Nanocarriers alter the bioavailability of hydrophobic deep eutectic solvents in controlled-release fertilizers during ecotoxicity testing

Keywords: nanocarriers, hydrophobic deep eutectic solvents, ecotoxicity

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Modern agriculture relies on chemical fertilizers to sustain high crop yields. However, only 30-50% of applied nutrients are taken up by crops while the remaining may be lost through leaching and runoff, contributing to environmental problems such as eutrophication. Controlled-release fertilizers (CRFs) are a promising solution to improve nutrient use efficiency and reduce these impacts. However, their environmental safety remains insufficiently investigated. Ecotoxicological information provides a scientific basis for identifying environmental hazards, which is particularly important during the design phase of new substances. In this context, the aim of this study was to assess the environmental safety of four CRFs consisting of inorganic nanocarriers (NCL, SiO₂) impregnated with fertilizers (KCl, NH₄NO₃) and encapsulated with hydrophobic deep eutectic solvents (HDES). The individual substances and final formulations were tested in acute toxicity assays using the freshwater algae *Raphidocelis subcapitata* and crustacean *Daphnia magna*. The inorganic nanocarriers inhibited algal growth, with EC₅₀ values of 84 mg/L and 33 mg/L for NCL and SiO₂ respectively, while no immobilization of *D. magna* was observed at concentrations up to 1000 mg/L. No effects were observed for the HDES and fertilizers when tested individually. HDES was tested at concentrations up to 10 mg/L due to its limited water solubility. In contrast to the individual substances, the CRFs exhibited higher toxicity to both organisms, with EC₅₀ values of 0.08-10 mg/L for *R. subcapitata* and 0.1-6 mg/L for *D. magna*. This increased toxicity was primarily attributed to HDES, whose bioavailability may have been altered by the nano-encapsulation. These findings highlight that the environmental safety of nano-enabled formulations cannot be predicted based on the toxicity of their individual substances and extrapolation criteria (e.g. EC₅₀ values from literature) may not be applicable to nano and HDES substances.

[P016] Fluorotelomer Alcohols (FTOHs) in Dust from Danish Schools: Implications of Different Sampling Techniques for Indoor Exposure Assessment

FLASH PRESENTATION • PFAS session

Keywords: *Indoor Air Quality, Semi-volatile organic compounds, PFAS*

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Indoor environments are important sources of exposure to semi-volatile organic compounds, as we spend about 90% of our time indoors. This study investigated fluorotelomer alcohols (FTOHs), known precursors of highly persistent per- and polyfluoroalkyl substances (PFAS), in dust collected from Danish schools using two different sampling approaches.

Dust was collected as (i) settled dust on filters deployed for 200-238 days between October 2024 and June 2025 and (ii) vacuum-collected dust during three campaigns (February, May, and October 2025). Samples were spiked with isotopically labelled standards, extracted, and analysed by gas chromatography-mass spectrometry (GC-MS). Field and laboratory blanks were included for QA/QC.

6:2, 8:2, and 10:2 FTOHs were detected in all schools and by both sampling approaches, confirming the widespread presence of precursor PFAS in both indoor air and dust of Danish school environments. The FTOHs concentrations in vacuum-collected dust were generally below 45 ng/g, whereas concentrations in settled dust ranged from 41.2 to 1040.6 ng/g. Despite collecting substantially less dust, settled dust samples generally showed higher FTOH concentrations than vacuum-collected dust, particularly for 8:2 and 10:2 FTOH. The higher concentrations may reflect the longer sampling duration of the settled dust approach, allowing particle deposition and sorption of gaseous FTOHs, or differences in the dust fractions and accumulation periods represented by the two sampling approaches.

The results indicate that school dust represents a relevant exposure pathway for precursor PFAS, in addition to indoor air, and highlight the importance of sampling methodology for exposure assessment. Settled dust and vacuum-collected dust integrate contamination over different temporal and physical scales and should therefore be interpreted as complementary measures of indoor PFAS contamination rather than directly equivalent metrics.

[P017] Using silicone wristbands as screening tools for occupational exposure to chlorinated paraffins

FLASH PRESENTATION • Air Pollution session

Keywords: *Persistent organic pollutants, human exposure, personal passive sampling*

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Chlorinated paraffins (CPs) are complex mixtures of polychlorinated alkanes classified by their carbon chain length– short (SCCP, C10-13), medium (MCCP, C14-17), and long chain (LCCP, ≥C18)– and are typically 30-70% chlorine. As flame retardants and plasticizers, they are widely used in consumer and industrial products. SCCPs and MCCPs are regulated by the Stockholm Convention, but exemptions suggest occupational exposure concerns. Here, we deployed silicone wristbands as personal passive samplers among Danish workers to identify high-risk jobs for CP exposure.

Pre-cleaned wristbands (n=84) were deployed among workers for 1–3 days, only during work hours. Job types included sludge workers, plastic and electronic waste handlers, demolition workers, electricians, plumbers, scrap metal handlers, and computer numerical control (CNC) metalworking machinists plus an office worker reference. Wristbands were extracted and analyzed using LC-HRMS. Pattern deconvolution was adapted from Bogdal et al. using single chain length standards with 3-5 chlorination degrees (C10-24) and isotopically labeled standards. Semi-quantification was done in R.

SCCPs, MCCPs, and LCCPs were detected in wristbands across job types, including office workers. Median wristband concentrations were 74.5 ng/g/8h workday for SCCPs, 670 ng/g/workday for MCCPs, and 87.4 ng/g/workday for LCCPs. Plastic waste recyclers had the highest median, followed by scrap metal handling. Most job types had significantly higher concentrations compared to reference. Generally, MCCPs dominated, but several groups including demolition workers had comparatively elevated SCCPs.

Wristband CP concentrations in this study were an order of magnitude higher than previous studies with wristbands. This work provides preliminary insights on CPs as ‘emerging contaminants’ in occupational health and points to the use of wristbands as a simple tool to map occupational exposure and identify occupations with the highest exposure risk.

[P018] Modification of commercially available polypropylene filters with amphiphilic cyclodextrins: Application for PFAS removal

Keywords: PFAS, amphiphilic cyclodextrin, water treatment, dip coating, adsorption

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Per- and polyfluoroalkyl substances (PFAS) are a group of manmade organofluoride compounds which are environmentally persistent, bioaccumulative and toxic to humans. Since conventional wastewater treatment methods show insufficient removal of PFAS, it is essential to develop new technologies. Cyclodextrin (CD) based materials have emerged as promising adsorbents for PFAS remediation. Modification of surfaces with CDs often require harsh organic solvents, long reaction times and/or advanced equipment. We suggest an alternative method for immobilizing amphiphilic cyclodextrins (ACDs) on polymeric materials, which are fast, simple and only require household chemicals. The aim of the presented study was to modify commercially available polypropylene (PP) filters with ACDs to demonstrate its application for PFAS removal.

Non-woven PP was modified with ACDs by dip coating in a mixture of ACDs, ethanol and water for 10 s. Scanning electron microscopy and contact angle measurements were performed to characterize the properties of the ACD coat. The removal of the PFAS perfluorooctanesulfonic acid (PFOS) was tested in both static and dynamic adsorption experiments.

It was demonstrated that based on the choice of ACD, it is possible to increase the hydrophilicity of the non-woven PP. The immobilization of ACDs on the PP filters increased the removal of PFOS up to a factor of 24 compared to the non-coated PP.

The results demonstrate that non-woven PP easily can be modified with ACDs by a simple and fast dip coating to increase its ability to remove PFAS.

[P019] Nothing is forever: Analogue enrichment on acetate yields a microbial consortium that defluorinates the ultra-short-chain PFAS trifluoroacetate

FLASH PRESENTATION • PFAS session

Keywords: TFA, PFAS, biodegradation, defluorinating enzymes, pollution remediation

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Trifluoroacetic acid (TFA) is a perfluoroalkyl (PFAS) pollutant of global significance; it is persistent and ubiquitous in the environment across compartments, including food, drinking water, humans, and animals. Concentrations in the environment are rising, concerns over the toxicity of the compound are increasing, and there are currently no efficient ways to remedy TFA pollution, as conventional methods are ineffective. Microorganisms possessing dehalogenating enzymes targeting the structurally analogous compound monofluoroacetate present a potential solution in the form of microbial TFA degradation.

Analogue enrichment has been shown to enrich microorganisms capable of cometabolic degradation of other organic pollutants. This strategy constituted the framework of this project, which aimed at finding microbial TFA degraders through enrichment of acetate metabolizing microorganisms and screening for defluorination of monofluoroacetate. This was done to search for organisms capable of cometabolic degradation of TFA via promiscuous dehalogenase enzymes.

The experiment yielded several cultures which showed significant defluorination of TFA after 30 days. Genetic sequencing and protein-ligand modelling identified two candidate dehalogenase enzymes with capacity to degrade TFA; PAKLIA_03565 from *Achromobacter denitrificans* and KHCNEI_21275 from *Stenotrophomonas* sp. These findings are a crucial first step towards bioremediation of TFA, and is, to the best of our knowledge, the first study to identify a TFA degrading organism.

[P020] Removal of Metronidazole from Aqueous Solutions by the VUV/Cu-doped-ZnO Advanced Oxidation Process

Keywords: Metronidazole, VUV/Cu-doped-ZnO, AOP

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Background and objective: Pharmaceutical residues are emerging aquatic pollutants of increasing environmental concern. This study evaluated the efficiency of the VUV/Cu-doped-ZnO advanced oxidation process for the removal of metronidazole (MTZ) from aqueous solutions.

Methods: A bench-scale experimental study was conducted using a 200-mL cylindrical photoreactor equipped with a 6-W VUV lamp. Cu-doped ZnO nanorods were synthesized by co-precipitation and characterized by XRD, SEM, and EDX. The effects of pH (5, 7, and 9), catalyst dosage (0–200 mg/L), initial MTZ concentration (5, 10, and 20 mg/L), reaction time (5–180 min), inorganic anions (Cl^- , PO_4^{3-} , and SO_4^{2-}), and radical scavengers (TBA, EDTA, and BQ) were investigated. Residual MTZ concentrations were measured using an Agilent HPLC system.

Results: XRD characterization showed that Cu-doped ZnO nanorods retained the hexagonal wurtzite structure of ZnO, with no detectable Cu oxide or other secondary crystalline phases, supporting successful Cu incorporation into the ZnO lattice. Under optimal conditions (pH 7, 100 mg/L Cu-doped ZnO, 10 mg/L MTZ, and 180 min), VUV/Cu-doped-ZnO achieved 100% MTZ removal, and degradation followed pseudo-first-order kinetics. Under identical conditions, VUV/ZnO achieved 70% removal, while the synergistic effects of VUV/Cu-doped-ZnO and VUV/ZnO were 30% and 8%, respectively. Inorganic anions inhibited photocatalytic MTZ degradation while enhancing its removal by photolysis. Radical scavenger experiments reduced MTZ removal, with EDTA showing the strongest inhibitory effect (from 100% to 56%), indicating an important role of photogenerated holes (h^+) in the degradation process.

Conclusion: Cu doping substantially enhanced process performance compared with VUV/ZnO, suggesting that VUV/Cu-doped-ZnO is a promising advanced oxidation process for treating water contaminated with pharmaceutical pollutants.

[P021] A non-animal biomarker for regulatory use: bridging *in vivo* outcomes with *in vitro* methods

Keywords: New approach methodologies (NAMs), biomarker, anti-androgen

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Regulatory chemical toxicity testing still relies heavily on animal models for hazard identification, but there is a growing demand for alternative test methods. This comes with several challenges, however, not least linking model read-out with predicted apical endpoints. This challenge is prominent in the identification of endocrine-disrupting chemicals (EDCs), for which one traditionally needs to show adverse effects in intact organisms, often by overt changes such as shortened anogenital distance (AGD) in male offspring; a sensitive endpoint for identification of anti-androgenic (AA) compounds. We have previously identified molecular biomarkers for AA compounds in heterogeneous tissues such as the perineum, but these have proven difficult to transfer to *in vitro* assays. Instead, we want to explore the prostate gland as an alternative organ for biomarker identification, as reduced postnatal prostate weight is significantly correlated with other AA-mediated effects. The aim is to develop an *in vivo*-relevant AA biomarker that can be tested *in vitro* to identify chemicals with AA properties. To ensure *in vivo* relevance, *in vitro* cell cultures (LaPC4), *ex vivo* organ cultures (rat prostate) and an *in vivo* animal model (rat) will all be exposed to AA model compounds and gene expression analysis (RNA sequencing) data compared to establish the *in vitro* AA signature. The first phase of the project has included optimization of the *in vitro* and *ex vivo* models as well as exposure studies with the same well-known AA-compounds across the three models. Initial data from these studies show expected AA effects with reduced expression of genes downstream the androgen receptor *in vitro* and *ex vivo* as well as effects on traditional AA endpoints such AGD and nipple retention *in vivo*. We expect this project to provide new knowledge for mechanistic-based predictive toxicology working towards replacing animal testing with a time and cost-effective alternative.

[P022] Microplastic in Snow from Remote Alpine and Arctic Regions

FLASH PRESENTATION • Plastics and Micro Plastics session

Keywords: QA/QC, Atmospheric Deposition, FPA- μ -FTIR

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Microplastic particles (MPs) are increasingly recognized as atmospheric contaminants capable of long-range transport. Due to limited local anthropogenic activity, MPs detected in high-alpine regions and remote polar environments are expected to largely reflect atmospheric (long-range) transport and deposition. Snow acts as an efficient particle scavenger, allowing atmospherically transported MPs to accumulate in freshly deposited surface snow. Previous studies have reported varying MP concentrations in snow, while blank measurements and contamination control have been inconsistent. Given the expected low MP concentrations in remote environments, reliable and contamination-controlled methods are essential.

This study aims to improve MP quantification in fresh surface snow and seasonal snowpacks from high-elevation Switzerland (>2000 m a.s.l.) and Arctic environments by optimizing sampling design and processed snow volumes while minimizing contamination. First samples and blanks were processed during winter 2025/2026. The limit of detection (LOD) was calculated as the mean blank concentration + 3 $\times$ standard deviation. Laboratory blanks ($n = 4$) resulted in an LOD of 22 particles L^{-1} , while field blanks ($n = 7$) resulted in an LOD of 103 particles L^{-1} . Combining laboratory and field blanks ($n = 11$) yielded an overall LOD of 93 particles L^{-1} . Swiss snow samples (395–1373 mL) contained 64–257 particles L^{-1} , but only 3 of 10 samples exceeded the overall LOD. These were either old, deposited snow or snow collected within a village. Greenland snow samples ($n = 9$), collected in April 2025 with sampling volumes of 322–392 mL, were all below the overall LOD. These results indicate that optimized sampling methods for reliable MP quantification in low-concentration snow samples should ideally combine primarily larger sampling volumes with lower blank values.

[P023] A window into the developing brain: Detecting Thyroid Hormone System (THS) mediated Developmental Neurotoxicity (DNT) in zebrafish (*Danio rerio*)

FLASH PRESENTATION • Ecotoxicology session

Keywords: *Ecotoxicology, Developmental Neurotoxicity (DNT), Thyroid hormone system disruption (THSD)*

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1. Introduction

Developmental neurotoxicity (DNT) is an emerging environmental concern, but standardized methods for wildlife are lacking (Westerink, 2013). We investigated whether brain histopathology can detect THSD-mediated DNT in zebrafish using Methimazole (MMI). We hypothesized that MMI would alter brain development through THSD, detectable as changes in specific brain regions.

2. Method

Exposure to MMI was carried out following OECD TG 210 and sampled at 30 dpf. 4 µm sagittal brain histopathology slides containing the spinal cord entering the hindbrain as an anatomic landmark were obtained.

3. Results

MMI exposure altered brain morphology. Overall brain size was reduced, while the relative telencephalon size increased. A decreasing trend was observed for the optic tectum, and the balance between the PGZ and neuropil layer was altered.

4. Discussion and conclusion

To date, most studies on brains in zebrafish rely on semi-quantitative scorings of microscopic areas in the brain without anatomic landmarks. Therefore, we incorporated quantitative brain measurements using the spinal cord entering the hindbrain as an anatomic landmark, as described in Kjær et al. (2026), to improve DNT detection in wildlife. Our results confirm that THSD-mediated DNT can be detected using brain histopathology.

[P024] The impact of pyrolytic conversion and biochar amendments on metal exposure and mobility in soils

Keywords: *biochar, metals, nutrients*

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Over the last two decades, pyrolytic conversion and biochar amendments have emerged as promising technology within waste management, resource recovery and contaminant remediation. More recently, large scale biochar amendments have been suggested as an important pillar for carbon capture within the green transition of Danish Agriculture, which has triggered concerns and discussions about the associated contamination risks. This concern is particularly relevant for metals, which are known to up-concentrate in biochar. However, pyrolysis also promotes the formation of mineral phases which enhances metal retention in the solid phase, thereby reducing aqueous metal concentrations and hence metal mobility. These changes would then be reflected in higher solid–water distribution coefficients (K_D values). This raises critical questions regarding the environmental fate of metals in biochar-amended soils, including their mobility, leaching potential, and long-term impacts on soil and water quality.

This study addresses these concerns by investigating the behavior of metals in biochar, with a focus on their exposure and mobility under varying pH conditions. Carefully paired samples from wastewater treatment plant WWTP sludge and biogas residue fiber, along with their corresponding biochars, were obtained from full-scale pyrolysis facilities in Denmark. Aqueous-phase metal concentrations in equilibrium with the feedstocks and their derived biochars were analyzed, covering a wide range of elements, including rare earth elements (REEs). To further assess metal partitioning between solid and aqueous phases, solid–water distribution coefficients were determined with two different approaches. Finally, column experiments were conducted to determine the metal leaching from soils at varying amendments of biochar from straw, biogas residue fiber and WWTP sludge.

[P025] Combining biodegradation simulation tests with HRMS analysis for the persistence assessment of chemicals discharged in river water

Keywords: *Persistence assessment, HRMS analysis, WWTP discharge*

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Persistence is one of the most problematic properties of a contaminant entering aquatic environments. However, data on chemical persistence from standardized tests is scarce. There are many pathways for chemicals to enter surface waters and one of the most significant is discharge from WWTPs. The total number and type of persistent compounds in these complex mixtures is generally unknown and methods to assess these are needed. A novel persistence-directed testing approach is here presented where biodegradation simulation tests are conducted by diluting a whole discharge sample in an environmental water sample containing degrading microorganisms. Test systems are incubated for 60 days and analyzed by chromatographic methods. By comparing the peak area ratios between the biotic test system and the abiotic control, persistent features can be singled out. In this way, even unidentified chromatographic features occurring in an effluent can be categorized as persistent. Chemical analysis performed by high resolution mass spectrometry, allows a combination of target-, suspect-, and non-target screening. Environmentally relevant persistent features can then be prioritized during structure elucidation efforts. This will now be applied to find persistent chemicals in WWTP discharges, which however requires method adaptation. The poster will address (1) the need for sample preparation and conservation prior to analysis, (2) the optimal combination of analytical methods for covering the chemical space of organic pollutants in WWTP discharges, (3) how the approach can inform regulation of persistent chemicals in case of high-confidence identification and (4) how the approach can enhance mechanistic understanding of structural characteristics that drive persistence. The poster will present the current state of development and invites discussion. This is a modification of a poster previously presented at SETAC 2026 in Maastricht.

[P026] Reduced leaching of PFAS and Polar Organics from Biochar: The combined effect of pyrolytic removal and increased sorption

Keywords: Biochar, polar organics, PFAS, NTS, leaching

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The Danish Government has placed a strong focus on pyrolysis as part of the national green transition, due to its potential and increasing applications within circular economy, carbon sequestration, soil improvement, and contaminant removal. Sewage sludge (SS) from wastewater treatment plants (WWTPs) and biogas residue fiber (BRF) offer high nutrient content that makes biochars (BC) from these feedstocks strong candidates as fertilizers. However, the presence of pollutants in the feedstock or formation during pyrolysis, has raised concerns about biochar being used as fertilizer.

The main aim of the present work was to study the combined effect of (1) pyrolytic removal and (2) increased sorption, on the release of PFAS and polar organic contaminants from biochar.

Dewatered SS and BRF were used as feedstock, with carefully matched samples of feedstock and BC obtained from different full-scale pyrolysis plants in Denmark. Equilibrium batch tests with feedstock and corresponding BC suspended in water were conducted, followed by up-flow column percolation tests with BC and soil mixtures. Aqueous concentrations from both experiments were measured across a broad range of polar organics including PFAS, utilizing advanced analytical techniques as LC-HRMS. To comprehensively assess the impact of pyrolytic conversion on various pollutants, non-target screening (NTS) and suspect screening was conducted in addition to targeted PFAS analysis.

The results showed that pyrolytic conversion resulted in substantial reductions of release and leaching of polar organic compounds. NTS of equilibrated water from batch tests showed fewer features and lower peak areas of polar contaminants released from BC compared to feedstock. Column tests showed that PFAS concentrations in leachates from BC amended soils and pure BC columns were generally lower than for non-amended soils. The results confirm the potential of pyrolysis to lower the environmental risk of organic contaminant spread.

[P027] Analytical method evaluation for trace detection of peptide biopesticides in environmental matrices

Keywords: *biopesticides, method-matrix evaluation, Environmental fate*

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Peptide biopesticides are an emerging class of crop protection products with potential for effective pest control and reduced environmental footprint. However, their environmental fate remains poorly understood, particularly regarding degradation, sorption and bioavailability, and persistence in complex matrices.

Using Melittin (bee venom) as a model peptide, we compare analytical methods including SDS-PAGE, NMR spectroscopy, LC-qTOF-MS, LC-Orbitrap-MS/MS, Dot blot, and Biolayer Interferometry (BLI). Methods are evaluated for limits of detection (LoD) and applicability to environmental samples under broadly applicable, non-peptide-specific conditions. Particular emphasis is placed on antibody-based detection.

Preliminary results indicate that BLI provides high sensitivity for intact peptide detection and may enable lower detection limits than several conventional approaches tested under comparable conditions.

A complementary ¹³C-labelled peptide strategy is being developed to resolve degradation pathways. Mass spectrometry will track labelled peptide, degradation products, and potential microbial reuse of ¹³C-labelled amino acids, while cavity ring-down spectroscopy will quantify complete mineralisation to ¹³CO₂ and, under anaerobic conditions, ¹³CH₄.

Adsorption and desorption kinetics will also be characterised because sorption affects extraction efficiency, environmental availability to target pests and microorganisms, and persistence. Integrating sensitive antibody-based detection, isotope tracing, and sorption kinetics provides a framework for resolving the environmental fate of peptide biopesticides and supporting environmental risk assessment.

[P028] Metals and PFAS in Smålandsfarvandet south of Zealand

Keywords: *Heavy metals, PFAS, passive samplers*

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The area around Great Belt and Smålandsfarvandet south of Zealand has been sampled from December 2023 to June 2025 for metals and PFAS, using both water samples and passive DGT samplers, both in the marine environment and in rivers. The objective was to give spatial and seasonal background values for a hydrodynamic model of the pollution sources and transport ways for the NewSea project (<https://projects.au.dk/newsea/>) and investigate potential for new monitoring approaches.

Spatial and seasonal data for selected metals and PFAS are presented, and potential sources of pollution discussed, for PFAS particularly the hotspot for PFAS research at Korsør Nor firefighting training school. Comparison of the measured water concentration with the time-integrated passive samplers are shown, and the possibilities of passive samplers use in monitoring in connection with the Water Framework Directive are discussed, particularly as an alternative to biota monitoring where it has been shown difficult to catch fish or collect mussels due to e.g. pronounced oxygen depletion events.

[P029] Soil Amendment with Sewage Sludge: Fate and Microbial Effects of Quaternary Ammonium Biocides

Keywords: Quaternary ammonium compounds, QACs, quats, benzalkonium compounds, 16S rRNA metabarcoding

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Quaternary ammonium compounds (QACs) are high production volume cationic surfactants and biocides entering wastewater treatment plants after application in healthcare, consumer products or industry. As QACs sorb strongly to sewage sludge with concentrations up to 10² mg/kg, they can enter agricultural soils in high amounts via sludge application as organic fertilizer. However, little is known about the fate and effects of sludge-borne QACs in soil ecosystems. QACs are aerobically degradable but strong adsorption to organic matter and clay may lead to incomplete degradation and persistence in soil. Moreover, as QACs are broad-spectrum antimicrobials, exposure may negatively impact the diversity and function of the soil microbiome.

This study investigated the dissipation kinetics, metabolic transformation and microbial community effects of structurally diverse QACs in controlled lab-scale soil microcosm experiments. QAC parent compounds were quantified by UPLC-MS/MS, metabolites elucidated by UPLC-qTOF, and effects on soil microbial communities investigated by 16S rRNA gene metabarcoding.

While metabolomics confirmed formation of QAC transformation products in soil, only limited parent compound dissipation was observed after 60-day incubation, indicating potential for persistence. QACs altered bacterial richness, evenness, and β -diversity in a dose-dependent manner at exposure concentrations between 0.001-100 mg/kg. Overall, bacterial communities were restructured towards more stress-adapted taxa. Benzalkonium compounds showed the clearest toxicity threshold around 0.01 mg/kg soil dry weight, corresponding to realistic soil concentrations after sludge application.

Sewage sludge application is a major emission pathway for QACs into agricultural soils. Our findings show that this may lead to long-term contamination, formation of unregulated breakdown products, and negative impacts on the diversity and function of soil microbial communities at realistic exposure levels.

[P030] A first step toward characterizing Danish groundwater microbiomes as a baseline in bioremediation studies

FLASH PRESENTATION • Treatment of contaminated water session

Keywords: *Groundwater, microbiology, metatranscriptomics*

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Bioremediation using specialized microorganisms is a promising strategy for removing environmental contaminants. For example, chlorinated ethenes, a group of groundwater contaminants, can be degraded by the microbial consortium KB-1. However, introducing these microorganisms and modifying environmental conditions may affect native microbial communities. To evaluate their ecological impact, baseline knowledge of natural groundwater microbiomes is needed. This project aims to characterize groundwater microbial communities across Denmark.

Groundwater samples were partly collected in collaboration with the Danish Agency for Green Land Use and Aquatic Environment (SGAV). In total, 21 wells in Zealand and Jutland during May and June 2026 were sampled. In general, three 1 L samples were collected, kept cool, filtered within 24 h, and filters were stored at –80°C. DNA and RNA were co-extracted from the filters using the Macherey-Nagel "RNA and DNA from Soil" protocol. RNA quantity and quality were assessed using Qubit and TapeStation, and DNA contamination was evaluated by qPCR before and after DNase treatment. Metatranscriptomic libraries were prepared using the xGen™ Broad-Range RNA Library Prep Kit on a subset of samples.

Preliminary results show that RNA can be recovered from 1 L groundwater samples despite low biomass. RNA concentrations were below Qubit detection limits but were detected by TapeStation. Libraries were successfully generated from RNA inputs below the manufacturer's recommended threshold.

This workflow enables RNA library generation from low-biomass groundwater. While 1 L seems sufficient, larger volumes may improve RNA yield. Once libraries are prepared for all samples, sequencing and community analyses will be conducted. This work represents a first step toward establishing a baseline for Danish groundwater microbiomes. It will support future comparisons with contaminated and bioremediated sites.

[P031] Potential ecotoxicological effects of leachates from offshore wind turbine coating erosion

FLASH PRESENTATION • Plastics and Micro Plastics session

Keywords: coatings, leachates, green transition

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The expansion of offshore wind energy may introduce emerging pollutants into marine environments through erosion and maintenance of turbine blade coatings. Yet, the ecotoxicological significance of microplastic particles and chemical leachates released from leading-edge protection (LEP) systems remains poorly understood. Within the PREMISE project (PREventing Microplastics pollution in SEawater from offshore wind turbines), we investigated acute and sublethal effects of coating-derived particle leachates in the marine copepod *Acartia tonsa*, a key pelagic grazer.

In 48 h laboratory exposures, leachates from five LEP coatings and four repair-material mixtures comprising LEP, filler, and laminate were initially tested at 1 g L⁻¹. Acute toxicity was generally low. Concentration-response experiments with one LEP coating and one repair mixture covered concentrations from 1.5 mg L⁻¹ to 10 g L⁻¹. Mortality remained limited and increased mainly at the highest concentrations, indicating low acute sensitivity under short-term exposure. To detect more subtle effects, copepod behavior was quantified with an automated biomonitor following 72 h exposure to leachates from four repair materials at 1 g L⁻¹. Preliminary results indicate altered and more variable activity patterns relative to controls, although no consistent pattern was observed across materials.

Ongoing chemical characterization will identify leached compounds and support links between material composition and biological responses. Overall, the findings suggest low acute toxicity of coating-derived pollutants, while behavioral changes indicate that sublethal endpoints may reveal effects not captured by mortality. Integrating information on particle exposure, leached chemicals, and biological responses is important for assessing the potential environmental risks associated with offshore renewable-energy infrastructure and supporting environmentally informed material selection and management.

[P032] Are Danish mini-wetlands micropollutant sinks or buffering zones? Insights from a decade of operation

FLASH PRESENTATION • Treatment of contaminated water session

Keywords: *Agricultural micropollutants, Accumulation pattern, Treatment wetlands*

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Danish mini-wetlands (minivådområder) are the most widely implemented agricultural mitigation measure in Denmark, central to reducing national nitrogen emissions by 13,100 tonnes by 2027. While their nitrogen removal performance is relatively well-characterised, their long-term fate as receivers of agricultural micropollutants remains largely unknown. Within the EU Path4Med project, we present the first study examining micropollutant accumulation over a 10-year operational period in a Danish mini-wetland. A sediment transect campaign (August 2025) sampled sediment cores along the wetland flow path, from the inlet sedimentation basin through the vegetated woodchip subsurface bioreactor, capturing both surface and deeper layers to assess temporal and spatial accumulation patterns.

Using targeted LC-MS/MS, we characterised micropollutant occurrence and the horizontal and vertical accumulation pattern along the flow path. We quantified 80 micropollutants including pesticides and pharmaceuticals, as well as 15 metal species. Furthermore, using LC-HRMS, we will perform suspect screening across a library of over 1,000 compounds (pharmaceuticals, pesticides, and transformation products), intending to capture semi-quantitatively the compounds which are not present in the targeted method. Preliminary results reveal up to ten-fold higher micropollutant concentrations in woodchip reactor sediments compared to sediments (1000 – 0.04 µg/g dry weight) in 75% of the samples. We detected 24 micropollutants including 4 antibiotics, 7 biocides and 6 pharmaceuticals.

As Denmark races to promote additional mini-wetlands for nitrogen mitigation, these results urge a broader evaluation, one that accounts for long-term micropollutant fate, sediment toxicity, and the risk of trading one pollution problem for another.

[P033] Environmental fate and transformation of carbapenem antibiotics: implications for monitoring, water treatment and antimicrobial resistance

Keywords: *β-lactams, emerging contaminants, degradation products, LC–MS/MS, micropollutants*

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Carbapenem antibiotics are increasingly used as last-resort treatments, yet their environmental fate remains poorly understood. We investigated the stability and transformation of selected carbapenems in aqueous systems, with particular focus on meropenem and its transformation products. Targeted LC-MS/MS and high-resolution mass spectrometry showed rapid loss of the parent compound under several conditions, while multiple transformation products retaining the β-lactam-related structural features persisted considerably longer. In parallel, aged meropenem mixtures were assessed for residual antibacterial effects to determine whether disappearance of the parent antibiotic corresponded to loss of biological activity. The results indicate that monitoring based only on parent compounds may underestimate the environmental relevance of carbapenem residues. Transformation products should therefore be considered when evaluating environmental persistence, treatment efficiency and potential contributions to antimicrobial resistance.

[P034] Influence of Water Matrix on the UVC and UV/H₂O₂ Degradation of Pharmaceutical Residues in Recirculating Aquaculture Systems

Keywords: *Recirculating aquaculture system (RAS), UV/H₂O₂, Pharmaceutical residues, Photolysis*

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Pharmaceutical residues in aquatic environments are an emerging issue due to their persistence and incomplete removal by conventional wastewater treatment. Recirculating aquaculture system (RAS) water is a complex matrix in which dissolved organic matter and inorganic constituents interfere with photochemical oxidation processes. This study focused on the degradation of caffeine, sulfamethoxazole, sulfapyridine, and flumequine (100 µg L⁻¹ each) under UVC irradiation (254 nm) alone and combined with H₂O₂ in ELGA and RAS wastewater. Experiments were carried out in a collimated-beam reactor (86 mL). The H₂O₂ concentrations tested in ELGA water were 5–50 mg L⁻¹ and in RAS water 3–20 mg L⁻¹. Degradation profiles were expressed as a function of UV fluence rather than irradiation time to allow direct comparison based on the UV energy delivered to the samples. The degradation of the contaminants was determined by high-performance liquid chromatography coupled with diode-array detection (HPLC-DAD). A fluence-based pseudo-first-order kinetic model was used to describe contaminant degradation. Numerical simulations of the degradation kinetics were performed to predict pharmaceutical removal incorporating direct photolysis based on molar absorption coefficients and quantum yields, as well as hydroxyl-radical reactions and scavenging effects to support the interpretation of the experimental results. Sulfamethoxazole and sulfapyridine exhibited the highest susceptibility to UVC photolysis, whereas caffeine and flumequine were more persistent. In ELGA water a fast degradation was observed, however the presence of higher dissolved organic carbon and inorganic substances in RAS water decreased the efficacy of the degradation by causing the scavenging of hydroxyl-radicals. These results confirm that the performance of UV/H₂O₂ is influenced by both the intrinsic photochemical properties of the contaminants and the water matrix.

[P035] Integrated Monitoring and Biological Treatment of Pesticide-Contaminated Groundwater

Keywords: *pesticide-contaminated groundwater, chlorophenoxy pesticides, passive sampling, biological treatment, MBBR*

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Groundwater contamination by pesticides and their transformation products remains a challenge at sites affected by historical industrial activities. This study investigates sustainable approaches for monitoring and treating contaminated groundwater by combining time-integrative chemical monitoring with biologically driven remediation. The work focuses on chlorophenoxy acid pesticides, including mecoprop and dichlorprop, and their transformation products, at the Stengården landfill in Denmark.

A pilot-scale treatment system based on Moving Bed Biofilm Reactors (MBBR) and biofilters was operated under realistic field conditions to evaluate contaminant removal and factors controlling biological transformation. In parallel, ceramic passive samplers were calibrated and applied to obtain time-integrated measurements of chlorophenoxy compounds, complementing conventional grab sampling. The samplers showed effective time-dependent accumulation for several target compounds and enabled monitoring of concentration changes across the treatment process.

The biological treatment achieved high average removal of the parent pesticides (approximately 85%) and moderate removal of their metabolites (approximately 60%). Performance was influenced by dissolved oxygen, temperature and hydraulic retention time.

By integrating innovative passive sampling with low-energy biological treatment, this study aims to improve both the assessment and remediation of pesticide-contaminated groundwater. The project contributes to scalable and sustainable strategies for managing complex contamination under realistic environmental conditions.

[P036] Phytoremediation of Heavy Metal–Contaminated Urban Sediments: Evaluating the Potential of Lavender (*Lavandula angustifolia* Mill.)

Keywords: Accumulation, Cadmium, Lavender, Lead, Phytoremediation

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Elevated concentrations of heavy metals and metalloids in urban sediments pose a severe environmental threat. To mitigate these risks, gentle remediation options (GRO) such as phytoremediation using non-edible plant species offer an eco-friendly and highly effective management strategy. The aim of this study was to assess the heavy metal and metalloid uptake in lavender (*Lavandula angustifolia* cv. Hidcote Blue) and bioconcentration factor (BCF) from the contaminated urban sediment (Malmfjärden Bay, Kalmar, Sweden) and its potential use in GRO management. In this pilot study, *L. angustifolia* was cultivated in control (0) soil and combined growth substrate (sediment + soil) for eight weeks. The heavy metal and metalloid concentrations in both *L. angustifolia* and the sediment were measured using inductively coupled plasma mass spectrometry (ICP-MS). Our result shows both roots and shoots accumulated higher levels of Cd and Zn from the growth substrate compared to the control and their BCF values > 1. The results from this pilot study suggest that *L. angustifolia* could accumulate heavy metals from contaminated sediment and could be a strong potential candidate for GRO-based urban management. However, long-term cultivation and thorough biotic and abiotic evaluation are needed before field applications.

[P037] What is the difference between blocking enzyme activity with a chemical versus silencing its transcription with double-stranded RNA?

Keywords: *dsRNA, insecticide, bioassay*

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When regulators are confronted with the possibility of using double-stranded RNA (dsRNA) as an insecticide, they ask: How fast is the response in non-target organisms? Are our OECD (Organisation for Economic Co-operation and Development) bioassay designs long enough to capture their full effect? These are some of the questions we investigate in ENSAFE (The Environmental Safety of biotechnological plant protection products based on RNA and peptide technologies). While most conventional insecticides affect the nervous system and development, effective RNAi targets are related to basic cellular functions, such as proteasome-mediated protein degradation. However, some classic insecticide targets, such as acetyl-CoA carboxylase (ACCase), are also effective RNAi targets. The enzyme ACCase plays a role in fatty acid synthesis, and it is targeted by the group of insecticides of tetrone and tetrone acid derivatives (group 23 IRAC), such as spirotetramat. We are comparing the dose and time-course effects of the chemical insecticide spirotetramat with a dsRNA targeting the expression of the enzyme in three insect species with distinct feeding habits and ecological functions: coleopterans *Phaedon cochleariae* and *Adalia bipunctata*, and hemipteran pest *Myzus persicae*. We observed that:

1. Spirotetramat is a slow-acting insecticide, but the dsRNA acts more slowly, with effects showing up to two weeks after exposure;
2. Lethality often occurs in relation to moulting when exposing young life stages that strongly depend on the synthesis of new enzymes;
3. Exposing *A. bipunctata* to a dsRNA targeting the expression of an essential gene in *P. cochleariae* did not lead to adverse effects.

Preliminary results show that conventional bioassays might not be sufficient to cover the effects of slow-acting insecticides, such as spirotetramat and dsRNA. Therefore, our proposal to answer regulatory-raised questions is to span the lifecycle of non-target species, including early life stages.

[P038] Marine threshold values for microplastic litter

Keywords: *Microplastics, micro-litter, marine environment, threshold values, AI agents*

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Microplastics constitute a major marine pollution challenge. The European Marine Strategy Framework Directive (MSFD) is a key European regulation to help address marine pollution, requiring under its descriptor 10 that “*Properties and quantities of marine litter do not cause harm to the coastal and marine environment*”. Under descriptor 10, Member States are obliged to set threshold values for different categories of litter, including micro-litter. So far, few threshold values have been set, especially for micro-litter. In this study, we investigate how marine threshold values can be set for micro-litter in marine compartments, focusing on polymeric materials (microplastic litter). We critically evaluated six different threshold value methods (proposed by the MSFD Technical Group on Marine Litter) according to their suitability for application to microplastic litter, including the availability of the data needed to apply the methods. We created AI agents using Visual Studio Code, Claude Chat and Google Gemini to help process the large data sets reported in scientific articles and elsewhere that are needed to derive the threshold values. Preliminary results indicate that AI agents can be used to derive threshold values according to the established regulatory procedures, extract information and data and evaluate the reliability and relevance of this data. However, limited data still hampers the use of the “*Point-of-no return*”/“*Tipping Points*” method as well as setting toxicological-based threshold values for especially secondary microplastics. It might be possible to establish threshold values using the so-called “*Cut-off value*” method, which defines societally tolerable levels without relying on quantitative information on harm and impact. Elements from the so-called “*Lowest endpoint*” method may also be useful, while we also propose that threshold value methods are generally applied in accordance with the precautionary approach and non-deterioration concept.

[P039] The copper that arrives, not the copper you measure: an EDTA-free macrophyte copper SSD and the interfacial dose

Keywords: *copper, species sensitivity distribution, bioavailability, free-ion activity model, aquatic macrophytes*

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Copper toxicity is regulated on a bioavailability basis: the free cupric ion, not total dissolved copper, is taken as the dose, an idea operationalized for regulation by the gill-parameterized biotic ligand model. Vascular macrophytes have no gill; they take up copper across a thick, charged cell wall. The tension surfaces in the standard Lemna medium, where EDTA drives the equilibrium free cupric ion to near zero yet growth is still inhibited, pointing to a dose set at the frond surface, not in the bulk.

To separate this interfacial chemistry from the sensitivity ranking, we re-tested the three floating Lemnaceae without EDTA, in a buffered (MES) medium, and fused them with six submerged species into one macrophyte copper species sensitivity distribution (SSD): nine species, all three-parameter log-logistic on a yield endpoint. With every species now on a common EDTA-free basis, the three functional groups (floating, submerged-free, submerged-rooted) fall in a single distribution with no life-form offset detected. The model-averaged HC5 is 15.39 $\mu\text{g Cu/L}$ on the nominal axis and 2.27 $\mu\text{g Cu}^{2+}/\text{L}$ on the free-ion (mechanism) axis.

Removing EDTA fixes the ranking but not the mechanism: what concentrates copper at the surface when the bulk free ion is low stays open, with electrostatic (Donnan) accumulation in the charged wall a leading candidate alongside reaction-layer resupply and geometry. Two floating species, *Spirodela polyrhiza* and *Wolffia arrhiza*, grew slowly in the EDTA-free medium and are reported with a stated limitation that biases them toward tolerance; dropping either shifts the HC5 by under ten percent, within its bootstrap interval.

For macrophytes, the bioavailable dose is the copper that reaches the surface, not what an equilibrium model reports for the bulk. A single EDTA-free SSD, paired with a free-ion scenario, gives both a usable benchmark and a platform to test which interfacial process sets the dose.

[P040] Spatially-Resolved Electrochemical Oxidation of Organic Micropollutants in Sewage Sludge

Keywords: *Electrochemical advanced oxidation processes (EAOPs), Sludge treatment, Emerging contaminants, MMO electrode, UHPLC-MS/MS*

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The proper management of sewage sludge generated in Wastewater Treatment Plants represents a significant environmental challenge, especially due to the presence of Organic Micropollutants (OMPs) that persist even after dewatering processes such as Sludge Treatment Reed Beds. The final disposal of this sludge in soils or landfills can result in the leaching of these contaminants, demanding complementary technologies for their remediation. This study evaluates bench-scale electrochemical oxidation reactors (≈ 20 L) for OMP removal from sludge. Two electrochemical reactors (R1 and R2) and two controls (without current) were set up. Each reactor contained one stainless steel cathode (AISI 316, 100×100 mm) and two MMO-coated titanium mesh anodes ($\text{IrO}_2\text{-RuO}_2$, 101.6×63.5 mm), with a 5 cm inter-electrode gap. Operation ran at 1 A target current and variable voltage over 10 days, with sampling on days 0, 3, 7, and 10. In R1, an Ag/AgCl reference electrode and five stainless steel electric potential sensors were installed. Oxidation-reduction potentials (ORP) were measured at the top and bottom of the reactor to assess redox gradients. Stratified sampling evaluated degradation near anodes, cathode, top, bottom, and composite samples after homogenization. For quantification, sample preparation included lyophilization (48 h) and sequential ultrasonic extraction with methanol, methanol:water, and water (all with 0.2% formic acid). OMPs were quantified via UHPLC-MS/MS (Shimadzu Nexera, BEH Shield RP18 column, Sciex 7500, ESI+). Preliminary results, to be presented for the first time in the conference, are expected to show significant OMP removal in the electrochemical oxidation reactors versus controls, alongside spatial variations in degradation efficiency related to electrode proximity and redox conditions. This study contributes to assessing electrochemical oxidation as a feasible treatment for sewage sludge, aiming to OMP contaminant loads and enable safer final disposal.

[P041] Micro- and nanoplastic analysis: analytical challenges, stakeholder needs and future recommendations

Keywords: *policy, best-practices, analytical chemistry*

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Plastics, particularly micro- and nanoplastics (MNPs), are recognized as pervasive environmental contaminants with potentially adverse effects for ecosystems and human health. However, meaningful exposure assessment, risk evaluation, and policy development depend on analytical methods that produce accurate, reproducible, and comparable data across complex matrices. Major challenges include analytical validation and standardization, poor interstudy comparability, contamination control issues, and the lack of methods capable of isolating, characterizing and accurately measuring MNPs across relevant size ranges and in complex matrices. These challenges affect many stakeholders, including toxicologists and risk assessors, regulators and policymakers, environmental monitoring authorities, wastewater treatment plant operators, commercial laboratory scientists, academic researchers, environmental non-governmental organizations and public health organizations. Each group requires MNP data for different purposes and at different levels of analytical detail. Toxicologists need precise physicochemical characterization, while regulators need standardized data for policy development.

Another major limitation in current research is the gap between laboratory experiments and environmental reality. Many studies rely on artificially produced particles with uniform size and idealized shapes that do not reflect the heterogeneous and irregular particles generated by real-world degradation, and are often tested at concentrations far above environmental levels. To advance the MNP field, priority should be given to developing a comprehensive library of well-characterized reference materials, standardized analytical methods, improved high-throughput approaches, and open-access databases with standardized metadata reporting. Coordinated efforts are essential to improve data quality, strengthen interstudy comparability, and support evidence-based environmental and public health decisions.

[P042] Spatial Mapping of Benzalkonium Biotransformation Pathways in Wastewater Biofilms

FLASH PRESENTATION • Treatment of contaminated water session

Keywords: *Imaging, Mass spectrometry, biofilms, Biotransformation*

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Micropollutant biotransformation within biofilms is spatially structured, but the organization of transformation networks remains poorly resolved. Here we used mass spectrometry imaging (MSI) to map one benzalkonium congener with a dodecyl group (BAC12) and its 15 transformation products in wastewater biofilms at 20 μm resolution. Transformation products showed pathway-associated spatial distributions encompassing ω -oxidation, secondary oxidation, and odd- and even-carbon chain-shortening products. Trapped ion mobility further resolved two hydroxy isomers with distinct spatial distributions, revealing chemical heterogeneity inaccessible to conventional MSI. Endogenous lipid imaging identified distinct ceramide-, sphingomyelin- and triacylglycerol-associated microdomains, while infrared imaging verified the presence of proteins, polysaccharides, lipids and calcium carbonate constituents of the biofilms and revealed modest differences in protein–polysaccharide organization between blank and BAC12-exposed biofilms. Together, these data extend spatial mapping of BAC biotransformation beyond initial oxidation steps and show that downstream transformation products are organized into distinct chemical microdomains, providing a framework for spatially informed analysis and optimization of micropollutant removal in biofilm reactors.

[P043] Micropollutant and Phosphorus Removal Using Pile Cloth Media Filtration and Powder Activated Carbon: Process Performance and Design Considerations

FLASH PRESENTATION • NonTarget Screening session

Keywords: *Pile Cloth Media Filtration, Micropollutant removal, Non-target analysis*

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The Pile Cloth Media Filtration (PCMF) demonstration pilot at the Avedøre Wastewater Treatment Plant (WWTP) in Copenhagen achieved high-quality effluent suitable for discharge into sensitive receiving waters. This study evaluated a PCMF pilot system combining a coagulant (0 to 6 mg/L) with powdered activated carbon (PAC at 15 mg/L) for advanced municipal wastewater effluent polishing.

An average removal efficiency of 84.2% for six key indicator micropollutants – exceeding the 80% regulatory requirement – was achieved with PAC dosing alone in the pilot. Upon coagulant addition, phosphorus reduction was achieved, lowering total phosphorus levels below 0.2 mg/L.

Non-target analysis (NTA) of micropollutants via liquid chromatography-high-resolution mass spectrometry (LC-HRMS) screened >800 features, highlighting enhanced removal across persistent pharmaceuticals besides the ones targeted by the directive, with no evidence of filter media leaching. However, micropollutant removal efficiency dropped with coagulant dosing. Process optimization revealed that PAC must be dosed prior to the coagulant to prevent adsorption site blockage.

Additionally, future evaluations should assess total plant removal efficiency from the WWTP inlet to the pilot outlet to better align with upcoming EU regulatory frameworks.

[P044] Endocrine disruptive potential of Quaternary ammonium compounds *in vitro*

FLASH PRESENTATION • Ecotoxicology session

Keywords: QAC, Endocrine Disruption, *In vitro*

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Quaternary ammonium compounds (QACs) comprise a group of industrial chemicals commonly used as antimicrobials, surfactants, preservatives, and more. During the SARS-COVID pandemic, the use of QACs increased, which was directly measurable in blood samples of USA citizens, where detection frequencies and concentrations increased with increased use. Besides association between use and adult human exposure, there is evidence suggesting that fetuses and neonates are also exposed. This is particularly concerning, since limited existing data point to potential reproductive toxicity through endocrine disruption. Yet, very limited mechanistic data are available.

To address this data gap, we tested 16 QACs belonging to different sub-groups (BACs, ATMACs, DADMACs, APYrCs, and others) for their endocrine disruptive potential across five *in vitro* assays. Three reporter gene assays for the human androgen, estrogen and retinoic acid receptors were used, in concert with the H295R steroidogenesis assay, in which effects on steroid hormone production can be examined. Steroid hormones were measured in the H295R culture medium by LC-MS/MS. Finally, an ANSA-TTR displacement assay was used.

Several QACs induced estrogen receptor activity. Four QACs showed marked efficacious effects with potencies in the μM range. A more generic effect profile was observed in the H295R steroidogenesis assay, where most QACs decreased steroid hormone production, including progestogens, corticoids, and androgens. One QAC displaced ANSA from the TTR, whereas none affected androgen or retinoic acid receptor activities.

Collectively, our data show that QACs can affect endocrine-relevant targets and thus further studies should be performed to inform on potential reproductive toxicity of QACs to safeguard humans in future.

[P045] Intervention against PFAS exposure of office workers in chrome plating companies

Keywords: PFAS, chrome plating, biomonitoring, intervention, systematic observations

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PFAS (in particular PFOS) have been used as additive to reduce evaporation of carcinogenic Cr-6 from chrome plating baths. PFAS addition to the chrome baths was discontinued 5-10 years ago, but is likely still present, as only the top layer of the liquid in the chrome baths is routinely renewed. Thus, the chrome baths are likely sources of continuous PFAS exposure. Inhalation exposure and skin contact with chrome plating liquid are likely PFAS exposure routes for the chrome platers. In addition, exposure may occur through skin contact with contaminated surfaces and hand-to-mouth exposure. In a previous biomonitoring study (SAM-Krom), we showed that both chrome platers and office workers in chrome plating companies have very high plasma levels of PFOS.

The aim of this ongoing PFAS intervention study (2026-2027) is to reduce the high and involuntary PFAS exposure of office workers at Danish chrome plating companies.

Following recruitment of Danish chrome plating companies for this study, the specific aims are:

- 1) To identify possible PFAS exposure pathways for office workers at chrome plating companies by combining systematic observations of work routines and PFAS analyses of wipes, air samples and source samples
- 2) To identify mitigation strategies (as intervention) based on observed work routines and the proposed exposure routes
- 3) To monitor and evaluate the effects of the intervention by assessing PFAS in wipes and air samples after the intervention.
- 4) Analyse spot waste water samples to assess potential sources of environmental PFAS exposure

The plasma levels of PFOS in the chrome platers and office workers are among the highest found in Denmark to date. The project will provide new scientific knowledge on a newly identified PFAS exposure hotspot. The project will provide and test mitigation strategies for the involuntary PFAS exposure of office workers using knowledge transfer and exchange strategies.

The study is financed by the Danish PFAS Centre.

[P046] To which extent can azoxystrobin affect the uptake and elimination of copper in *Daphnia magna*?

Keywords: Ecotoxicology, metals, kinetics, organic micropollutants

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Copper (Cu) is an essential metal for living organisms. Through active uptake and elimination, organisms regulate internal metal concentrations to maintain homeostasis and prevent toxicity. Although metal uptake and elimination kinetics have been extensively studied in aquatic organisms, the influence of organic micropollutants (OMPs) on metal kinetics is poorly understood. Using the stable isotope ⁶⁵Cu, we investigated whether and to what extent the fungicide azoxystrobin affects Cu uptake and elimination kinetics in *D. magna*. Both Cu and azoxystrobin are commonly used fungicides and are often detected together in vineyard or orchard run-off. Uptake and elimination were studied over 72 h, with a 48 h uptake phase and a 24 h depuration phase. Kinetic modelling was performed using the standard one-compartment model. The presence of azoxystrobin significantly increased Cu uptake. A mechanistic explanation for the observed elevated Cu uptake is currently unknown. However, we hypothesise that azoxystrobin may increase membrane permeability, thereby facilitating Cu uptake. During elimination of previously accumulated Cu, organisms reexposed to Cu and Cu–azoxystrobin retained significantly less Cu than those kept under control conditions or those exposed to azoxystrobin alone. This indicates that azoxystrobin alone does not influence Cu elimination; rather, the presence of Cu during the elimination phase does. This suggests that *k_e* of Cu is not independent of exposure concentration of Cu. To the best of our knowledge, this study is among the first investigating the effects of an organic substance on metal kinetics. Further mechanistic research is needed to explain the elevated Cu uptake in the presence of azoxystrobin. These findings suggest that OMPs can alter metal toxicokinetics and should be investigated further for different metal-OMP mixtures given their high environmental relevance.

[P047] Comparison of solar and vacuum UV-based advanced oxidation processes for degradation and toxicity mitigation of benzalkonium chloride

FLASH PRESENTATION • Ecotoxicology session

Keywords: Quaternary ammonium compounds, Benzalkonium chloride, Advanced oxidation processes, Photochemical degradation, Aquatic toxicity

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Benzalkonium chloride (BAC) is a widely used quaternary ammonium biocide that is increasingly detected in aquatic environments due to its use in disinfection and sanitation products.

This study evaluated BAC degradation and toxicity attenuation in drinking water (DW) and simulated aquaculture water (SAW) using advanced oxidation processes (AOPs) driven by monochromatic vacuum UV (VUV, 172 nm), combined VUV/UVC irradiation (185 and 254 nm) or solar irradiation. Some irradiation regimes were also coupled with photo-Fenton, peroxymonosulfate (PMS), peroxydisulfate (PDS), and hydrogen peroxide-based treatments.

90% degradation of an initial BAC concentration of 10 mg L⁻¹ was achieved with solar photo-Fenton, monochromatic VUV/H₂O₂ and combined VUV/UVC-PMS at an irradiation dose (fluence) of 0.055 kJ L⁻¹, 0.11 kJ L⁻¹, and 1.18 kJ L⁻¹, respectively.

The ability of the AOP processes to mitigate toxicity was assessed using growth inhibition assays with the yeast *Saccharomyces cerevisiae* and the microalga *Raphidocelis subcapitata*.

The initial EC₅₀ of the contaminated water before treatment was below 1 mg L⁻¹ and the apparent EC₅₀ increased 5-250-fold after treatment with EC₅₀ values of 5.1 mg L⁻¹, 12.4 mg L⁻¹ and 251 mg L⁻¹ after monochromatic VUV with PMS, solar photo-Fenton, and combined VUV/UVC-PMS, respectively.

Combined VUV/UVC-PMS and solar photo-Fenton provided the greatest toxicity mitigation in relation to energy input (kJ L⁻¹). However, the solar photo-Fenton process required more challenging operating conditions and the addition of more chemical reagents.

Overall, VUV-based technologies and solar photo-Fenton were highly effective for both BAC degradation and toxicity attenuation, highlighting their potential for treatment of BAC-contaminated water.

[P048] Bioplastic and conventional plastic products: Chemical release and ecotoxicity

Keywords: Biodegradable plastics, plastic leachates, chemical mixtures, non-target analysis, aquatic toxicity

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Bioplastics are increasingly promoted as more sustainable alternatives to conventional plastics, yet their environmental effects remain uncertain, particularly regarding the release of chemical constituents. This study compared the chemical profiles and ecotoxicity of leachates from commercial bioplastic and conventional plastic products.

Methanol-based extracts and water-based leachates were analyzed for inorganic elements using ICP-MS and ICP-OES, and for small organic compounds using non-target high-resolution LC-MS. Ecotoxicity of water-based leachates was assessed using the marine bacterium *Aliivibrio fischeri*, the freshwater algae *Raphidocelis subcapitata*, and the freshwater crustacean *Daphnia magna*.

Leachates from biodegradable bioplastics showed greater chemical diversity and, in some cases, higher metal concentrations than those from conventional plastics. These leachates also caused greater bacterial and algal inhibition, with one product causing up to 80 % algal growth inhibition. In contrast, leachates from a non-biodegradable bioplastic showed low chemical complexity but similarly strong ecotoxic effects. Conventional plastic leachates showed both low chemical complexity and low ecotoxicity. The leachates caused limited effects in *D. magna* across all tested products.

The results demonstrate substantial differences in chemical profiles and ecotoxicity among leachates from the tested products. High chemical complexity and ecotoxicity co-occurred in biodegradable bioplastics, but low chemical complexity did not necessarily indicate low ecotoxicity, as observed for the non-biodegradable bioplastic. These findings show that bioplastics do not always offer greater environmental safety than conventional plastics and highlight the importance of product-specific assessment.

[P049] The influence of azoxystrobin on copper partitioning into water, sediment, and aquatic plants in a freshwater mesocosm study

Keywords: *Mesocosm, chemical mixtures, macrophytes, freshwater, metal partitioning*

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Metals frequently co-occur in surface waters with various organic substances such as pesticides released from agricultural production. Yet the effects of pesticides on metal fate and bioaccumulation under environmentally realistic conditions remain understudied. This study investigated the fate of copper in freshwater mesocosms containing the submerged macrophytes *Elodea nuttallii* and *Myriophyllum spicatum*, and how it was influenced by co-exposure to azoxystrobin. Mesocosms were exposed to copper (0.609 μM) and azoxystrobin (0.102 μM) individually and in combination (mixture 1: 0.609 + 0.102 μM , mixture 0.5: 0.144 + 0.0511 μM , respectively) during two pulse applications over 64 days. Following exposure, copper rapidly dissipated from the water column (half-lives: 15-23 d) and partitioned into the sediment. Both macrophyte species accumulated copper above background concentrations, but uptake and translocation patterns differed between species and changed over time, reflecting species-specific uptake and allocation. Copper dissipation from the water phase, uptake, and elimination kinetics were generally similar between copper-only and mixture treatments, indicating limited effects of co-exposure to azoxystrobin. Under these experimental conditions, azoxystrobin did not measurably alter copper fate or accumulation, highlighting the importance of ecological realism in freshwater mixture risk assessment.

[P050] Plant species selection for enhanced microbial removal in constructed wetlands: implications for antimicrobial resistance control

Keywords: *Constructed wetlands, macrophytes, pathogen removal, antimicrobial resistance*

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Microbiological contamination and the environmental spread of antimicrobial resistance genes (ARG) set a growing challenge to sustainable water management and the protection of public health due to the presence of pathogenic microorganisms in wastewater and the increase in resistance associated with the excessive and inappropriate use of antibiotics. In this context, constructed wetlands (CW) offer a nature-based solution with high potential for decentralized wastewater treatment, thanks to their low energy requirements, ecological benefits, and ability to remove both conventional and emerging contaminants. However, optimizing their performance requires identifying plant species that promote the physical, chemical, and microbiological processes responsible for the removal of pathogenic microorganisms and ARG. To this end, a batch-type laboratory experiment was initially conducted under controlled conditions to evaluate the removal kinetics of total coliforms and *Escherichia coli* in domestic wastewater using *Equisetum bogotense*, *Heliconia psittacorum*, *Cyperus alternifolius*, and *Chrysopogon zizanioides*. The results showed that microorganism removal followed first-order kinetics and that *Cyperus alternifolius* and *Chrysopogon zizanioides* exhibited the highest removal constants and the shortest times required to achieve a 90 percent reduction in the initial concentration. Furthermore, maximum reductions of 1.30 logarithmic units were obtained for total coliforms and 2.18 logarithmic units for *Escherichia coli*, demonstrating that the selection of macrophytes is a fundamental criterion for optimizing the design of CW. The next stage of the study will investigate whether differences among plant species are associated with plant–microorganism interactions and the production of antimicrobial metabolites through root exudation, and whether these processes may contribute to pathogen removal and the attenuation of ARGs in CW treatment systems.

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