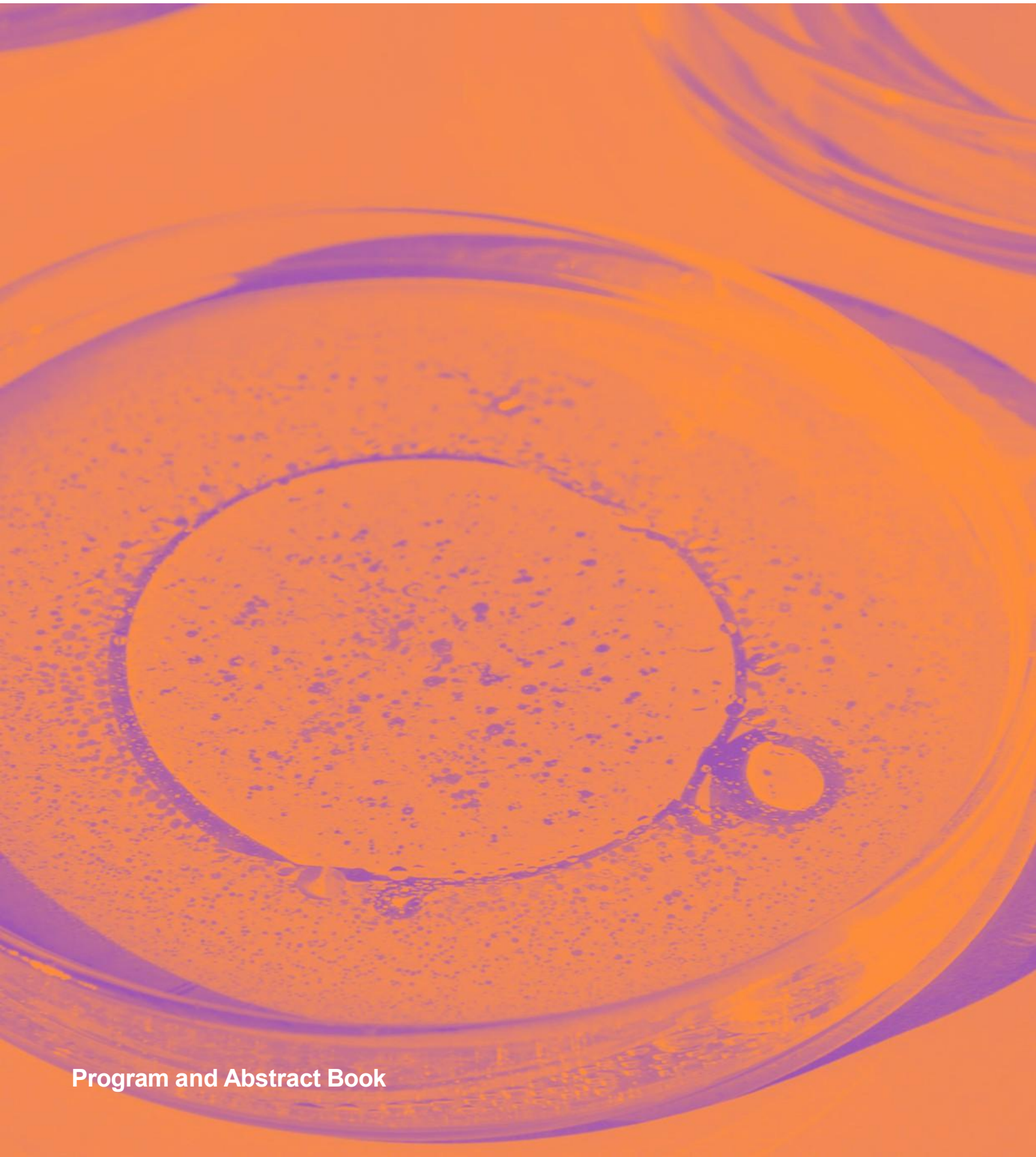
IOCTO 2025 Conference

The 2nd International Online Conference on Toxics

8–10 September 2025 | Online



Program and Abstract Book

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MDPI

The 2nd International Online Conference on Toxics

8–10 September 2025 | Online

MDPI

Organizing Committee

Event Chairs

Dr. Carlos Barata

Dr. Natalia Garcia-Reyero

Session Chairs

Dr. Carlos Barata
Dr. Virgínia Cruz Fernandes
Dr. Xiaojun Luo
Prof. Dr. Mingce Long

Prof. Dr. Youssef Sari

Event Committee

Dr. Alison K. Bauer
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Welcome from the Chairs

Dear colleagues,

On behalf of the MDPI journal *Toxics* (ISSN: 2305-6304; Impact Factor: 4.1) and its Scientific Committee, I am pleased to invite you to participate in the **2nd International Online Conference on Toxics**. This meeting will be held **online** from **8-10 September 2025**.

The aim of this platform is to bring together students, researchers, and scientists from around the world to present their work and exchange ideas on the exposure, effects, and risks regarding chemicals and materials in terms of humans and the natural environment, as well as on the development of new approaches to assess and/or manage the toxicological and ecotoxicological risks of chemicals and materials. The topics are organized into six sessions, corresponding to the following journal sections:

1. Exposure Pathways – Air and Water Contamination;
2. Molecular Stressors – Nanoparticles, Mixtures, and Persistent Pollutants;
3. Cutting-Edge Approaches in Pharmacology and Toxicology;
4. Pesticides, Pollutants, and Health Risk;
5. Exploring Non-Model Species for Ecotoxicology.

Submitted abstracts will be reviewed by the conference committee and, if accepted, authors can choose to submit proceedings papers or posters, potentially alongside a PowerPoint and/or video presentation of their work. All accepted abstracts will be published as one dedicated volume in the *Proceedings* journal (ISSN: 2504-3900).

The 2nd International Online Conference on Toxics offers you the opportunity to participate in this international, scholarly conference without having the concern or expenditure of travel fees. We would like to invite you to “attend” this conference by presenting your latest work. Abstracts (in English) should be submitted online before **13 June 2025**.

Kind regards,

Dr. Natalia Garcia-Reyero
Event Chair
Institute for Genomics, Biocomputing & Biotechnology, Mississippi State University, Starkville, USA

Dr. Carlos Barata
Event Chair
Institute of Environmental Assessment and Water Research (IDAEA-CSIC), Barcelona, Spain

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Toxics (ISSN 2305-6304) is an international, peer-reviewed, open access journal which provides an advanced forum for studies related to all aspects of toxic chemicals and materials. It publishes reviews, regular research papers, and short communications. Our aim is to encourage scientists to publish their experimental and theoretical results in detail. There is, therefore, no restriction on the maximum length of the papers, although authors should write their papers in a clear and concise way. The full experimental details must be provided so that the results can be reproduced. Electronic files or software regarding the full details of calculations and experimental procedure can be deposited as supplementary material, if it is not possible to publish them along with the text.

Impact Factor: 2 4.1 (2024); 5-Year Impact Factor: 4.6 (2024)

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Program Overview

	Day 1	Day 2	Day 3
Morning	**Session 1.** Exposure Pathways—Air and Water Contamination	**Session 2.** Molecular Stressors—Nanoparticles, Mixtures, and Persistent Pollutants	**Session 4.** Pesticides, Pollutants, and Health Risk
Afternoon	**Session 3.** Cutting-Edge Approaches in Pharmacology and Toxicology	**Session 5.** Exploring Non-Model Species for Ecotoxicology	**Session 4.** Pesticides, Pollutants, and Health Risk

IOCTO 2025 Program

8 September 2025 (Monday)

Session 1. Exposure Pathways—Air and Water Contamination

Time: 9:00 (CEST, Basel) | 03:00 (EST, New York) | 15:00 (CST Asia, Beijing)

CEST	Speaker	Title
09:00–09:10	**Dr. Carlos Barata** Co-Chair	Opening Speech
09:10–09:20	**Prof. Dr. Mingce Long** Session Chair	Welcome from the session chair
09:20–09:40	**Dr. Gongbo Chen** Invited Speaker	Global mortality burden of traffic-related PM2.5: Trends and Inequities
9:40-10:10	**Dr. Matthias Karl** Keynote Speaker	A Coastal Perspective on Air Quality Modelling
10:10-10:30	**Dr. Paolo Pastorino** Invited Speaker	High- Mountain Lakes: Sentinels of Global Change and Environmental Pollution
10:30-10:45	**Codau Natanael** Selected Oral Speaker	Plastic Particle Migration in Bottled Water: Emerging Health Risks Associated with Long-Term Storage
10:45-11:00	**Tiago Filipe da Silva Simões** Selected Oral Speaker	Ecological Implications of LC-PUFAs in Benthic Dinoflagellates: A Toxicological Perspective
11:00-11:15	**El Mahdi Redouane** Selected Oral Speaker	Microbiota Shifts in *Vicia faba* Exposed to Microcystin-Contaminated Water
11:15-11:30	**Wioleta Sowińska** Selected Oral Speaker	Research on the Presence of Selenium in the Bodies of Dogs and its Effect on Animals of this Species
11:30-11:45	**Abdullah Bin Firoz** Selected Oral Speaker	Abundance, Characterization and Risk Assessment of Microplastics of the Payra River, Bangladesh
11:45–14:00	**BREAK**	

Session 3. Cutting-Edge Approaches in Pharmacology and Toxicology

Time: 14:00 (CEST, Basel) | 08:00 (EST, New York) | 20:00 (CST Asia, Beijing)

CEST	Speaker	Title
14:00–14:10	**Dr. Natalia Garcia-Reyero** Event Chair	Opening Speech
14:10–14:20	**Prof. Dr. Youssef Sari** Session Chair	Welcome from the session chair
14:20–14:50	**Dr. Stephen Ferguson** Keynote Speaker	Microphysiological Systems to Understand and Predict Human Liver and Kidney Toxicity in Response to Drug, Botanical, and Environmental Exposures
14:50–15:20	**Dr. Lisa Truong** Keynote speaker	Novel Dual-Platform Approach: Integrating In Vitro and Zebrafish Models for Advanced Toxicological Assessment in Antiviral Drug Development
15:20–15:40	**Dr. William M. Gwinn** Invited Speaker	Application of In Vitro Lung Models to the Inhalation Toxicology of Volatile Compounds
15:40–16:00	**Dr. Maja Katalinić** Invited Speaker	Double-Edged Sword: Efficacy vs. Toxicity of Biologically Active Molecules
16:00-16:15	**Karolina Nowak** Selected Oral Speaker	The Determination of 2-Phenylethylamine Derivatives in MGG-Stained and Unstained Blood Smears: A Cutting-Edge Approach in Contemporary Toxicology
16:15-16:30	**Monica Torres-Ruiz** Selected Oral Speaker	Behavioral Biomarkers of Neurotoxicity: A High-Throughput Zebrafish Thigmotaxis Assay
16:30-16:45	**Tiago Rosado** Selected Oral Speaker	Epidemiological Profile of Poisonings Attended in Emergency Departments of Local Health Units in Interior Portugal in 2022
16:45-17:00	**Marta Moreno-Torres** Selected Oral Speaker	Impact of persistent organic pollutants and preexisting steatosis on drug hepatotoxicity in cultured human hepatocytes

9 September 2025 (Tuesday)

Session 2. Molecular Stressors—Nanoparticles, Mixtures, and Persistent Pollutants

Time: 9:00 (CEST, Basel) | 03:00 (EST, New York) | 15:00 (CST Asia, Beijing)

CEST	Speaker	Title
9:00–9:10	**Dr. Xiaojun Luo** Session Chair	Opening Speech
9:10-9:30	**Dr. Wenlong Li** Invited Speaker	Urinary Monitoring of Environmental Contaminants: A Review of Analytical Methods, Occurrence, Exposure Levels, and Risk Assessment
9:30-9:45	**Hideaki Sekine** Selected Oral Speaker	Hormetic Effect of Werner-type Metal Complex Formation on the Bioluminescence Intensity of Marine Luminescent Bacterium *Aliivibrio fischeri*
9:45-10:00	**Min Zhang** Selected Oral Speaker	Molecular Mechanisms of Foodborne Titanium Dioxide Nanoparticle-Induced Intestinal Toxicity: A Multi-Omics and Adverse Outcome Pathway Analysis
10:00-10:15	**Mojtaba Ehsanifar** Selected Oral Speaker	Exposure to Diesel Exhaust Nanoparticles: Depression-like Behavior Induced by Systemic Inflammation and Brain-Derived Neurotrophic Factors
10:15-10:30	**Manuela Piccardo** Selected Oral Speaker	Biochemical and Transcriptomic Effects of Polystyrene Nanoplastics in Juvenile *Amphiprion ocellaris*
10:30-10:45	**Anne Leung** Selected Oral Speaker	Methyl and Propyl Paraben Impact the Physiology of Daphnids
10:45-11:00	**Narimane Kebieche** Selected Oral Speaker	Scientific Validation of a Cortical Neurosphere Model for Developmental Neurotoxicity Assessment and Evaluation of Chronic PFAS Mixture Exposure
11:00-11:20	**Dr. Tianshu Wu** Invited Speaker	Mechanisms of Neurotoxicity and Health Risks Induced by Quantum Dot Nanoparticles
11:20-14:00	**BREAK**	

Session 5. Exploring Non-Model Species for Ecotoxicology

Time: 14:00 (CEST, Basel) | 08:00 (EST, New York) | 20:00 (CST Asia, Beijing)

CEST	Speaker	Title
14:00–14:10	**Dr. Carlos Barata** Session Chair	Welcome from the session chair
14:10–14:40	**Prof. Dr. Monia Renzi** Keynote Speaker	Expanding the Toolbox: The Role of Non-Standard Organisms in Ecotoxicological Research
14:40–15:10	**Dr. Susana Loureiro** Keynote Speaker	Insects at the Crossroads of Ecotoxicology and Bioindustry: Tools, Risks, and Sustainability Pathways
15:10–15:40	**Dr. Sara Novais** Keynote Speaker	Unseen Threats: The Hidden Impacts of Pollutants on Marine Megafauna
15:40–16:10	**Dr. Marco Parolini** Keynote Speaker	Birds as Sentinels of Environmental Pollution: Insights into Exposure and Effects of Emerging Contaminants
16:10–16:25	**Inês F. C. Morão** Selected Oral Speaker	Maternal Transfer of Persistent Organic Pollutants in Green Sea Turtles: Implications for Reproductive Success
16:25–16:40	**Telma Esteves** Selected Oral Speaker	Optimisation of Three-Dimensional Cultures of the RTL-W1 Liver Cell Line to Model Polycyclic Aromatic Hydrocarbon Effects on Liver Detoxification
16:40–16:55	**Itrat Zahra** Selected Oral Speaker	Comparative Proteomic Analysis of Cadmium Stress Response in a Newly Identified Paramecium Species Isolated from Industrial Wastewater

10 September 2025 (Wednesday)

Morning Session 4. Pesticides, Pollutants, and Health Risk [Full Day]

Time: 9:00 (CEST, Basel) | 03:00 (EST, New York) | 15:00 (CST Asia, Beijing)

CEST	Speaker	Title
9:00–9:10	**Dr. Virgínia Cruz Fernandes** Session Chair	Welcome from the session chair
9:10–9:30	**Prof. Dr. Minjian Chen** Invited Speaker	Metabolomics: A Bridge Linking the Exposome and Reproductive and Developmental Disorders

9:30–9:50	**Dr. Antonietta Morena Gatti** Invited speaker	Incidental Nanopollution Can Represent a Risk for Neurological Diseases: A Prototypal Frontotemporal Dementia Investigation
9:50–10:05	**Zhen Ma** Selected speaker	The Association Between Organophosphate Insecticide Metabolites (DAPs) and COPD: Multi Model Epidemiological Analysis and Network Toxicology Analysis
10:05–10:20	**Vanda Lopes de Andrade** Selected speaker	The potential For Fetal Lead Exposure in Utero due to Contamination in Cow's Milk or Soy-based Beverages Sold in the Portuguese Market
10:20–10:35	**Gemma Lopez** Selected speaker	Assessing the Toxicity of Bisphenol A Alternatives Using a 3D Zebrafish Liver Cell Model
10:35–10:50	**Hafsat Bulama** Selected speaker	Associations Between Occupational Exposure to Endocrine-Disrupting Chemicals and Sperm Quality
10:50–11:05	**Kalliopi Tavernaraki** Selected speaker	Assessment of Particulate Polycyclic Aromatic Compounds and Associated Carcinogenic Risk in an Urban Greek Environment: A Three-Year Investigation
11:05–11:20	**Suzana Žunec** Selected speaker	The toxicological Effects of α-cypermethrin on Placental Oxidative Balance in a Rat Model
11:20–11:35	**Mariana Lamas** Selected speaker	Physicochemical Alterations of LDPE Microplastics During Simulated Gastrointestinal Digestion
11:35–11:50	**Kanyapak Kohsuwan** Selected speaker	Leukocyte Telomere Length and PM2.5 Exposure Among Adults in Chiang Mai, Thailand
11:50–14:00	**BREAK**	

Afternoon Session 4. Pesticides, Pollutants, and Health Risk

Time: 14:00 (CEST, Basel) | 08:00 (EST, New York) | 20:00 (CST Asia, Beijing)

CEST	Speaker	Title
14:00–14:10	**Dr. Alison K. Bauer** Invited Speaker	Welcome from the Invited speaker
14:10–14:30	**Dr. Megan Mahoney** Invited Speaker	The Effect of the Neonicotinoid Pesticide Imidacloprid on Cognition, Mood, and Associated Brain Regions in CD-1 Mice
14:30–14:45	**Dean Song** Selected speaker	Effective Pesticide Degradation and Toxicity Control Through Selective Oxidation of Permanganate
14:45–15:00	**Andrea López-Botella** Selected speaker	Exploring the association between exposure to multiple toxic metals and endometriosis risk using Bayesian Kernel Machine Regression: evidence from peritoneal fluid
15:00–15:15	**Joana Teixeira** Selected speaker	Exposure Assessment Outside and Inside Firefighters' Respiratory Protection System: Levels of PAHs and Associated In Vitro Toxicity
15:15–15:30	**Núria Ferrer-Cortés** Selected speaker	Assessing Variability of Heavy Metals Concentrations in Follicular Fluid: Insights from a Novel ICP-MS/MS Methodology and Previously Published Studies
15:30–15:45	**Andrzej Michał Sobański** Selected speaker	In Silico Study of Organophosphorus Pesticides' Ability to Bind to the ABCG2 Transporter in the Context of Health Risks Associated with Breastfeeding
15:45–16:15	**Dr. Christopher J. Martyniuk** Keynote Speaker	Understanding Toxicity Mechanisms of Novel Pesticides in Zebrafish (Danio rerio)
16:15–16:35	**Dr. Susan C. Tilton** Invited Speaker	Utilization of an In Vitro Dosimetry Model for Toxicity Assessment
16:35–16:55	**Dr. Alison K. Bauer** Invited Speaker	Similarities Between a Wildfire Particulate Matter Surrogate Effects in Human Lung Cells and Polycyclic Aromatic Hydrocarbon-Induced Tumor Promoting Events in Mice

Session 1. Exposure Pathways—Air and Water Contamination

sciforum-124213: $La_2Ti_2O_7$ doped with Pt, obtained by the sol--gel method, with photocatalytic activity in the oxidative degradation of ethanol

Elena-Alexandra Ilie (Săndulescu) *, Luminita Predoana, Crina Anastasescu, Silviu Preda, Veronica Bratan, Daniela C. Culita, Ioan Balint and Maria Zaharescu

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Introduction and Aim:

Perovskites are materials with increasing applications in a variety of domains, including catalysis and photocatalysis [1–3]. The oxidation of organic compounds by sunlight is significant for several reasons, including its low cost, its ability to purify air and water [4], and its potential as an alternative to the selective synthesis of high-value oxygenated compounds [5]. The aim of this work is to study the synthesis of $La_2Ti_2O_7$ perovskite through the sol--gel method and to test its photocatalytic activity in oxidative ethanol degradation under simulated solar light.

Methods:

Materials used: lanthanum (III) nitrate hexahydrated [$La(NO_3)_3x6H_2O$] and titanium (IV) isopropoxide [$Ti[OCH(CH_3)_2]_4$] as precursors, glacial acetic acid (CH_3COOH) and isopropanol (i-C_3H_7OH) as a solvents, and $PtCl_4$ as a dopant. The reaction products of gas phase oxidation processes were analyzed by gas phase chromatography (GC-TCD and GC-FID).

Results:

The structural and morphological comparison of nanopowders was accomplished by Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM) coupled with EDX, transmission electron microscopy (TEM), X-ray diffraction (XRD), X-ray fluorescence (XRF), ultraviolet-visible spectroscopy (UV–Vis), and specific surface area and porosity analysis (BET). Their photocatalytic activity was evaluated by the oxidative photodegradation of ethanol under simulated solar irradiation. The highest conversion of ethanol (29.75%) was obtained in the case of the Pt-doped sample.

Conclusions:

Nanopowders of $La_2Ti_2O_7$ (LTA) were prepared by the sol--gel method. The effect of the dopant on the properties of the Pt-doped powder was evaluated. The samples' morphology revealed nanoparticle aggregates with well-defined mesopores. The photocatalytic activity in terms of ethanol conversion and selectivity to CO_2 was increased by the addition of platinum to the LTA catalyst. Consequently, these powders demonstrate potential applications for air depollution technologies.

sciforum-124387: Optimization and Validation of a Stir Bar Sorptive Extraction–HPLC–FLD Method for Monitoring PAHs in Water

Eduardo Lage [1,2,*], Maria José José Alves [1,2], Cosme Moura [3,4] and Juliana Garcia [1,5]

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Polycyclic aromatic hydrocarbons (PAHs) are a class of persistent organic pollutants with known mutagenic and carcinogenic properties. They are commonly introduced into aquatic environments through industrial activities, fossil fuel combustion, and residential heating. Given their low concentrations and environmental relevance, the development of sensitive, selective, and cost-effective methods for their determination in water matrices is of critical importance. This study presents an optimized and validated analytical methodology for the simultaneous quantification of six priority PAHs—fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[ghi]perylene, and indeno[1,2,3-cd]pyrene—in drinking water, groundwater, and surface water. The method employs stir bar sorptive extraction (SBSE) followed by high-performance liquid chromatography with fluorescence detection (HPLC–FLD). Key extraction parameters, including sample temperature, extraction time, stirring rate, matrix composition, and desorption time, were systematically optimized. The method demonstrated excellent linearity ($R^2 > 0.998$) across all analytes. Limits of detection ranged from 0.04 to 0.18 ng/L, while limits of quantification ranged from 0.13 to 0.61 ng/L. Recovery values were within 82–108%, with intra- and inter-day precision (RSD) below 10%. The total chromatographic runtime was 24 minutes, followed by a 2-minute post-run. Measurement uncertainty was also evaluated according to ISO/IEC 17025 guidelines.The validated SBSE–HPLC–FLD method provides a reliable, sensitive, and efficient approach for the monitoring of PAHs in environmental water matrices, contributing to improved risk assessment and regulatory compliance.

sciforum-126305: Plastic Particle Migration in Bottled Water: Emerging Health Risks Associated with Long-Term Storage

Codau Natanael

Faculty of Electrical Engineering and Computer Science, Ștefan cel Mare University of Suceava, Suceava, 7210229, Romania

The widespread reliance on bottled water has prompted increasing scrutiny regarding its chemical and particulate content, particularly under prolonged storage and variable environmental conditions. Recent investigations reveal that bottled water may contain hundreds of thousands of plastic particles per liter, predominantly in the nanometric range. These particles, often invisible to the naked eye, originate primarily from the degradation of common packaging materials such as polyethylene terephthalate (PET) and polycarbonate. Their small size and high surface-area-to-volume ratio make them difficult to detect, filter, and neutralize, posing a growing challenge to both scientific monitoring and public health protection. Prolonged exposure to elevated temperatures—such as those encountered during transport or storage—can accelerate the leaching process, increasing the release of micro- and nanoplastics, along with hazardous chemical additives like bisphenol A (BPA), antimony, and phthalates. These substances are known endocrine disruptors with the potential to interfere with hormonal regulation, immune function, and developmental processes. An expanding body of toxicological evidence associates chronic exposure to these contaminants with a range of health problems, including hormonal imbalances, neurodevelopmental disorders, metabolic disturbances, and increased cancer risk. Alarming recent findings report the presence of nanoplastics in human blood, placenta, and other biological tissues, raising urgent concerns about their bioaccumulation and long-term systemic effects. In response, emerging regulatory frameworks—such as new European Union directives and WHO guidelines—aim to limit exposure and enhance transparency. This abstract advocates for a comprehensive approach involving safer packaging alternatives, advancement in detection and filtration technologies, and heightened consumer education as pillars of an effective public health strategy to reduce the potential risks associated with bottled water consumption.

sciforum-122141: A Coastal Perspective on Air Quality Modelling

Matthias Karl

Department for Chemistry Transport Modelling, Helmholtz-Zentrum Hereon, Geesthacht, Germany

Introduction

Air quality in coastal cities is considerably affected by emissions from maritime transport in addition to land-based emissions. Pollutant emissions related to shipping, including particulate matter (PM), nitrogen oxides (NO_x) and sulphur dioxide (SO_2), can have adverse effects on ecosystem health by contributing to acid rain and eutrophication (Karl et al., 2019). Shipping emerges as a major source of ultrafine particle (UFP; diameter below 100 nm) emission and secondary formed aerosols in coastal cities. This presentation highlights various aspects of modelling air quality and exposure in coastal regions.

Methodology and Results

Impacts of ship emissions are assessed using a regional-to-local chemistry transport model chain with the EPISODE-CityChem model for the urban scale. Emissions from ocean-going ships are calculated using detailed emission models with ship positions based on data from the Automatic Identification System (AIS). The model chain is applied to simulate air quality concentrations and exposures in several European coastal cities, with more advanced modelling of secondary aerosol and UFP formation in Marseille (Karl et al., 2023), Athens and Hamburg. Local shipping significantly contributes to the UFP and NO_x exposure in port environments and nearby residential areas but less to urban PM levels.

Conclusions

Modelling the fate of particles emitted from shipping demonstrates the much higher significance of UFP exposure compared to PM exposure, especially near the source of emissions. To assess health impacts of ship-emitted particles with air quality models, it is crucial to include not just mass-based emission but also particle number and size distribution.

References

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sciforum-129636: Abundance, Characterization and Risk assessment of Microplastics in the Payra River, Bangladesh

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Microplastics (5 mm) are persistent emerging contaminants now ubiquitous in all environmental matrices, posing serious ecological and health risks due to their toxic effects, their ability to act as vectors of toxic pollutants and their integration into food webs. Despite extensive global research on freshwater microplastic contamination, only a few rivers in Bangladesh have been studied, with no prior research conducted on rivers inthe Barishal region, which experience increased anthropogenic pressure and have ecological significance. Hence, this research was carried out to provide the first overview of microplastic distribution in the region. A total of 30 surface water samples were collected from ten locations along the length of the river during the pre-monsoon season and analyzed using a microscope and FTIR. The results revealed microplastic abundance ranging from 93.33 ± 8.08 particles/L to 196 ± 11.89 particles/L, with downstream sites exhibiting significantly higher concentrations. Fragments and fibers were the predominant shapes, with red and navy blue as the most common colors. The majority of particles fell under a 100–500 µm size range, followed by smaller particles (100 µm), indicating a potential for greater pollutant adsorption and bioavailability. Six polymer types were identified: PE (34%), PP (22%), PETE (16%), PS (8%), PVC and nylons (both at 10%). These polymers indicate sources such as municipal waste, industrial discharge, plastic bags, bottles, pipes, packaging materials and fishing nets. Risk assessment through indices revealed an overall moderate pollution scenario where Polymer Hazard Index (PHI) values ranged from 7 to 4236.6 (Category II to IV) and ERI_{river}=145.86. PLIi and PLI_{river} values were >1, indicating that all sites were significantly polluted. This study provides baseline microplastic contamination data for the Payra River and is crucial for future research and evidence-based policymaking to ensure sustainable riverine ecosystem management.

sciforum-125614: Climate-driven toxicity of *Amphidinium carterae*: behavioral and biomarker evidence in a microcrustacean

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Harmful algal blooms (HABs) are increasing in frequency and intensity due to global warming and coastal eutrophication, posing growing threats to aquatic ecosystems and human health. *Amphidinium carterae*, a cosmopolitan benthic dinoflagellate capable of forming HABs, remains underexplored regarding its ecotoxicological effects. This study evaluated both lethal and sublethal impacts of *A. carterae* grown under different temperature and nutrient conditions on the brine shrimp *Artemia franciscana*, a widely used model in marine ecotoxicology and a key component of the aquatic food web.

Controlled laboratory exposures were conducted using live cells, cell lysate, and supernatant across a concentration gradient for 48 hours at 19 °C. Mortality and motility were assessed to determine dose-response relationships. Additional exposures tested the influence of increased temperature (24 °C) and nutrient enrichment (N/P) on the toxicity of live cells using a factorial design. Motility was quantified using automated video tracking software (ToxTrac), and biomarker assays were employed to investigate mechanistic ways of toxic action.

Results showed clear density-dependent toxicity, with the lysate exhibiting greater potency (LC_{50} ≈ 1.7 × 10^5 cells/mL) than live cells (LC_{50} ≈ 1.0 × 10^6 cells/mL). Sublethal effects included reduced swimming distance and motility; live cell exposures produced a linear motility decline, while lysate exposures triggered erratic movement. Biomarker analysis revealed alterations in acetylcholinesterase (AChE) activity and signs of DNA damage in exposed *Artemia*, suggesting potential neurotoxic and genotoxic pathways.

Combined increased temperature and nutrient enrichment further intensified motility impairments, suggesting a synergistic interaction between environmental drivers and algal toxicity.

This study shows that *A. carterae* can exert both lethal and sublethal effects on non-target aquatic organisms, with impacts amplified under warming and eutrophic conditions. These findings underscore the need for proactive monitoring and mechanistic risk assessments to address HAB-related threats in a changing climate.

sciforum-126053: Eco-Treatment of Microplastics: Laccase Enzyme-based Biodegradation

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Microplastics (MPs), defined as plastic particles smaller than 5 mm, are persistent and widespread in both aquatic and terrestrial ecosystems owing to the mismanagement of plastic waste [1, 2]. These particles undergo aging through environmental weathering, increasing their toxicity and capacity to adsorb pollutants [3, 4]. These particles can cause physical stress, inflammation, oxidative damage, and immune responses, potentially contributing to diseases such as cancer, metabolic disorders, and neurodevelopmental conditions [5]. In response to growing concerns, the revised EU Urban Wastewater Treatment Directive highlights the need to reduce the release of target micropollutants, including MPs, into the environment [6]. In this study, the potential of biodegradation using the enzyme laccase was investigated as an eco-friendly and sustainable approach for their removal from wastewater. According to previous studies, laccase can break polymer bonds, potentially reducing environmental persistence and toxicity [7]. Three of the most common types of MPs were tested: low-density polyethylene (LDPE, 300 and 600 µm), polyethylene terephthalate (PET, 300 µm), and polyamide nylon 6 (PA6, 20 µm). Laccase concentrations ranging from 50 to 200 U/L were applied over a 7-day incubation period, and enzyme activity was determined using the ABTS oxidation method. MP samples were analyzed using FTIR and Raman spectroscopy to assess their structural modifications. The results indicated potential surface alterations evidenced by increased fluorescence in the Raman spectra; however, further optimization is required to enhance the degradation of specific functional groups and improve biodegradation efficiency.

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sciforum-125607: Ecological implications of LC-PUFAs in benthic dinoflagellates: toxicological perspective

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Background: Long-chain polyunsaturated fatty acids (LC-PUFAs) are vital for various physiological processes in marine organisms. While traditionally associated with health benefits in higher trophic levels, recent studies suggest that their presence in toxic harmful algal bloom (HAB) species may be linked to toxicity.

Objective: This study aims to investigate the potential role of LC-PUFAs as proxies for toxin production in the benthic dinoflagellates *Prorocentrum lima* and *Amphidinium carterae*, both known for producing bioactive secondary metabolites such as okadaic acid and amphidinols, respectively.

Methods: The toxicity of these dinoflagellate species was assessed through lethal concentration (LC50) tests on marine microinvertebrates (*Artemia* and amphipods). Additionally, the levels of specific fatty acids were quantified and correlated with the concentrations of common toxins in both species. Cultures were maintained at varying temperatures (15°C, 19°C, and 24°C) until the end of their exponential growth phase.

Results: Strong positive correlations were observed between eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) levels and toxin concentrations in both dinoflagellate species. Conversely, negative correlations were found between saturated fatty acids, such as palmitic (16:0) and stearic (18:0) acids, and toxin levels.

Conclusions: The findings suggest that LC-PUFAs, particularly EPA and DHA, may serve as biochemical precursors or modulators in the biosynthetic pathways of algal toxins. Understanding these mechanisms is crucial for predicting the ecological impacts of HABs and developing strategies to mitigate their effects on marine food webs.

sciforum-125435: Evaluation of spatio-temporal patterns of nutrient-related water quality parameters: A case study in Greater Houston Area, Texas.

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This study analyzed spatial and temporal patterns of surface water quality, specifically focusing on nutrient-related parameters in the Greater Houston Area (GHA), Texas. It addressed two key questions: (1) How have population growth and changes in land use over the past four decades influenced water quality over time and across space? (2) Have ongoing pollution control efforts effectively maintained water quality over the past 40 years? We analyzed water quality data from 20 stations in GHA, focusing on total nitrogen, total phosphorus, dissolved oxygen, total solids, fecal coliform, and pH levels. The Mann–Kendall test and Sen's slope estimator were utilized to detect long-term trends. The results show that nutrient pollution is increasingly becoming a significant issue in the GHA. Our spatial analysis reveals that water quality is inversely correlated with population density and the percentage of impervious land cover. This suggests areas with higher population density are more prone to water quality degradation. Mann–Kendall trend analysis indicates a strong increasing trend in fecal coliform, total nitrogen, and total phosphorus at stations situated in heavily urbanized counties. In contrast, these parameters remain stable in less populated counties, despite rapid population growth. The results demonstrate that the ongoing pollution control efforts have not been equally effective across the study area. These findings highlight the challenges in densely populated counties and underscore the necessity of sustained water pollution control and long-term monitoring efforts.

sciforum-117725: How polluted is the Black Sea?: A pilot assessment of heavy metals, toxic elements, and persistent organic pollutants in surface waters, sediments, and mussels

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The present study presents, for the first time, results from comprehensive chemical analyses concerning heavy metals, toxic elements, various polychlorinated diphenyl ethers (PCBs) congeners, polycyclic aromatic hydrocarbons (PAHs), and pesticides in sediments, surface waters, and mussels from the Bulgarian Black Sea. In the samples from most of the investigated locations, iron, zinc, PCB-28, and PAHs (Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(ghi)perylene, and Chrysene) were detected in the waters; arsenic, copper, iron, and zinc in the sediments; and arsenic, copper, cadmium, iron, lead, zinc, and PAHs (Acenaphtene, Acenaphthylene, Anthracene, Bezno(b)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, and Pyrene) in the mussels. No pesticides were detected in any of the analyzed matrices. According to Commission Regulation (EU) 2023/915 of 25 April 2023 on maximum levels for certain contaminants in food and repealing Regulation (EC) No 1881/2006 there are now human health hazards in terms of consuming bivalve mollusks because the levels of the contaminants that we investigated and are also included in the regulation - Cd, Pb, Hg, ∑PAHs (Bezno(a)anthracene, Bezno(a)pyrene, Bezno(b)fluoranthene, and Chrysene) were less than the maximum permissible levels set by law. The findings suggest that despite the detectable contaminants, the levels in mussels remain below thresholds deemed hazardous to human health. Yet, a set of biomarkers should be assessed in future in order to determine the effects on mussels which seem to live in a chronically contaminated aquatic environment, even though the contaminant levels are lower than the ones set in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000.

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sciforum-124861: Invisible Invaders: Tracing the Journey and Threats of Microplastics in Aquatic Ecosystems

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Microplastics, or plastic fragments smaller than 5 mm in diameter, are widespread water contaminants globally, raising international alarm due to their persistence, mobility, and toxicity. Microplastics enter into aquatic systems from primary (microbeads and plastic pellets) and secondary (fragmentation of larger plastics) sources through runoff, wastewater effluent, and atmospheric transport. Having invaded the environment, they are conveyed by flows and lodged in sediments or in food webs. The present review integrates recent findings concerning their mode of behavior within the environment, their biological consequences, and health implications for mankind. Microplastics are transportation media for unwanted chemicals—persistent organic pollutants and heavy metals—thatexaggerate their effects in the environment. Microplastics are widely ingested by aquatic life forms, precipitating obstructive disorder in the gut, dwarfing growth, inflammation, and trophic transfer. Human exposure is increasingly documented through seafood consumption, drinking water, and inhalation, though the long-term effects are largely uncharacterized. There is no international standardization of existing monitoring techniques, and thus comparative analysis and regulation are problematic. This review delineates the essential research requirements and calls for interdisciplinary collaboration, improved analytical tools, and policy changes. Mitigation of microplastic pollution is no longer an option—it is a requirement to safeguard ecosystem resilience and public health against a silent but increasing environmental hazard.

sciforum-125433: Microbiota Shifts in *Vicia faba* Exposed to Microcystin-Contaminated Water

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Microcystins (MCs), common toxins produced during cyanobacterial blooms, are frequently found in water sources used for irrigation, leading to their introduction into agricultural environments. While MCs are well-known for their toxic effects on plant growth and physiology, their influence on plant-associated microbial communities remains underexplored. To address this gap, we studied how exposure to 100 µg/L of MCs affects the bacterial microbiota inhabiting bulk soil (BS), root-adhering soil (RAS), and root tissue (RT) in *Vicia faba* using a greenhouse pot experiment. Our findings revealed that MC exposure significantly altered the microbial community structure, co-occurrence patterns, and assembly mechanisms, with the most pronounced changes observed in RT microbiota, followed by BS and then RAS. Notably, MCs caused a marked decline in several Actinobacteriota taxa within RT, particularly members of the genus *Streptomyces*, which are commonly associated with plant health. In contrast, the abundance of certain Proteobacteria, including *Methylobacillus*, *Methylotenera*, and *Paucibacter*, genera potentially involved in MC degradation, increased under MC treatment. Network analysis showed a reduction in microbial co-occurrence complexity in MC-exposed conditions compared to the control. Moreover, community assembly in RT appeared to be predominantly governed by deterministic processes, while both deterministic and stochastic processes influenced BS and RAS microbiota, with a stronger deterministic trend overall. These results suggest that MCs may reshape the microbiota structure in the soil-plant system by reducing bacterial taxa with potential phytobeneficial traits and increasing other taxa with a potential capacity to degrade MCs.

sciforum-128871: Microplastic contamination in reservoirs: an invisible threat to ecosystem and water quality integrity

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Reservoirs are essential aquatic ecosystems that provide drinking water and support various human activities. However, they are increasingly threatened by plastic pollution, posing risks to both environmental and human health. Despite this, the evaluation of the Ecological Potential (EP) of reservoirs under the Water Framework Directive (WFD) does not yet account for microplastics (MPs). This study aimed to quantify and characterize MPs in two Portuguese reservoirs (Rabagão and Aguieira), focused on their relation to the water quality and anthropogenic pressures. For this purpose, throughout 2023, sub-surface water samples were collected to assess the EP of the reservoirs, based on WFD metrics, and to identify MPs by size, colour, type, and chemical composition. Furthermore, the study areas were characterized by land use, soil occupation, and anthropogenic pressures to help identify potential sources of MPs. A total of 5862 MPs were observed in Rabagão and 1658 in Aguieira, with the highest concentrations recorded near the dam, in both reservoirs. For both reservoirs, the predominance of fibres between 0.1 and 0.5 mm was observed, and blue, black, and grey were the most common colours. Chemical composition analysis using ATR-FTIR identified polyethylene as the predominant polymer present in the samples from both reservoirs. Rabagão reservoir exhibited aquaculture as the main anthropogenic pressure, and a Good EP classification, while Aguieira exhibited greater anthropogenic impact (e.g. wastewater discharges, recreational activities, intensive forestry) and a Moderate EP classification. Overall, an apparent discrepancy was observed between the water quality of the reservoirs and the concentration of MPs, suggesting that a good ecological classification, based on existing metrics, does not necessarily indicate low microplastic pollution. This emphasizes that incorporating MPs monitoring into water quality assessments can provide important complementary information, particularly for reservoirs of notable environmental and social significance.

sciforum-124490: Polymer Inclusion Membrane for Passive Sampling of Zn(II) in Water

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Heavy metals, due to their toxicity, are known to cause various environmental and health issues; therefore, their monitoring is essential. Polymer inclusion membranes (PIMs) are innovative materials that can be utilized in passive sampling (PS) tools for monitoring heavy metals. Passive sampling is an integrative technique that has been developed over recent years and serves as a promising complementary tool to grab sampling. Its principle is based on the passive diffusion of contaminants through a membrane and their accumulation in a receiving phase. The concentration of pollutants in the studied system can thus be inferred from the amount of pollutant recovered from the binding phase. However, commercially available tools for passive sampling are quite limited. This work reports a preliminary application of a polymer inclusion membrane for potential integration into passive sampling tools. The PIM was prepared using 50% poly(vinyl chloride) (PVC) as the base polymer, 40% di(2-ethylhexyl) phosphoric acid (D2EHPA) as the carrier, and 10% dioctyl phthalate (DOP) as the plasticizer. Transport experiments through the PIM were conducted in a homemade permeation cell, using a Zn(II) solution at a concentration of 20 mg L^{-1} as the donor phase. The acceptor solution was 0.1 M HCl. The results indicated good performance regarding the transport of Zn(II) ions, with over 80% of the analyte being transported across the membrane.

sciforum-125628: Research on the Presence of Selenium in the Bodies of Dogs and its Effect on Animals of this Species

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Purpose and justification of the research: Selenium is an essential trace element for dogs, affecting the proper functioning of the body. Both its deficiency and excess carry the risk of serious health problems. The presentation presents the results of the presence of selenium in the bodies of dogs by analyzing the results of tests in the dog's fur and the effect of this element on the organisms of this species. The purpose of this study is to analyze the results of the presence of selenium in the fur of dogs collected for testing from one hundred individuals living in the Warmian–Masurian Voivodeship.

Materials and methods: Hair samples were analyzed using inductively coupled plasma mass spectrometry (ICP-MS). Hair samples were collected in April 2022 from 100 adult dogs of both sexes, different breeds, ages, and body conditions. All animals were domestic dogs that went for walks with their owners three to six times a day and had a similar diet. All dogs lived in the Iława and Nowe Miasto districts of the Warmian–Masurian Voivodeship. Hair samples were collected from the abdomen, as close to the skin as possible.

Results and conclusions: The results indicate the presence of selenium in the fur of all dogs tested, significantly exceeding the detection limit, with the lowest result being 0.20 µg/g and the highest 1.37 µg/g. The average content of this chemical element in the fur of the dogs tested was 0.58 µg/g.

The results obtained show that selenium is present in all dogs' bodies, and its level may depend on both its supply in the diet as well as its presence in the dogs' environment. In addition, this study indicates that the analysis of dog hair samples is useful for examining the level of selenium in the bodies of these animals.

Session 2. Molecular Stressors—Nanoparticles, Mixtures, and Persistent Pollutants

sciforum-116734: Phytoremediation of Cobalt Nanoparticles by Lemna minor: Insights into Uptake Mechanisms and Toxicity Responses

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The increasing use of cobalt nanoparticles (CoNPs) in industrial and biomedical applications raises concerns about their environmental fate and impact on aquatic ecosystems. In this study, we evaluated the phytotoxicity and phytoremediation potential of CoNPs using *Lemna minor*, a macrophyte known for its metal accumulation capacity. Specifically, we investigated CoNP-induced oxidative stress, physiological responses, and nanoparticle uptake mechanisms. *L. minor* plants were exposed to CoNPs at concentrations ranging from 0.1 to 20,000 µg L^{-1} for seven days. Growth rates, photosynthesis, and respiration were measured, while oxidative stress markers (H_2O_2 and MDA) and antioxidant enzyme activities (SOD, APX, and CAT) were analyzed. Cobalt accumulation in plant tissues was quantified using ICP-MS, and transmission electron microscopy (TEM) was used to assess ultrastructural changes and intracellular cobalt localization. Our results showed that CoNP exposure led to significant oxidative stress and metabolic impairment at concentrations ≥1000 µg L^{-1}, reducing photosynthesis by 85% and growth by 77%. TEM analyses revealed that CoNPs were internalized by *L. minor* and localized in chloroplasts, causing thylakoid disorganization and plastoglobuli accumulation. Interestingly, CoNPs were found in different subcellular locations than Co^{2+} ions, suggesting distinct toxicity mechanisms. Despite these effects, *L. minor* removed over 99% of CoNPs and Co^{2+} from the medium, highlighting its potential for nanoparticle remediation. This study provides novel insights into the uptake and impact of CoNPs in aquatic plants, reinforcing the role of *L. minor* as an effective phytoremediator in nanoparticle-contaminated environments. Future research should explore long-term accumulation dynamics and optimize phytoremediation strategies for sustainable nanoparticle management.

sciforum-125596: Cigarette- and E-Cigarette-Derived Pollutants Impact the Physiology of Daphnids

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Smoking is not only a main contributing cause in several diseases with implications in human health, but as the most popular habit with global consumption, it has severe implications and impact on the ecosystem, something that remains uncontrolled. Smoking leaves behind cigarette filter butts, which take up to fifteen years to decompose and can concentrate a great number of toxic compounds. These compounds leach out into the aqueous environment, polluting surface waters. Pollution assessment is based on the detection of chemicals and pollutants in the environment to estimate quality; however, such measurements are merely descriptive and provide, to their limit of detection, a report of the panel of pollutants present without any mechanistic information for their action. Therefore, water chemistry methods cannot predict the appearance of specific pollutants early. This is the reason why in the latest years' environmental risk assessment and monitoring are moving towards effect-based methods and novel approach methodologies as more sensitive tools for risk assessment. These approaches use biological systems and molecular information as new metrics for monitoring. Focusing on the freshwater ecosystem, the water flea is a sentinel organism used extensively in ecotoxicology. Combining phenotypic and holistic approaches, we screened for the molecular effects of a cigarette and an e-cigarette on daphnids following the analysis of filter extracts to assess their chemical composition. We identified perturbations in the physiology and metabolism of daphnids with feeding, enzyme activities, mortality and survival, and metabolic perturbations. Aiming to elevate the water flea as an equivalent to “a canary in the coal mine”, we intend to identify the presence of cigarette pollutants in the environment in actual river samples.

sciforum-125373: Molecular Mechanisms of Foodborne Titanium Dioxide Nanoparticle-Induced Intestinal Toxicity: A Multi-Omics and Adverse Outcome Pathway Analysis

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Introduction Titanium dioxide(TiO_2) is frequently used as a whitening agent(E171). Although historically classified as "generally recognized as safe", the European Food Safety Authority (EFSA) suspended its food additive approval due to unresolved concerns(EFSA Panel, 2021), while China and the United States maintain permissible limits. E171 ranges between 200 and 300 nm in diameter while smaller nanoparticles are more likely to be absorbed by intestinal epithelial cells. Based on bioinformatics, we studied the molecular mechanism of the TiO_2-induced intestinal damage process.

Methods Comparative Toxicogenomics Database (CTD) identified 160 colitis- and 258 colorectal cancer-associated genes modulated by TiO_2 and Cytoscape was used to make a PPI network diagram. Functional enrichment analysis (GO/KEGG) revealed key pathways, cross-validated with transcriptomic datasets from TiO_2-exposed enteritis (GSE92563) and colorectal tumor models (GSE109520). We screened the AOP-wiki database and constructed a new pathway network factors. Meanwhile, we used MECE and CT26 cells separately co-cultured with E171 and TiO_2-10nm for 48h for gene sequencing to validate our predictive model.

Results In the intestinal inflammation model, TiO_2 exposure initially activates the JNK and MAPK signaling pathways, causing changes in the cell membrane (invagination, endocytosis), cell death, inflammation, and hypoxia, leading to inflammatory bowel disease. For colorectal cancer, cytokines (Stat1, Pik3cd, Cxcr4, etc.) were activated, leading to extracellular matrix response and apoptosis, resulting in colorectal cancer and migration. Meanwhile, we analyzed the existing AOPs with high relevance to the intestinal damage mechanism of TiO_2 (AOP392, AOP451, and AOP303) and constructed a new AOP. In cell sequencing, we also enriched the relevant pathways, which pointed to different factors in the two types of cells.

Conclusion We introduced these regulatory cascades as new MIE and KE into the AOP framework, outlining the precise mechanism by which TiO_2 exposure induces colorectal damage and providing new evidence for food safety issues.

sciforum-115186: Advancing Nanotoxicology: High-Throughput Screening for Assessing the Toxicity of Nanoparticle Mixtures

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The widespread application of nanoparticles (NPs) in fields ranging from consumer products to industrial processes has led to increased concerns about their potential toxic effects on human health and the environment. While traditional toxicological studies often evaluate the effects of individual nanoparticles, real-world exposure scenarios typically involve mixtures of nanoparticles, where interactions between particles can significantly alter their toxicological profiles. This study focuses on addressing this critical gap by employing high-throughput screening (HTS) to evaluate the combined effects of nanoparticle mixtures under various exposure conditions. Our research investigated how metal oxide nanoparticles can provide advancements in commercial applications thanks to their cytotoxic, genotoxic, and oxidative stress-inducing effects. By leveraging HTS platforms, we rapidly screened multiple mixture ratios and exposure durations using human lung epithelial cells and zebrafish embryos as model systems. The results revealed a range of interactions, from synergistic effects, where the combined toxicity exceeded the sum of individual toxicities, to antagonistic effects, where toxicity was mitigated. Mechanistic analyses showed that oxidative stress and metal ion release were key drivers of toxicity, particularly in ZnO-dominant mixtures. This study highlights the importance of integrating HTS into nanotoxicology research to provide a more comprehensive understanding of nanoparticle mixtures' behavior. The large datasets generated through HTS enable predictive modeling, allowing researchers to anticipate toxicological outcomes and guide the development of safer nanomaterials. Furthermore, the findings emphasize the need for regulatory frameworks to incorporate mixture effects into nanoparticle risk assessments, moving beyond the current single-particle-focused approaches.

sciforum-126041: Biochemical and Transcriptomic Effects of Polystyrene Nanoplastics in Juvenile *Amphiprion ocellaris*

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Nanoplastics (NPs) pose significant ecological risks due to their small size and ability to penetrate biological tissues across all trophic levels. However, their biological effects remain incompletely understood, particularly in tropical reef ecosystems. This study investigated the effects of short-term (7-day) exposure to carboxyl-modified polystyrene nanoparticles (PS-NPs, 100 nm) on juvenile clownfish (*Amphiprion ocellaris*), using two concentrations: low (20 µg/L, environmentally relevant) and high (2000 µg/L). A multidisciplinary approach combining biochemical and transcriptomic analyses was used to assess toxicity. Biochemical assays revealed limited changes in oxidative stress biomarkers (CAT, GR, GST, and TOSCA assays). However, the Integrated Biomarker Response index (IBRv2i) suggested compromised fish health, a finding supported by transcriptomic data. Gene expression analysis showed that both concentrations induced significant changes, with shared differentially expressed genes (DEGs) mostly upregulated, indicating a core molecular response. Despite this, each treatment also elicited unique transcriptional signatures. GO enrichment analysis of the high-concentration group highlighted processes related to muscle contraction, extracellular matrix organization, and oxidative stress responses, suggesting structural and physiological remodeling. In contrast, the low-concentration group showed enrichment for sensory system development, particularly visual function, as well as neurodevelopment and metabolic processes. These results indicate that even low NP concentrations can trigger substantial molecular alterations, although the nature of the biological response varies by exposure level. While high exposure is associated with stress adaptation and tissue restructuring, low exposure predominantly affects neural and sensory pathways. In conclusion, this study demonstrates that PS-NP exposure can alter gene expression and physiological state in juvenile reef fish, even at environmentally relevant concentrations. The distinct molecular profiles observed at different concentrations underscore the importance of exposure level in determining affected biological systems and potential long-term impacts of nanoplastic pollution in marine environments.

sciforum-124928: Characterization of copper toxicity mechanisms, at environmentally relevant concentrations, in the model green alga *Raphidocelis subcapitata*

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Introduction: Copper (Cu) is a toxic and one of the most common heavy metals. Even at low concentrations, this pollutant negatively impacts the aquatic environment. This study aimed to characterize the mechanisms underlying Cu toxicity in the freshwater microalga *Raphidocelis subcapitata* at environmentally relevant concentrations.

Methods: Algal cultures were exposed to Cu (33 or 53 µg L^{-1}) in OECD medium up to 72 hours. Growth, photosynthetic pigments content, photosynthetic efficiency (by PAM fluorometry), intracellular ROS levels, antioxidant enzyme activity (SOD and CAT), lipid peroxidation (MDA levels), and membrane integrity were assessed over time.

Results: Both Cu concentrations significantly inhibited growth, with cell density reductions of 53% and 93%, respectively. At 33 µg L^{-1}, chlorophyll *a* level decreased transiently, with partial recovery by 72 hours. In contrast, exposure to 53 µg L^{-1} led to sustained chlorophyll loss and photoinhibition, as indicated by a decrease in F_v/F_m. ROS and MDA levels increased significantly for both concentrations, with membrane damage for 53 µg L^{-1} (5% of cells showed compromised membrane integrity). Enhanced catalase (CAT) activity indicates activation of antioxidant defences.

Conclusions: Exposure to environmentally relevant Cu concentrations caused a severe physiological disruption in *R. subcapitata,* as translated by the modification of different biomarkers of toxicity. This work provides insights into the algal response to Cu contamination and presents a global proposal of the toxicity pathway of Cu on *R. subcapitata* at environmental concentrations.

sciforum-127255: Exposure to diesel exhaust nanoparticles: Depression-like behavior induced by systemic inflammation and brain-derived neurotrophic factors

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The impact of particulate matter (PM) on health is an ongoing concern, with PM2.5 pollution being implicated in a broad spectrum of negative health outcomes, including cardiovascular and respiratory diseases, metabolic disorders, and various mood disorders. Despite significant research efforts, the exact mechanisms through which these particles exert their harmful effects remain largely elusive. In our current study, we utilized a sophisticated small animal whole-body inhalation exposure system to closely examine diesel engine exhaust particles (DEPs), aiming to replicate real-world atmospheric conditions as accurately as possible. The focus of our investigation was to scrutinize potential depression-like symptoms in mice subjected to long-term exposure to these particles, with insights into the molecular underpinnings offered via cutting-edge RNA sequencing techniques. In this study, we utilized male BALB/C mice that were systematically exposed to DEPs over varied durations. Behavioral assessments and pathological analyses of mice exposed to DEPs for 6, 8, and 10 weeks were conducted and juxtaposed with those from unexposed control groups. The findings revealed a discernable onset of depression-like behaviors in mice after 6, 8 and 10 weeks of DEP exposure, identifiable through behavioral testing and microscopic tissue examinations. Furthermore, RNA sequencing results suggested that the depression-like behaviors observed in DEP-exposed mice might be intricately tied to the modulation of both pro-inflammatory and anti-inflammatory cytokines, along with alterations in the BDNF pathways in brain regions such as the hippocampus and olfactory bulb. This evidence underscores the notion that exposure to DEPs could potentially instigate depressive patterns in a controlled murine model.

sciforum-129987: Hormetic effect of Werner-type metal complex formation on the bioluminescence intensity of marine luminescent bacterium *Aliivibrio fischeri*

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Introduction: The marine luminescent bacterium *Aliivibrio fischeri* is currently used to assess the toxicity of environmental contaminants. Heavy metal ions such as Co^{2+}, Zn^{2+}, and Cu^{2+} in aquatic samples are known to inhibit bacterial bioluminescence at high concentrations. These metal ions form Werner-type complexes upon reaction with bidentate ligands. However, the changes in bioluminescence inhibition associated with the stepwise formation of metal complexes have not been fully elucidated. Hormesis—a biphasic dose–response relationship in which low doses induce stimulation and high doses cause inhibition—may contribute to this phenomenon. This study aimed to investigate the hormetic effects of metal complex formation on the bioluminescence intensity of *Aliivibrio fischeri*. Methods: Octahedral complexes of Co^{2+}, Zn^{2+}, and Cu^{2+} were prepared by mixing the metal ions with varying concentrations of ethylenediamine. The bioluminescence intensity of *Aliivibrio fischeri* was measured using the ROTAS™ Leachable kit. The redox potential (ORP) of each complex solution was also measured, as ORP is known to influence the bacterial respiratory chain. The degree of hormetic response was evaluated by calculating the hormetic area from time–course data of bioluminescence intensity. Results: All metal ions exhibited hormetic responses upon complexation with ethylenediamine. The hormetic area increased as ORP decreased in the sample solutions (Co^{2+}: $r = 0.89$, Zn^{2+}: $r = 0.96$, Cu^{2+}: $r = 0.73$). The relatively weak correlation in Cu^{2+} complexes is likely attributable to the Jahn–Teller effect characteristic of Cu^{2+}. Conclusions: Heavy metal ions tend to exhibit hormesis via the formation of Werner-type complexes, and this behavior is influenced by ORP, which in turn depends on the structure of the metal complexes.

sciforum-125612: Methyl and propyl paraben impact the physiology of daphnids

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With the eminent threat of pollution rising as a result of human actions, many pollutants highlighted as emerging contaminants are appearing in the environment. Parabens are preservatives which are more frequently found to be present in food preservatives and personal care products. These compounds are frequently detected in freshwater ecosystems at concentrations ranging from ng/L to mg/L, and as such they are recognized as emerging contaminants posing ecological risks. In this study, we investigated the effects of methyl and propyl parabens, individually and in combination, on the physiology of daphnids. Using mortality and ingestion rate as phenotypic endpoints and key enzyme activities, we identified different responses to parabens. Feeding rate is crucial for the assessment of environmental impacts as it directly influences growth, reproduction, and survival in aquatic populations. Our findings showed that environmentally relevant concentrations of parabens have significant impacts on the ingestion rate of daphnids, potentially impairing population dynamics. Additionally, assays revealed complex biochemical responses to parabens and dose-dependent alterations in enzyme activity. These results suggest that exposure to parabens impacts the physiology of daphnids through distinct and potentially long-lasting mechanisms. We highlighted the need for further investigation into the effects of mixture of parabens in freshwater ecosystems, providing insights into their ecological risks.

sciforum-115182: Nanoparticle-Induced Oxidative Stress: Mechanisms and Implications for Human Health and Environmental Safety

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Nanoparticles (NPs), which possess unique physicochemical qualities such as large surface area and reactivity, have brought about a revolution in a variety of sectors, including medicine and electronics. The growing ubiquity of these substances, on the other hand, has given rise to worries over the toxicological effects they have on human health and ecosystems. The condition known as oxidative stress, which is caused by an imbalance between the formation of reactive oxygen species (ROS) and antioxidant defenses, is one of the key processes that contribute to the toxicity of NPs. An excessive amount of ROS may cause damage to cellular components such as lipids, proteins, and DNA, which can result in detrimental consequences such as inflammation, apoptosis, and the development of cancer. NP-induced oxidative stress is investigated in this work, which focuses on the molecular mechanisms that are responsible for it. These processes include mitochondrial dysfunction, catalytic redox cycling, and the release of metal ions from particle disintegration. In addition, we investigate how the features of NPs, such as their size, shape, surface charge, and composition, affect their capacity to produce ROS. Additionally, the consequences of oxidative stress for both acute and chronic health effects are examined, in addition to the role that it plays in the toxicity of the environment. The use of antioxidants and alterations to the surface of NPs are two examples of mitigation measures that are discussed in this article. The findings of this study highlight the significance of gaining knowledge of the processes behind oxidative stress to ensure the safe design and deployment of nanoparticles.

sciforum-127543: Role of *Akkermansia muciniphila* and Its Outer Membrane Vesicles in High-Fat Diet and Nano Titanium Dioxide-Induced Metabolic Dysfunction-Associated Fatty Liver Disease

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Background: Metabolic dysfunction-associated fatty liver disease (MAFLD) is a common metabolic disorder in which the gut–liver axis plays a key role. Titanium dioxide nanoparticles (TiO_2), common food additives, may affect gut microbiota and health. This study investigates the role of *Akkermansia muciniphila* and its outer membrane vesicles (OMVs) in TiO_2-induced MAFLD under a high-fat diet (HFD). Methods: Low-dose TiO_2 was co-incubated with *A. muciniphila* to assess its effects on growth and OMV production. OMVs derived from TiO_2-treated A. muciniphila were then co-cultured with hepatocytes to assess their impact on lipid accumulation. In vivo, mice were fed control or HFD with/without TiO_2 for 13 weeks. Hepatic lipid deposition, inflammatory cytokines, intestinal barrier integrity, and gut microbiota composition were assessed. Fecal OMVs were isolated for proteomic analysis and integrated with hepatic metabolomics to explore regulatory pathways. In the next experiment, mice were divided into HFD, HFD+TiO_2, HFD+A. muciniphila, and HFD+TiO_2+A. muciniphila groups to assess the protective effects of A. muciniphila. Results: Low-dose TiO_2 promoted A. muciniphila growth and OMV production. OMVs from TiO_2-treated bacteria reduced lipid accumulation in hepatocytes. TiO_2 reduced hepatic lipids under the control diet but exacerbated steatosis and inflammation under the HFD, associated with altered lipid metabolism genes and an impaired intestinal barrier. Metagenomic analysis showed that TiO_2 reshaped gut microbiota, increasing A. muciniphila under the control diet but decreasing it under the HFD. OMV proteomics and liver metabolomics revealed enrichment in lipid and energy metabolism pathways. Supplementation with A. muciniphila alleviated TiO_2-aggravated hepatic lipid accumulation in vivo. Conclusion: TiO_2 exacerbates HFD-induced MAFLD by altering gut microbiota, impairing gut barrier function, and promoting hepatic lipid accumulation and inflammation. Under the control diet, TiO_2 increases A. muciniphila, reducing hepatic lipid accumulation. Supplementation with A. muciniphila and its OMVs reverses these effects, suggesting TiO_2 may influence MAFLD progression via the modulation of specific gut microbes.

sciforum-125538: Scientific Validation of a Cortical Neurosphere Model for Developmental Neurotoxicity Assessment and Evaluation of Chronic PFAS Mixture Exposure

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Developmental neurotoxicity (DNT) is increasingly recognized as a public health concern due to evidence linking environmental exposures to neurodevelopmental disorders. Traditional in vivo approaches are resource-intensive, highlighting the need for alternative in vitro models. In this context, 3D neurosphere cultures derived from neural stem cells (NSCs) provide a promising platform to evaluate key neurodevelopmental processes and their disruption by toxicants. This study aimed to develop and characterize a 3D neurosphere model of cortical differentiation and assess its response to chronic exposure to the pesticide chlorpyrifos (CPF) and a representative mixture of per- and polyfluoroalkyl substances (PFAS). After 21 days of spontaneous differentiation, the model expressed genes corresponding to multiple neurodevelopmental endpoints—neurogenesis, gliogenesis, synaptogenesis, and neuronal signaling—as confirmed by means of qPCR and flow cytometry. Additional phenotypic endpoints included cell proliferation, neurosphere size, radial migration, and cytotoxicity (XTT assay). To assess the model's sensitivity to environmental toxicants, neurospheres were chronically exposed from Day 0 of differentiation, targeting a critical developmental window. The toxicants tested were CPF (125 μM and 250 μM) and a PFAS mixture at concentrations relevant to human serum exposure. CPF significantly reduced cell viability, inhibited sphere growth and radial migration, and disrupted gene expression across neurodevelopmental pathways, including the downregulation of genes involved in neuronal and glial differentiation and synaptogenesis, while upregulating early neurogenesis and signaling markers, particularly NTRK1. Furthermore, cytometry revealed CPF-induced alterations in the cell cycle profile and increased expression of proliferation markers. PFAS exposure, though not overtly cytotoxic, caused significant transcriptional disturbances in glial and neuronal genes, suggesting early interference with developmental programming even at non-cytotoxic, environmentally relevant levels. This neurosphere model recapitulates key stages of brain development and enables integrated molecular and functional DNT analysis. Its responsiveness to CPF and PFAS supports its relevance as an in vitro platform for chemical safety assessment.

sciforum-130019: Toxicity evaluation of solid lipid nanocarriers using *in vitro* and *in vivo* approaches

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Nanotechnology has been extensively used in the development of drug delivery systems, with various benefits on the protection, control release, and improvement of drug delivery to target sites. Among nanocarriers, lipid-based ones, such as solid lipid nanoparticles (SLN), have been biocompatible and theoretically safe for pharmaceutical application. Even so, a gap in terms of evaluating possible toxicity of nanocarriers have been dismissed and are lacking in literature. Therefore, our study aimed at evaluating the toxicity of SLN and their components using *in vitro* and *in vivo* studies. The *in vitro* studies were carried out in normal human fibroblast cell line. The formulations of positively charged SLN (SLN^+) exhibited greater cytotoxicity compared to negatively charged ones (SLN^-), especially at higher concentrations (10, 20, and 100µg/mL), suggesting that this response is probably due to the higher interaction of SLN^+ with cell membranes. The SLN components (Precirol® ATO 5, Tween® 80 and benzalkonium chloride) were also studied in their higher concentration within the formulation. Benzalkonium chloride was the only component that exhibit toxicity in the *in vitro* studies. The *in vivo* assays were performed using *Drosophila melanogaster* with SLN^+ at 100µg/mL and their components. The toxicity was studied taking into consideration chronic and periodic exposition, and the parameters accessed were egg number, hatched flies and sex. Considering chronic exposure, no statistical differences were found considering these parameters. When F_1 flies, submitted to chronical exposure, were crossed with non-treated flies, the effect on gender was evident when the different components were tested. The discrepancy between *in vitro* and *in vivo* result suggests that while SLN demonstrate toxicity in cell cultures, their effects are less pronounced in whole organisms, likely due to biological factors such as metabolism and detoxification mechanisms, highlighting the need for comprehensive *in vivo* testing to assess the true impact of nanocarriers.

sciforum-130072: Toxicological responses to Perfluorononanoic acid (PFNA) in larval zebrafish (Danio rerio)

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Per- and polyfluoroalkyl substances (PFAS) are a novel group of synthetic chemicals that are widely used in household and industrial products. PFAS are known to be environmentally persistent, characterized by having longer biological half-lives due to their carbon backbone with fluorine atoms. Perfluorononanoic acid (PFNA, C9HF17O2) is an example of a long-chain perfluorocarboxylic acid. As the potential toxicity of several long-chain per-and polyfluoroalkyl substances (PFAS) on aquatic species is not well understood, we assessed the effects of long-chain PFNA exposure on developing zebrafish. Several zebrafish embryos/larvae were exposed to PFNA over a 7-day period post-fertilization. Upon exposure termination, we measured sublethal toxicity effects in relation to locomotor behavior, apoptosis levels, neurotoxicity, oxidative stress (ROS), hatch rate, deformity rate, and survival rate. There was no evidence for ROS induction in 7-day-old larvae fish exposed from 0.1-1000 μg/L. In regard to developmental endpoints, PFNA did not significantly affect the hatch, survival, and deformity rate in comparison to the controls at the concentrations tested. However, PFNA induced hypoactivity of zebrafish larvae at concentrations of 0.1,10, and 1000 μg/L. PFNA was also observed to increase apoptosis in the 0.1 μg/L concentration. PFNA did not have any effect on transcript levels of genes related to apoptosis and neurotoxicity. As such, RNA-seq is being conducted to elucidate potential mechanisms of toxicity and this will be discussed. These data further our understanding of sublethal toxicity data for PFNA in zebrafish, helping to further contribute to toxicological risk assessments for PFAS

sciforum-125249: Transcriptional Biomarkers of Metal-Induced Stress Contamination in the Critically Endangered Burrunan Dolphin (*Tursiops australis*)

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Marine ecosystems face increasing threats from chemical pollutants, particularly metals, which persist in the environment, bioaccumulate, and pose risks to marine organisms and human health. In Victoria, Australia, Burrunan dolphins (Tursiops australis), a critically endangered and endemic species, are particularly vulnerable due to their strong site fidelity to coastal regions like Port Phillip Bay and Gippsland Lakes—areas subject to significant urban, agricultural, and industrial runoff. These regions are among the most mercury (Hg)-polluted globally, with previous studies reporting elevated Hg levels in deceased dolphins. Despite this, the biological effects of metal exposure in live individuals remain poorly understood. Investigating molecular responses—especially gene expression—offers valuable insight into physiological stress and potential health impacts. This study aimed to assess metal accumulation in Burrunan dolphins and its potential effects on molecular pathways associated with detoxification, antioxidant defenses, immune function, and oxidative stress. Skin biopsies were collected from free-ranging dolphins using minimally invasive methods. Samples were preserved in RNAlater and stored at –80 °C for RNA extraction and subsequent quantitative real-time PCR (qPCR) analysis. Simultaneously, metal concentrations in the same samples were quantified using inductively coupled plasma mass spectrometry (ICP-MS). Results revealed significant associations between the expression of stress-related genes and specific metal levels, highlighting the potential use of these genes as molecular biomarkers for biomonitoring efforts. These findings emphasize the urgent need to reduce pollutant exposure in critical habitats and demonstrate the utility of molecular tools in marine conservation. By linking environmental contamination to sub-lethal molecular effects, this research supports targeted conservation strategies for Tursiops australis and provides a framework for assessing pollution impacts in marine mammals.

sciforum-129676: When nanoplastics meet neurons: the impact of functionalized polystyrene nanoplastics on human neuroblastoma cells

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Nanoplastics (NPs) have emerged as a growing environmental and health concern due to their widespread presence in various environmental matrices, including food, water, and air. They are inadvertently ingested, inhaled, or absorbed through the skin, raising concerns about their potential to interact with cellular systems, including the nervous system. Despite increasing awareness, their neurotoxic potential, particularly the effects of functionalized NPs, remains poorly understood. This study provides novel insights into the neurotoxicity of four types of polystyrene nanoplastic (PS-NPs)—plain PS-NPs (50 nm and 100 nm) and amine- and carboxyl-functionalized PS-NPs (100 nm)—on human SH-SY5Y cells. Cells were exposed to NP concentrations ranging from 1 to 500 µg/mL for 24 and 48 hours, with NP characterization and stability assessments conducted in culture media prior to toxicity evaluations (cell viability, ROS/RNS production, NP internalization, morphological and ultrastructural changes). In-depth toxicity assessments revealed that functionalized NPs, particularly amine-modified ones, induced greater cytotoxicity than their plain counterparts. Cellular viability assays demonstrated a concentration- and time-dependent reduction, with significant cytotoxicity observed at 200-500 µg/mL. ROS/RNS production was markedly elevated in plain 100 nm and amine-functionalized NPs at concentrations of 200-500 µg/mL, with oxidative stress intensifying over time. Transmission electron microscopy uncovered distinct subcellular damage patterns, including endoplasmic reticulum dilation, mitochondrial impairment, and Golgi fragmentation, correlating with NP size, concentration and functionalization. Notably, functionalized NPs exhibited greater cellular uptake, with amine-modified NPs showing the highest internalization. Further mechanistic analyses revealed that PS-NPs induced apoptosis, autophagy, and lysosomal dysfunction, with functionalized variants exhibiting more pronounced effects. These findings underscore the critical influence of NP functionalization on neurotoxicity and highlight the urgent need for further investigation into their potential health implications, particularly concerning human exposure and neurodegenerative risk.

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Session 3. Cutting-Edge Approaches in Pharmacology and Toxicology

sciforum-125554: Epidemiological Profile of Poisonings Attended in Emergency Departments of Local Health Units in Portugal's Interior in 2022

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Introduction:

The increasing availability of pharmaceuticals, illicit substances, and alcohol has made the monitoring of poisonings a critical priority for guiding clinical and preventive interventions. In Portugal, especially in the interior regions, the reduction of public health services and the closure of local health centres have resulted in limited geographic access to healthcare. This study aims to characterize poisonings attended in the emergency departments of Local Health Units (LHUs) in Portugal's interior during 2022.

Methods:

A retrospective analysis was conducted of poisoning cases recorded in emergency departments across Local Health Units (LHUs) in the interior districts of Portugal—specifically Castelo Branco, Guarda, and Viseu—during the year 2022. Data on patient demographics, the type of toxic agent, the route of exposure, and intentionality were collected and analyzed. Descriptive and inferential analysis was carried out using SPSS software version 28.

Results:

Poisonings were more frequently observed in adult females. Alcohol was the most common toxic agent overall, especially among males, whereas pharmaceuticals—particularly benzodiazepines and analogues—were more prevalent among females. Other medications acting on the central nervous system (CNS), including antidepressants, antipsychotics, and anticonvulsants, also played a significant role. Illicit substances were identified less frequently. The oral route was the main mode of exposure, and most cases were of voluntary origin.

Conclusions:

Although poisonings account for a small proportion of emergency department admissions, they constitute a significant public health issue in Portugal's interior. The high prevalence of voluntary poisonings highlights the need for effective preventive measures, particularly regarding alcohol consumption and the rational use of medications.

sciforum-130175: Molecular and Behavioral Effects of Atorvastatin Exposure in Zebrafish (Danio rerio): Insights into Statin Toxicity at Environmentally Relevant Levels

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Atorvastatin, a widely used cholesterol-lowering statin, functions by inhibiting 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase. While its environmental presence has been documented, its toxicity to aquatic organisms remains poorly understood. In this research, I conducted RNA-seq and measured sub-lethal developmental as well as locomotor-related endpoints in zebrafish to identify toxicity mechanisms related to environmentally relevant exposures to atorvastatin. Zebrafish were exposed to atorvastatin continuously, and the water was renewed every 24 hours, with 90% water change of fresh chemical every day. No significant impact on survival, hatching success, or deformities was observed across treatment groups. However, reactive oxygen species (ROS) increased at lower doses, and locomotor activity was significantly reduced at 100 µg/L. RNA-seq analysis revealed dose-specific transcriptomic responses. At 1 µg/L, differentially expressed genes included collagen type I, alpha 1a, fatty acid desaturase 2, and prolactin, implicating pathways such as B-cell leukemia signaling, CD8+ T-cell activation, and NF-κB regulation. At 100 µg/L, genes such as solute carrier family 12 (potassium/ chloride transporter), and G-Protein subunit alpha z were affected, linked to pathways like Th17-cell activation and oxytocin signaling. These findings suggest that atorvastatin can alter neurodevelopmental and immune-related pathways even at low concentrations, without causing overt morphological defects. Data from this study are expected to contribute to our understanding of atorvastatin toxicity to early stages of fish and can support risk assessment efforts in aquatic ecosystems for statin drugs.

sciforum-125618: Advanced analytical method for determination of Aflatoxins in chilli powder using LC-MS/MS

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Chilli powder, a widely used spice, is commonly contaminated with aflatoxins (AFs) posing significant health risks. AFs, particularly Aflatoxin B1, a highly carcinogenic mycotoxin produced by *Aspergillus* species and pose serious health risks, especially in agricultural commodities like chilli, where contamination must be closely monitored. Traditional detection methods such as direct chromatographical analysis using HPLC often face challenges due to the complex matrix of chilli powder. Due to the lack of a validated method for the direct detection AFs in chilli powder, it was essential to develop one for effective monitoring and to support trade. In this study, we established and validated a sensitive, accurate, and precise analytical method capable of detecting AFs (AFB1, AFB2, AFG1, AFG2) in chilli powder. The optimized sample preparation involved QuEChERS method followed by analysis through liquid chromatography with tandem mass spectrometry (LC–MS/MS). This direct analysis provided the quantification limits (LOQs) of 0.25 ng/g for each AF well below the maximum levels set by the European Commission. Recoveries at and above the LOQ levels les in range of 80-108%, with RSD below 8%. The QuEChERS extraction protocol compared with the Immuno affinity clean up. Market sample analysis showed AFB1 levels with precision RSDs below 6%. Given its high efficiency and compliance with regulatory standards, this method is suitable for routine AF and OTA testing in chilli powder.

sciforum-124516: Behavioral Biomarkers of Neurotoxicity: A High-Throughput Zebrafish Thigmotaxis Assay

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Introduction:

Traditional neurotoxicity (NT) testing relies mainly on rodent-based guidelines (OECD TG 424 and 426). Despite their relevance to many neurotoxic mechanisms, these tests are costly and ethically challenging, and they overlook behavioral endpoints related to anxiety. To address the urgent need for animal replacement in NT testing, the European Partnership for the Assessment of Risks from Chemicals (PARC), subtask 5.2.1e, focuses on the development of human-relevant New Approach Methodologies (NAMs). In this context, the zebrafish embryo (ZFe), up to 120 hours post fertilization (hpf), is an in vivo model that has high human homology, but is not included in animal welfare regulations and is not considered an NAM.

Methods:

We developed a high-throughput thigmotaxis assay based on 120 hpf ZFEs to evaluate anxiety-like behavior as a biomarker of NT. Thigmotaxis—the tendency to remain close to the edge of a container—is a robust indicator of altered neural function. We optimized the assay to include visual and acoustic stimuli and evaluated two plate formats (24-well round and 96-well square). A range of known anxiogenics, anxiolytics, negative controls and known neurotoxicants (e.g., nicotine, chlorpyriphos) were tested to establish baseline responses and assay reliability. Thigmotaxis response was compared to general locomotion to test for assay sensitivity.

Results:

The 96-well square plate format offered optimal throughput and reproducibility. Exposure to positive control compounds resulted in significantly elevated/decreased thigmotactic behavior, consistent with anxiogenic/anxiolytic responses. Negative controls showed no behavioral alteration, supporting assay specificity. Comparison with general locomotion showed that thigmotaxis evaluation increased assay sensitivity.

Conclusions:

This thigmotaxis assay is a high-throughput and ethically viable approach for screening chemicals for neurotoxic potential. It effectively captures anxiety-related behaviors and serves as a promising NAM for inclusion in alternative developmental and adult neurotoxicity test batteries. Further validation under PARC is underway to support regulatory adoption.

sciforum-123307: Beyond the Blotter: Forensic Identification of Novel LSD Analogs via GC–QqQ–MS and UHPLC–QqQ–MS/MS

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Introduction: The proliferation of novel LSD analogs, often synthesized to circumvent existing legal regulations, presents a growing challenge for both forensic toxicology and public health. These so-called "designer psychedelics" often remain undetectable by routine screening methods and may exist in isomeric forms with different pharmacological profiles. As their availability rises, particularly via online markets, so does the urgency for accurate analytical methodologies that can distinguish known analogs and anticipate those yet to appear.

Methods: Two complementary analytical strategies were employed: GC–QqQ–MS and UV spectroscopy for analytical standards, and UHPLC–QqQ–MS/MS for biological matrices. The GC–QqQ–MS method was optimized for the separation and identification of 13 LSD analogs, including structural isomers, with attention paid in particular to solvent influence on compound stability. In parallel, the UHPLC–QqQ–MS/MS protocol was used to develop a comprehensive method for the determination of extremely low concentrations of analytes in biological material, as well as to investigate their stability over time under various storage conditions.

Results: GC–QqQ–MS with EI effectively differentiated critical isomer pairs (e.g., LSD vs. MiPLA, 1P-LSD vs. 1P-MiPLA) by unique ion fragmentation patterns and chromatographic separation. Solvent studies confirmed that methanol induces degradation in several analogs, whereas diethyl ether and acetone preserve compound integrity. The UHPLC–QqQ–MS/MS method demonstrated exceptional sensitivity (LOQ 0.5 pg/mL) and robustness, detecting analogs in forensic case samples and confirming degradation pathways, particularly for N1-substituted compounds converting to LSD or MiPLA.

Conclusions: This study highlights the necessity of robust, sensitive analytical methods to accurately identify LSD analogs and their isomers. Given their possible instability, ongoing method development is essential for reliable forensic interpretation and early detection of emerging substances.

sciforum-125310: Impact of persistent organic pollutants and preexisting steatosis on drug hepatotoxicity in cultured human hepatocytes

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Introduction

Drug-induced liver injury (DILI) is a major global health concern and a leading cause of acute liver failure. While intrinsic DILI, such as that caused by acetaminophen, is dose-dependent and predictable, idiosyncratic DILI (iDILI) occurs unpredictably at therapeutic doses. The incidence of iDILI is rising due to polypharmacy, aging populations, and increased use of herbal products. Although host factors such as age, immune response, and genetic variants (e.g., HLA alleles) influence susceptibility, they are not fully predictive. Emerging evidence points to acquired conditions—such as exposure to persistent organic pollutants (POPs) and preexisting hepatic steatosis—as contributors to iDILI by altering liver susceptibility and enhancing drug toxicity.

Methods

We used Upcyte human hepatocytes, which retain key metabolic and transport functions of primary liver cells. Hepatocytes were exposed to the POPs Bisphenol A (BPA) and Perfluorooctanoic acid (PFOA), with or without co-treatment with azathioprine, valproic acid (VPA), or amoxicillin/clavulanic acid. Cell viability was assessed using the MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay. To model hepatic steatosis, cells were preincubated with 0.2 mM oleate/palmitate (2:1) for 44 hours. Triglyceride (TG) accumulation was measured using a fluorescence-based assay.

Results

A synergistic cytotoxic effect was observed in cells co-treated with azathioprine plus BPA, VPA plus BPA, and amoxicillin/clavulanic acid plus PFOA. Metabolic steatosis preconditioning enhanced TG accumulation when combined with azathioprine or VPA. Interestingly, BPA reduced the steatotic effect of VPA, possibly because BPA may operate as an antisteatotic polyphenol or due to modulation of estrogen receptor activity.

Conclusions

These preliminary findings suggest that environmental exposures and hepatic steatosis modulate drug toxicity and may increase susceptibility to iDILI. POPs like BPA and PFOA can exacerbate hepatotoxicity, highlighting the importance of including such factors in risk assessment and prevention strategies for drug-induced liver injury.

sciforum-124741: Molecular and metabolic profiles of individual and combined nanoplastic–BPA exposure assessed by FTIR spectroscopy

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The excessive use of plastic has raised concerns about exposure to nanoplastics (NPs) and bisphenol A (BPA) and their impacts on human health. This study aimed to assess a new method of detecting the in vitro effects of NPs and BPA that is sensitive yet simpler and faster compared to cytogenetic techniques such as cytokinesis-blocked micronucleus (CBMN) assay.

Individual and combined exposure of BPA and polystyrene nanoparticles (PS-NPs) was evaluated using the GP202 gastric cell line. The culture media, designated as 0h after exposure and 24h after the exposure, and cells 24h after exposure, were analyzed by Fourier transform infrared (FTIR) spectroscopy. CBMN did not reveal statistically significant differences in exposure to NPs and BPA compared with controls, though a trend towards an increase in MN, nucleoplasmic bridges (NBPs), and nuclear buds (NBUDs) was observed with combined exposure to PS-NPs and BPA. A univariate analysis of several FTIR spectral bands was performed after various spectral preprocessing methods, including baseline correction, baseline correction with normalization, second derivative, and second derivative with normalization. Several statistically different bands were observed, with significance at 1%, 5%, and 10%, both in multiple comparisons between exposure conditions and pairwise comparisons between exposure conditions. These changes were noted in spectra obtained from culture media and directly from cells. The FTIR spectrum represents the molecular profile of the culture media and cells, reflecting the metabolic state of the cells. Thus, FTIR spectroscopy proves to be a highly sensitive, rapid, and straightforward technique for detecting metabolic changes in gastric cell lines when exposed to NPs and BPA, even in conditions where no genotoxic changes are detected, as observed by CBMN.

sciforum-124548: The Determination of 2-Phenylethylamine Derivatives in MGG-Stained and Unstained Blood Smears: A Cutting-Edge Approach in Contemporary Toxicology

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Introduction Complete blood count (CBC) is one of the fundamental tests for assessing a patient's condition. Despite widespread automation in hematology, manual blood smear analysis remains essential. This study aimed to evaluate the use of manual blood smears, both unstained and May–Grünwald–Giemsa (MGG)-stained, as a novel alternative biological matrix for xenobiotic determination.

Methods Analytical standards of selected 2-phenylethylamine derivatives were added to K_2EDTA whole blood, followed by manual smear preparation. Half of the smears were stained using the MGG technique. The developed method involved transferring the matrix from the slide into a test tube, followed by extraction with an *n*-hexane/ethyl acetate mixture under alkaline conditions. Analyses were conducted using UHPLC-ESI-QqQ-MS/MS. In unstained smears, xenobiotics were monitored across concentrations ranging from pg/mL to µg/mL. Total hemoglobin was evaluated at low (critical), moderate, and normal levels. The method was further applied to evaluate xenobiotic stability in blood smears stored at room temperature, the typical storage condition for such samples.

Results The study demonstrated that unstained blood smears can serve as a valuable alternative matrix for xenobiotic determination, enabling detection not only in poisoning cases (toxic/lethal concentrations) but also in exposure assessments, with a limit of quantification down to the ng/mL range. Despite substantial differences in total hemoglobin concentration, effective xenobiotic detection was achieved. In MGG-stained smears, however, staining steps reduced detection capabilities, and a qualitative interpretation approach is recommended.

Conclusions The results indicate that small blood volumes are sufficient for both qualitative and quantitative toxicological analyses, particularly in unstained smears. Furthermore, the ability to detect substances at trace levels highlights the necessity for cautious interpretation due to contamination risk. The findings regarding unstained blood smears, including stability results, may provide valuable support for toxicological examinations of blood traces on other glass surfaces.

Session 4. Pesticides, Pollutants, and Health Risk

sciforum-125622: Assessment of Particulate Polycyclic Aromatic Compounds and Associated Carcinogenic Risk in an Urban Greek Environment: A Three-Year Investigation

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Polycyclic Aromatic Hydrocarbons (PAHs) and their oxygenated derivatives (OPAHs), collectively termed Polycyclic Aromatic Compounds (PACs), are hazardous air pollutants with documented carcinogenicity. Benzo[a]pyrene (B[a]P), a representative PAH, has an established European annual target concentration of 1 ng m^{-3} due to its toxicity. These compounds primarily originate from incomplete combustion processes, including biomass and fossil fuel burning, and undergo further atmospheric transformation. Systematic monitoring of PACs in urban settings is essential for understanding their sources and evaluating public exposure risks. A total of 160 24-hour aerosol samples were collected on quartz filters over a three-year period (2022–2024) in Heraklion, Crete—a Mediterranean city with a significant seasonal population increase due to tourism. Samples were analyzed for PACs, Organic and Elemental Carbon (OC/EC), ions, metals, and traffic-related organic markers using the methods of Tsiodra et. al., 2025 and Paraskevopoulou et. al., 2019. Source attribution and carcinogenic risk assessments were conducted using chemical speciation data and toxic equivalent factors (BaPeq). PAC concentrations exhibited strong seasonal variation, with winter levels significantly exceeding summer values. Total PAHs were nine times higher in winter, and OPAHs and B[a]P showed 18-fold increases, largely due to residential biomass burning. Summer samples indicated a greater presence of low molecular weight PAHs (e.g., phenanthrene), suggesting a dominant influence from traffic and marine emissions. Carcinogenic risk, as measured by BaPeq, was markedly elevated in winter (17.9 ng m^{-3}) compared to summer (0.5 ng m^{-3}). This study provides the first long-term dataset on PAC exposure in this region of Greece and highlights the seasonal impact of combustion sources on urban air quality and health risk.

sciforum-125149: A Green In-Syringe Microextraction Approach Using Deep Eutectic Solvents for the Determination of Pesticides in Environmental Water by GC-MS

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The pervasive presence of pesticide residues in aquatic environments poses significant risks to both ecosystems and human health. In response to the growing need for environmentally sustainable analytical techniques, we present a novel in-syringe dispersive liquid–liquid microextraction (IS-DLLME) method utilizing a natural deep eutectic solvent (DES) for the extraction of selected pesticides from water samples.

In this study, the DES was synthesized from choline chloride and a hydrogen bond donor, offering a biodegradable and non-volatile alternative to traditional organic solvents. The microextraction was carried out inside a standard plastic syringe, eliminating the need for additional equipment and minimizing solvent consumption. Following extraction, analytes were separated and quantified using gas chromatography–mass spectrometry (GC-MS).

The method demonstrated excellent analytical performance, with extraction recoveries ranging from 86% to 97%, relative standard deviations below 4.5%, and limits of detection in the low µg/L range. The linearity was confirmed over a broad concentration range, and matrix effects were negligible. Application to environmental water samples confirmed the method's robustness and applicability to real-world analysis.

This work highlights the potential of combining IS-DLLME with DESs for rapid and sustainable monitoring of trace contaminants in water. The integration of green chemistry principles into sample preparation not only enhances analytical performance but also supports safer and more eco-conscious laboratory practices.

sciforum-129968: Association between phenolic compound exposure and liver function: Using machine learning models to identify primary risk factors

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Objective: This study aims to evaluate the impacts of exposure to phenolic compounds on liver function, while also using machine learning models to identify primary risk pollutants.

Methods: Based on the Henan rural cohort, this cross-sectional study enrolled 876 normal glucose tolerance (NGT) individuals and 860 impaired fasting glucose (IFG) individuals. Ultra-performance liquid chromatography tandem mass spectrometry was utilized to measure the levels of endocrine-disrupting chemicals, including bisphenol A (BPA), bisphenol E (BPE), bisphenol P (BPP), bisphenol S (BPS), bisphenol Z (BPZ), methyl paraben (MeP), ethyl paraben (EtP), propyl paraben (PrP), butyl paraben (BuP), and benzyl paraben (BzP). Linear models, the quantile-based g-computation (QGC) model, the Bayesian Kernel Machine Regression (BKMR) model, and a machine learning model were employed to assess the associations between single- and mixed-exposure and liver injury indicators.

Results: In the IFG group, linear regression, QGC models, and BKMR models all showed positive associations of exposure with Aspartate aminotransferase and Fibrosis-4 index, in which EtP, BuP, BPS, and BPZ were found in single-exposure models and EtP, as well as BPZ, contributing mostly among mixed-exposure models. In addition, QGC and BKMR models presented an increased Aspartate aminotransferase-to-platelet ratio index with mixed exposure. However, no significant results were found in the NGT group. By integrating the results of the ML model and the mixed-exposure analysis, for the IFG population, EtP, BuP, BPP, BPZ, and BPE were risk factors for AST, Fib-4, and APRI. Subgroup analysis showed more evident results in females, with IFG having a significant modifying effect.

Conclusion: Phenolic compound exposure was associated with impaired liver function among the IFG population. EtP, BuP, BPP, BPZ, and BPE were identified as primary risk factors for liver fibrosis indicators. IFG females demonstrated a stronger association between mixed exposure to phenolic EDCs and liver fibrosis indicators, and hyperglycemia modified the association.

sciforum-126857: Evaluating the Combined Effects of Pesticides and Heavy Metals on Human and Honey Bee Health: A One Health Perspective

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The synergistic impact of pesticides and heavy metal exposure poses significant risks to both human health and honey bee populations, necessitating a comprehensive One Health assessment. This study integrates findings from recent research to evaluate the combined effects of these environmental contaminants. Pesticides and heavy metals, which are prevalent in agricultural and industrial settings, exhibit enhanced toxicity in co-exposure, leading to severe physiological and ecological consequences. This paper will specifically explore the mechanisms and outcomes of combined exposure and toxicity, providing case examples from both experimental and field-based studies. For humans, this synergistic toxicity manifests in increased oxidative stress, disruption of endocrine functions, and heightened risks of chronic diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders. Honey bees, who are crucial pollinators in ecosystems, suffer from impaired neural functions, reduced foraging efficiency, and increased mortality rates, which can lead to significant declines in pollination services and biodiversity. The One Health approach underscores the interconnectedness of human, animal, and environmental health, advocating for integrated strategies to mitigate these risks. By addressing combined exposure to pesticides and heavy metals, this assessment aims to inform policy decisions and promote sustainable practices that safeguard health across species and ecosystems. Ultimately, this holistic perspective emphasizes the need for collaborative efforts among scientists, policymakers, and stakeholders to develop effective interventions that protect both human and environmental health. Such collaborative efforts are essential for ensuring the resilience and sustainability of ecosystems, which, in turn, support human well-being and biodiversity.

sciforum-124621: Exposure assessment outside and inside firefighters' respiratory protection system: Levels of PAHs and associated in vitro toxicity

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Structural firefighting exposes firefighters to intense physical and thermal stress, and emissions of health-burden compounds [*e.g.*, particulate matter and polycyclic aromatic hydrocarbons (PAHs)]. The use of a self-contained breathing apparatus (SCBA) is mandatory during structure fires, although in the overhaul phase, firefighters often remove it. The characterization of inhaled PAHs during structure fires remains scarce, particularly for European firefighters. This study assessed, for the first time, the levels of PAH in the air of firefighters outside and inside the SCBA during training firefighting activities and at fire stations on regular working days. The control group included 13 male volunteer firefighters without active participation in firefighting in the previous 7 days, while the exposed group included 31 professional sapper firefighters. Outside PAHs were monitored with a pre-treated polyurethane foam (PUF), placed in the personal protective equipment, while a cotton disk was placed inside the SCBA. PAHs were quantified by high-performance liquid chromatography. Total PAH levels in PUFs of exposed firefighters were higher than PUFs from the control group (11.5–28.0 μg/m^3 *versus* 1.41 μg/m^3), and significantly higher than levels detected inside the SCBA (1.96-10.40 ng/m^3). Regarding carcinogenic PAHs, levels quantified outside the SCBA were higher for exposed firefighters than the control group (5.80-17.2 μg/m^3 *versus* 0.84 μg/m^3), and superior to the inside SCBA' levels (0.77-0.93 ng/m^3) (p0.005). International occupational guidelines were not exceeded. The inside–outside ratios (1) suggested that ambient PAHs contributed to the levels quantified inside the SCBA. Extracts collected outside and inside the SCBA caused cytotoxicity in human alveolar and bronchial cell lines. Moreover, the collected samples were applied to an *in vitro* co-culture air–blood barrier model to assess permeability. Carcinogenic benzo(*a*)pyrene (100%) permeated the model. Overall, the negative effects of fire emissions on human respiratory cell lines were confirmed, suggesting that fire pollutants contribute to firefighters' respiratory health burden.

sciforum-124919: ^{210}Po and ^{210}Pb content and radiation safety of worldwide tea brands

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Tea stands as one of the most widely enjoyed beverages globally. Given the escalating environmental pollution with toxic substances such as pesticides, metals, and radioactivity, it is crucial to conduct monitoring studies on the presence of radionuclides in the environment, especially when the EU Council Regulation 2016/52/Euratom systematized the emergency limits on radionuclides in foods, including ^{210}Po, the most critical radionuclides from the ingestion pathway. This study widely presents the content of radiotoxic radionuclides, the alpha emitter ^{210}Po and the beta emitter ^{210}Pb, in 141 different tea brands collected from 18 countries worldwide. The concentrations of ^{210}Po of analyzed teas ranged from 1.64±0.09 Bq·kg^{-1} in green tea from Columbia (Valle de Cauca), up to 59.5±1.60 Bq·kg^{-1} also in green tea but from China (Zhejiang). Similarly to ^{210}Po, the highest concentration of ^{210}Pb activity was observed in green tea from China (Jiangxi), at 72.2±2.74 Bq·kg^{-1}, while the lowest in the leaves of the rooibos plant (Aspalathus linearis) from South Africa (Cedarberg), which ranged 0.46±0.04 Bq·kg^{-1}. All ^{210}Po and ^{210}Pb activity concentration values in examined teas are presented. The effective annual radiation doses and cancer risk resulting from consuming tea infusions were also calculated based on the measured activity concentrations. The research findings and outcomes highlight that consuming the investigated teas is safe from a radiological perspective.

sciforum-123459: ^{241}Am in the bottom sediments of the southern Baltic Sea

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Based on observations of ^{241}Am in dated sediments, we studied the history of isotope accumulation in these sediments and evaluated their contamination level and distribution in the sediment cores. The fieldwork and sampling collection in the presented project were performed during a cruise on the r/v Oceania, which belongs to the Polish Academy of Sciences (IO PAN). Sediment cores were collected from various locations in the southern Baltic Sea: the Bornholm Deep, the Gdansk Deep, and the Gotland Deep.

An analytical method for determining Am was adapted to analyse ^{241}Am in environmental and biological samples, which relies on the sequential use of ion exchange (Dowex 1x8) and extraction chromatography (UTEVA and TRU) to obtain a pure radioactive source of ^{241}Am. The procedure was developed using the tracer ^{243}Am isotope and alpha spectrometry. The accuracy of the procedure was tested using the reference materials IAEA-300, IAEA-384 and IAEA-385.

The results showed that in bottom sediment samples taken in 2010, the activity concentrations of ^{241}Am in the Gdańsk Deep ranged from 0.009±0.003 (k=2) to 0.938±0.070 Bq·kg^{-1}, and those in the Gotland Deep ranged from 0.024±0.004 to 2.57±0.19 Bq·kg^{-1}. For bottom sediment samples collected in 2019, ^{241}Am activity concentrations in samples from the Bornholm Deep ranged from 0.030±0.012 to 0.85±0.06 Bq·kg^{-1}, and those in the Gdańsk Deep ranged from 0.24±0.017 to 1.59±0.12 Bq·kg^{-1}, while those in the Gotland Deep ranged from 0.017±0.002 to 2.25±0.16 Bq·kg^{-1}.

sciforum-125260: A study evaluating the performance of the GHS Mixtures Equation for predicting the acute oral toxicity (LD_{50}) of spray adjuvants

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Spray adjuvants are products used with pesticides to improve their application or effectiveness. While exempt from federal pesticide registration by the US Environmental Protection Agency (US EPA), California law requires their registration as pesticides before sale or use. The California Department of Pesticide Regulation evaluated the suitability and acceptability of the United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS) Mixtures Equation for predicting the acute oral toxicity of spray adjuvants as an alternative to requiring in vivo animal toxicity testing. The GHS Mixtures Equation estimates the acute oral toxicity (LD_{50}) of a mixture by combining individual LD_{50} values of component ingredients. This study compared the results of the acute oral toxicity categories derived from the GHS Mixtures Equation with toxicity categories determined from in vivo oral studies for 51 mixtures. The results showed that the availability of LD_{50} values for the relevant ingredients in the mixture limited the equation's predictivity. The equation predicted the LD_{50} values for 67% (N = 34) of the dataset. When these datasets were further compared against the US EPA toxicity classification system, the GHS Mixtures Equation results achieved 71% concordance, with toxicity either over-classified (6%) or under-classified (22%) by one category. Most discordant results were for spray adjuvant mixtures with LD_{50} > 2000 mg/kg (limit test), particularly when 20% or more of the components had unknown LD_{50}s (N = 5). Finally, when compared against the US Occupational Safety and Health Administration's GHS classification system, our results showed 82% concordance with 15% over-classified and 3% under-classified by one toxicity category (N = 34). Overall, the findings indicate that the GHS Mixtures Equation can reliably predict acute oral toxicity in low-toxicity mixtures, provided that all active ingredients have known LD_{50}s and that fewer than 20% of the components have unknown LD_{50}s.

sciforum-130178: A Toxicity assessment of metyltetraprole, a novel fungicide inhibitor, to embryo/larval zebrafish (Danio rerio)

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Strobilurins are a prominent class of fungicides capable of entering aquatic environments via runoff and leaching from the soil. Findings from previous studies suggest that strobilurins are highly toxic in aquatic environments, and evidence of acute developmental toxicity and altered behavioral responses have been emphasized. The objective of this study was to assess the effects of a new strobilurin, metyltetraprole (MTP), on zebrafish using developmental endpoints, gene expression, and behavioral locomotor assays. We hypothesized that MTP would cause developmental toxicity and induce hyperactivity in zebrafish (*Danio rerio*). To test this, developing zebrafish embryos/larvae were exposed to environmentally relevant levels of MTP (0.1, 1, 10, and 100 μg/L) until 7 days post-fertilization. Results showed no statistically significant difference in survivorship across the treatment groups. No change in reactive oxygen species production was found, but two genes involved in the mitochondrial electron transport chain (*mt-nd3* and *uqcrc2*) were altered following MTP exposure. Moreover, the highest concentrations (100 μg/L) of MTP caused notable hyperactivity in the zebrafish in the visual motor response test. Overall, results from this study improve our understanding of the sub-lethal effects of MTP, helping to inform risk assessment for aquatic environments.

sciforum-125047: Apicultural Contaminants as Emerging Food Safety Hazards: The Case of Acaricides

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Bee products are widely consumed and valued for their nutritional and therapeutic properties. However, these products are increasingly at risk of contamination due to the routine use of acaricides in apiculture to control *Varroa destructor*, a major parasitic threat to honeybee colonies. When improperly applied or overused, these chemical treatments can leave residues in bee-derived foods, representing an emerging hazard to food safety and consumer health. This study presents a comprehensive review of acaricide residues in bee products across Europe and Turkey, emphasizing their potential impact on human exposure. The literature review covered a six-year period (2019–2024) and included original research articles published in English, retrieved from Scopus, Web of Science, and PubMed. Selection criteria included studies analyzing more than 15 samples, using validated analytical methods and covering a broad range of bee-related matrices (pollen, bee bread, honey, beeswax, royal jelly, and propolis). The review focused on residues from seven pesticide families, including neonicotinoids, fungicides, herbicides, acaricides, insecticides, inert ingredients, and glyphosate-related compounds. The data were compiled in collaboration with over 20 international researchers. The most frequently reported residues were fluvalinate, coumaphos, amitraz, and chlorpyrifos, frequently found in beeswax compared to other bee products. These compounds, some of which are persistent and bioaccumulative, may pose chronic toxicological risks, including endocrine disruption and neurotoxicity. This work emphasizes the need for continuous monitoring and risk assessment of apicultural contaminants and highlights the importance of integrating food safety considerations into pest management strategies in beekeeping.

sciforum-122889: Arterial Damage Associated with Chronic Exposure to Glyphosate and Dichlorophenoxyacetic Acid: A Study in Rats

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Introduction: Atherosclerosis is a chronic inflammatory disease which can culminate in significant cardiovascular manifestations. Some pesticides have been implicated in atherogenesis. Glyphosate and dichlorophenoxyacetic acid (2,4-D) are the most widely used herbicides in crops worldwide. The objective of this study was to compare the potential for arterial damage from chronic inhalation and oral exposure to the herbicide glyphosate and 2,4-D in rats. Methods: This study was approved by the Animal Use Ethics Committee of the proposing institution (Protocol 6724). Seventy adult male Wistar rats were distributed into 14 groups: 2 control groups (exposed to distilled water via inhalation and oral route), 6 groups exposed to glyphosate, and 6 exposed to 2,4-D (n=10/group). The animals were exposed to three doses of each herbicide via inhalation (inhalation groups) and in the diet (oral groups): low concentration, 3.71 x 10^{-3} grams of active ingredient per hectare (g.a.i./ha); medium concentration, 6.19 x 10^{-3} g.a.i./ha; and high concentration, 9.28 x 10^{-3} g.a.i./ha. The experiment lasted six months. The aorta was collected for histological analysis. Results: Fatty streaks were observed only in animals exposed to herbicides (p0.0001), with no difference regarding the route of exposure (oral or inhalation) (p>0.05). Animals exposed to GBH had twice as many cases of cholesterol streaks than those exposed to 2,4-D (p0.05). There was no significant difference in the thickness of the aorta between those exposed and those not exposed (p>0.05). Animals exposed to 2,4-D showed a greater fractal dimension of the nuclei when compared to animals exposed to GBH and those in the control group (p0.05). Conclusions: Both herbicides have atherogenic potential, but this is greater in exposure to GBH. Animals exposed to 2,4-D have the largest nuclear fractal dimension, showing that this herbicide causes greater nuclear reactivity of the aortic wall.

sciforum-126771: Assessing the cyto-genotoxic effects of 2,4,6-Tribromophenol and its musty-smelling derivative 2,4,6-Tribromoanisole.

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2,4,6-Tribromophenol (TBP) is a widely used flame retardant and biocide. Studies have detected TBP in a variety of human samples, such as blood and urine, and linked it to thyroid dysfunction, carcinogenicity and reproductive toxicity. Additionally, TBP is a precursor of 2,4,6-Tribromoanisole (TBA), a characteristic musty/corky-smelling compound with an odour threshold concentration (OTC) of 0.008-10 ng L^{-1}. TBA is commonly formed through microbial methylation of TBP in environmental conditions. Compounds belonging to the Taste and Odor category have attracted substantial interest from the scientific community, and considering that water is vital for life, the possible adverse effects of these compounds on humans are of great concern.

Given that TBP and TBA can co-exist in the environment, and consequently, humans can be exposed to both of them, the possible adverse effects of the individual compounds, as well as their mixture, was investigated. A Cytokinesis-Block Micronucleus (CBMN) assay was utilized in order to evaluate the possible cyto-genotoxic effects of the aforementioned compounds. CBMN is a simple, rapid and reliable method.

In this study, whole blood was exposed to representative concentrations of each compound and their mixture (0.125 -1 mg L^{-1}). Based on the preliminary results, TBP presented significant genotoxic effects only at the highest tested concentration. Genotoxic effects were also observed at the highest concentrations of the mixture. This work highlights the importance of the cyto-genotoxic evaluation of compounds that commonly co-exist in the environment as mixtures.

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sciforum-123079: Assessing the Toxicity of Bisphenol A Alternatives Using a 3D Zebrafish Liver Cell Model

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Plastic products, such as bisphenol A (BPA), are widely released into the environment, causing adverse effects in aquatic organisms. In response to regulatory restrictions on BPA, structurally similar bisphenol analogues have been introduced as alternatives. However, these compounds often lack comprehensive toxicological evaluation and may pose comparable or even greater environmental risks.

This study investigated the toxicity of BPA, two BPA analogues (BPAP and BPAF), and one BPA monomer derivative (BADGE·2HCl) using zebrafish liver (ZFL) cell spheroids. ZFL spheroids were exposed to 5 µM for acute exposure (24 hours) and 1–5 µM for chronic exposure (6 days). Afterwards, metabolic activity, changes in gene expression and alterations in the lipidome were evaluated.

For acute exposure, upregulation of *cyp1a* expression was detected after exposure to BADGE·2HCl, suggesting activation of xenobiotic metabolism pathways. For chronic exposure, ATP levels decreased at 5 µM for BPAP, BPAF, and BADGE·2HCl. Notably, chronic exposure to BADGE·2HCl (1–5 µM) and BPA (5 µM) caused significant alterations in membrane lipid composition, predominantly affecting phosphatidylcholines, ether-linked phosphatidylcholines, and phosphatidylethanolamines, lipids essential for maintaining membrane integrity. Additionally, exposure to 5 µM BADGE·2HCl led to a substantial upregulation of ceramides and sphingomyelins, which are associated with mitochondrial dysfunction and apoptotic pathways.

In conclusion, BADGE·2HCl elicited the most pronounced alterations in lipid metabolism, followed by BPA. The results highlight the need for more rigorous testing and stricter regulatory measures to mitigate the potential environmental and health risks posed by these compounds. Moreover, this study highlights the utility of ZFL spheroids as a robust in vitro model for evaluating the chronic toxicity of environmental contaminants, offering a physiologically relevant alternative to traditional monolayer cultures.

sciforum-125537: Assessing variability of heavy metal concentrations in follicular fluid: insights from novel ICP-MS/MS methodology and previously published studies

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Introduction: Environmental heavy metals have been associated with female infertility. Follicular fluid (FF), which envelops the oocyte, offers insights into element composition. Nevertheless, standardized studies on its trace elements remain limited. Due to its direct contact with the oocyte, FF is a critical medium through which heavy metal concentrations can significantly impact female fertility. Last year, our group attempted to detect 22 analytes (Ba, Be, Bi, Cd, Ce, Co, Cr, La, Li, Mn, Mo, Ni, Pb, Rb, Sb, Sn, Sr, Ti, Tl, U, V, Zn) in four FF samples from patients undergoing in vitro fertilization, using ICP-MS/MS without sample digestion. Consequently, a novel and reliable methodology was developed. This study aimed to compare our results with previous reports, analyze their similarities and differences, and identify possible causes.

Methods: An exhaustive literature search was conducted using adequate keywords. Relevant data were extracted for comparison, considering the type of matrix analyzed, the method used, and the elements detected. Finally, these were compared with those obtained by our group in a database.

Results: Of our 22 analytes, values were available for 16 of them, as the remaining ones were not detected (Be, Ce, Cd, La, Pb, and U). Comparable values for 13 of the 16 elements were found in the literature, as there is no published data on FF regarding Bi, Sb, and Rb. Some of the comparisons showed very similar data, but most presented considerable variations.

Conclusions: Although there is similarity in some of the data compared, great variability still exists. This may be due to different factors, such as the methodology used in each case, lifestyle habits, occupational exposure, place of residence, pathologies, or demographic factors. Further study in this field is necessary in order to homogenize conditions and obtain more robust results of analysis regarding potentially toxic elements.

sciforum-125421: Assessment of endocrine-disrupting chemicals in companion animals

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Endocrine-disrupting chemicals (EDCs) can interfere with hormone signalling, posing a significant risk to animal and human health. Usually, EDCs are environmental pollutants and, due to their lipophilic nature, can accumulate in fat tissues, leading to chronic exposure and serious health issues, such as endocrine-related neoplasia. Companion animals, particularly dogs and cats, are frequently exposed to EDCs at higher rates than their owners, owing to their proximity to the ground and their behaviours.

Despite increasing concern regarding EDC exposure, most biomonitoring studies to date have focused on humans and livestock, with limited attention given to pets. This study aimed to assess the presence of EDCs in the adipose tissue of dogs and cats diagnosed with hormone-sensitive neoplasms. Biological samples were collected from animals with and without neoplasia (i.e., a control group) at veterinary care centres across the north of Portugal. Clinical and pathological data, along with lifestyle information obtained through in-person questionnaires, were also gathered. A broad range of persistent and emerging EDCs were quantified using gas chromatography after a single ultrasound-assisted extraction (UAE) method was performed. Statistical data analysis was conducted to explore associations between EDC exposure and various clinical/pathological characteristics or animal habits. The findings from this research could provide valuable insights into the risks posed to pets by EDCs and support the development of improved strategies for the prevention, diagnosis, and treatment of endocrine-related diseases in companion animals.

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sciforum-125032: Assessment of potentially toxic elements in the peritoneal fluid of patients with ovarian endometrioma, peritoneal endometriosis, and deeply infiltrative endometriosis: differences between entities

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Introduction: Endometriosis is a chronic gynecological disease affecting up to 7 - 10% of menstruating individuals worldwide. To date, its etiopathogenesis remains largely unknown, with environmental factors such as potentially toxic elements (PTEs) being contributors.

Methods: Peritoneal fluid (PF) samples were collected from 13 patients with superficial peritoneal endometriosis (SUP), 13 with ovarian endometrioma (OMA), 4 with deeply infiltrative endometriosis (DEEP), and 13 non-endometriosis controls. The samples were collected between June 2020 and September 2022 from patients who underwent laparoscopic procedures within the Gynecology Service of a University Hospital in San Juan (Spain). The group classification was based on surgical findings and histopathological reports. After sample processing, the PF was stored in the dark at -20°C until analysis by inductively coupled plasma tandem mass spectrometry (Agilent 8900 ICP-MS/MS). Statistical analyses were performed using IBM SPSS Statistics version 28.0 (IBM, Armonk, NY, USA). Elemental ratios were calculated by normalizing the average concentration of each element to that of the control group.

Results: The concentration of Fe was significantly elevated in the OMA group compared to the control group (p=0.005), with mean concentrations of 8,172 ± 13,361 and 967 ± 1,524 μg L^{-1}, respectively. No statistically significant differences were found when comparing the elemental concentrations in SUP and DEEP with those in the control group. When examining the elemental ratios (threshold of >1.5), elevated levels were observed as follows: the levels of Fe and Co were above average in SUP, OMA, and DEEP; the level of Ba was above average in OMA and SUP; the level of Pb was above average in SUP and DEEP; the levels of Cd and Mn were above average in OMA; and finally, the levels of Cu and Zn were above average in DEEP. Distinct patterns of Spearman correlations between the elements were identified depending on the specific endometriosis entity.

Conclusions: These findings suggest that multielemental profiles in peritoneal fluid vary according to the specific endometriosis entity.

sciforum-125648: Associations between occupational exposure to endocrine-disrupting chemicals and sperm quality

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Declining male fertility rates have become a significant global health concern, with potential implications for individual reproductive health and broader societal demographics. Increasing evidence from animal and human studies suggests a strong link between occupational exposure to endocrine-disrupting chemicals (EDCs) and impaired sperm quality. EDCs are exogenous substances that interfere with the normal function of the endocrine system, potentially disrupting hormonal balance and reproductive processes. Occupational settings, particularly in industries like agriculture, manufacturing, and waste management, often involve exposure to complex mixtures of these EDCs, raising significant concerns about their cumulative impact on male reproductive health. The aim of this study is to determine the associations between occupational exposure to EDCs and sperm quality using data from the CHAPS-UK study. This was a multi-centre case-referent study of male infertility that recruited men who were part of couples attempting conception without success for at least 12 months. The study involved 2,249 men who were recruited over the period of 37 months, between January 1999 and February 2002. Risk factors associated with low sperm motility and adverse sperm morphology were identified, including glycol ether exposure. Exposure to potential EDCs will be estimated for their men and their mothers using a previously developed job exposure matrix, and the associations between exposure and sperm quality (concentration, motility, and morphology) will be determined.

In addition to synthesising the existing knowledge on this topic, this study seeks to bridge critical gaps in understanding the reproductive toxicity of EDCs. The findings are expected to provide valuable insights into preventing and mitigating EDC-related health risks, guiding regulatory policies and public health interventions to reduce exposure and protect reproductive health.

sciforum-125427: Azithromycin reshapes the effect of toxic Microcystis aeruginosa on the grazing behavior of Daphnia similis at environmentally relevant concentrations

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The irregular disposal of effluents and agropastoral waste promotes artificial eutrophication, favoring the proliferation of cyanobacteria in water bodies. In addition to nutrients, antibiotics frequently reach these environments, further limiting water quality and impacting aquatic biota. During the SARS-CoV-2 pandemic in Brazil, the indiscriminate use of azithromycin (AZT) significantly increased its concentrations in water bodies, with concentrations reaching up to 2.85 µg L^{-1}, a value four times higher than that reported before the pandemic. This study investigated the effect of environmentally relevant concentrations of AZT on the feeding behavior of the zooplankton *Daphnia similis* in the presence of the toxic cyanobacterium *Microcystis aeruginosa* (LETC-MC-25). After 12 h of starvation, two individuals per replicate (n = 4) were incubated for 6 hours in tubes containing 20 mL of RT medium with different diets (chlorophytes and/or cyanobacteria, totaling 1000 µgC L^{-1}) and AZT concentrations (0.3, 0.6, and 3.0 µg L^{-1}), totaling 16 treatments. A control with chlorophytes, individual treatments, and combinations of the antibiotic with cyanobacteria at concentrations of 125, 250, and 500 µgC L^{-1} were evaluated. Isolated exposure to AZT did not significantly alter the feeding behavior of the organisms. In contrast, a single exposure to *M. aeruginosa* reduced the clearance rate by up to 34%. However, in combined exposures, a significant increase in clearance rates was observed, indicating greater consumption of toxic cells in the presence of the antibiotic. This increase was 16% for 125 µgC L^{-1} of *M. aeruginosa* combined with 0.3 µg L^{-1} of AZT, and between 33.7% and 61.8% for 250 µgC L^{-1} of *M. aeruginosa* combined with 0.3-3.0 µg L^{-1} of AZT. These results suggest that azithromycin enhances the consumption of toxic cyanobacteria, increasing the risk of exposure to their toxins. Therefore, it is essential to investigate the combined effects of antibiotics and cyanobacteria on non-target species.

sciforum-125431: Comprehensive multiclass method for the determination of pesticide residues and selected mycotoxins in nuts using liquid chromatography with tandem mass spectrometry: Single Laboratory Validation

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Highlights

- For the first time, simultaneous analysis of pesticide residues & mycotoxins in nuts
- Acetonitrile based sample preparation provided satisfactory extraction
- Two step cleanup strategy effectively minimised the matrix effects
- The performance of the method complied with the national (FSSAI) and international regulatory requirements and guidelines

For the first time, a multiresidue analytical method is reported for the simultaneous analysis of multi-class pesticides and mycotoxins in nuts (groundnut, almond, cashew and pistachio). The optimised sample preparation method involved comminution with water, extraction by acetonitrile and cleanup using dispersive solid phase extraction with a C_{18} sorbent followed by a freezing step at - 80º C. The final analysis was carried out using liquid chromatography coupled with tandem mass spectrometry. The method performance was evaluated on 208 multi-class pesticides and mycotoxins [aflatoxins and ochratoxin A]. The strategies minimised the matrix effects and achieved suitable LOQs for checking regulatory compliance. The findings indicated satisfactory recoveries (70 - 110 %) at LOQ of 0.01 mg/kg and higher levels with repeatability 16 % RSD. Notably, the extraction and analysis using a single chromatographic run provided satisfactory selectivity, sensitivity, quantification, and accuracy (recovery and precision) for target compounds during single laboratory studies. The developed method complied with the regulatory requirements as well as international analytical quality control guidelines.

sciforum-122607: Dietary Exposure to Arsenic in the Cuban Population: Results from a Total Diet Study

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Arsenic (As), particularly in its inorganic form (iAs), is a toxic metalloid commonly found in food and associated with various health risks. This study assessed dietary exposure to total arsenic (t-As) and estimated inorganic arsenic intake in the Cuban adult population using a Total Diet Study (TDS). A 24-hour dietary recall survey was conducted with 450 individuals from different regions of Cuba. A total of 107 commonly consumed food items were purchased, prepared as typically consumed, and grouped into 17 categories. The samples were digested and analyzed by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) to quantify t-As. Estimated Daily Intake (EDI), Target Hazard Quotient (THQ), and Carcinogenic Risk (CR) were calculated. The highest concentrations of t-As were detected in the fish and seafood group (0.288 µg/g), followed by rice (0.032 µg/g) and vegetables (0.018 µg/g). The estimated intake of t-As was 54.6 µg/day. Assuming that 10% corresponds to iAs, the intake of inorganic arsenic was estimated at 5.46 µg/day. The THQ for iAs was 0.22, suggesting no significant non-carcinogenic risk. However, the CR for iAs was $1.0 \cdot 10^{-4}$, indicating a potential lifetime cancer risk for 10 individuals per 100,000, which falls within the acceptable risk range. In conclusion, while total arsenic intake in the Cuban population complies with national limits, the presence of iAs may still pose a low but noteworthy cancer risk. Continued monitoring and public health interventions are recommended to minimize exposure through dietary sources.

sciforum-122626: Effective pesticide degradation and toxicity control through selective oxidation of permanganate

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In recent years, many new pesticides have been developed to meet the growing agricultural demands driven by global population growth. Unfortunately, this has led to their frequent detection in aquatic ecosystems, posing risks to non-target organisms and human health through environmental pollution and dietary exposure. Therefore, there is an urgent requirement to develop effective technologies to remove these pesticides from the environment. However, due to the complexity of pesticide structures, their degradation products are commonly unknown, and may result in new environmental risks.

Permanganate is a strong oxidant, plays a vital role in drinking water purification, groundwater remediation, and wastewater treatment. It does not introduce new pollutants and its reduction product, manganese dioxide, can also act as a coagulant to further remove pollutants.

In this study, we used experimental and theoretical methods to explore how potassium permanganate degrades pesticides. The reaction between permanganate and quinclorac was firstly studied, showing a bimolecular reaction mode, which is stable in a wide pH range. The UPLC-Q-TOF-MS analysis showed that the initial product was mono-hydroxylated quinclorac, which was formed by permanganate oxidation at the benzene ring and could be further oxidized to a less toxic catechol structure.

It is then hypothesized that permanganate oxidation is selective for certain functional groups, better than non- selective oxidants like hydroxyl radical. Then the imidacloprid degradation by permanganate was further studied. The reaction was stable and efficient near neutral pH and different ion strengths. Background substances like humic acid and chloride ions in water barely affected degradation. UPLC-Q-TOF-MS analysis showed that the main pathway was C-H bond hydroxylation on the imidazole ring, and finally leading to the breakage of the imidazole ring. Toxicity analysis with the ECOSAR program showed that the degradation products of imidacloprid by permanganate oxidation was less toxic to aquatic organisms.

sciforum-129909: Environmental Exposure Assessment among Infant via Diapered Urine Analysis: A Challenge of Methodology

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Introduction

Assessment of environmental exposure using biological samples such as urine is non-invasive. However, most infants wear disposable diapers.

Therefore, extraction urine from diapers is a challenge step before laboratory analysis. This study aims to develop and validate a method for detecting ten hydroxylated polycyclic aromatic hydrocarbons (OHPAHs) in diapered urine.

Methods

Ten individual adult urine samples (≈100 mL) were employed to experiment. Thirty millimeters of urine were pass through the diaper and extract diaper urine (DU) with 50 mL of 50 g/L calcium chloride ($CaCl_2$) solution. The DU extract was measured calcium ion using atomic absorption spectroscopy (AAS). Then 10 mL aliquot of extracted DU along with normal individual urine (U) were acidified to pH 5.0, hydrolyzed with β-glucuronidase, and clean up the extract using solid phase extraction (C18 OH). Ten OHPAH metabolites (2-hydroxynaphthalene (2-OHNap), 1-hydroxynaphthalene (1-OHNap), 2+3-hydroxyfluorene (2+3-OHFlu), 2-hydroxyphenanthrene (2-OHPhe), 3-hydroxyphenanthrene (3-OHPhe), 9-hydroxyphenanthrene (9-OHPhe), 1-hydroxyphenanthrene (1-OHPhe), 4-hydroxyphenanthrene (4-OHPhe) and 1-hydroxypyrene (1-OHP)) were quantified using High Performance Liquid Chromatography with Fluorescence Detection (HPLC-FLD) with deuterated internal standards (1-OHP-d9 and 1-OHNap-d7) to ensure accuracy. The detected OHPAHs concentrations of DU and U were compared and discussed.

Results

We found that the recovery rates of OHPAH metabolites from DU compared to U ranged from approximately 34 to 94%, with the highest recoveries observed for 4-OHPhe (94%) and 1-OHPhe (92%), followed by 1-OHP (87%), 2-OHPhe (68%), 2+3-OHFlu (47%), 3-OHPhe (41%), 2-OHNap (40%), 9-OHPhe (36%), and 1-OHNap (34%).

Conclusions

This study developed and validated a method for detecting OHPAH metabolites in infant diaper urine, with recovery rates ranging from 34% to 94%. Lower recoveries for some metabolites suggest losses during extraction from diaper, and interference of high calcium levels in diaper-extracted urine with enzymatic hydrolysis. Further study is warranted to address these challenges.

sciforum-125102: Environmental Toxins in the Beehive: GC-Based Detection of Pesticides in Royal Jelly

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The progressive decline in pollinator populations, particularly bees, has become a pressing concern in recent years. One of the key contributors to this phenomenon is the infestation by parasitic mites such as *Varroa destructor*, which compromises bee health and compels apiculturists and agricultural producers to intensify the use of acaricides. As a result, residues of the previous mites can be transferred into the food supply via edible bee-derived products and agricultural commodities. Ensuring consumer safety in relation to said toxic products requires the implementation of stricter pesticide regulation and improved apicultural management, which in turn depends on robust analytical monitoring of hive products.

In this context, a gas chromatography mass spectrometry-based method was developed and validated for the simultaneous determination of seven commonly applied pesticides in Spain, atrazine, chlorpyrifos, chlorfenvinphos, α-endosulfan, bromopropylate, coumaphos, and τ-fluvalinate, specifically in royal jelly. The extraction procedure employed a mixture of hexane and isopropanol, followed by a clean-up using primary and secondary amine (PSA) as a sorbent. Chromatographic separation was achieved on a DB-5MS capillary column using a temperature gradient program. The method was validated according to current EU guidelines, evaluating parameters such as selectivity, detection and quantification limits, linearity, matrix effects, accuracy, and precision. Analysis of nine royal jelly samples revealed the presence of chlorfenvinphos in eight samples and α-endosulfan in one, with six samples exceeding the maximum residue limits set by European legislation.

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sciforum-121039: Evaluation of radioactivity in chanterelle (*Cantharellus cibarius*) and health implications

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The contamination, accumulation, spatial distribution, and potential health risks of cesium ^{137}Cs, polonium ^{210}Po, radiolead ^{210}Pb, and potassium ^{40}K in chanterelles collected across Poland were examined using validated methodology and gamma-ray and alpha-particle spectrometric measurements. Values of anthropogenic ^{137}Cs activity concentration in mushrooms were between 118 and 1647 Bq·kg^{-1} dry weight (dw), while for natural ^{40}K, they were from 1316 to 1895 Bq·kg^{-1} dw. The activity concentrations of ^{210}Po in chanterelles were between 2.23 and 8.57 Bq·kg^{-1} dw, and in forest topsoil, between 11.4 and 83.0 Bq·kg^{-1} dw, while corresponding values for ^{210}Pb were 1.50-6.14 and 7.74-46.1 Bq·kg^{-1} dw, respectively. The obtained results varied significantly: the highest values of activity concentrations were determined for ^{40}K, while the lowest were for ^{210}Po and ^{210}Pb. Studies have shown that lamellae mushrooms, such as chanterelles, may contain higher activity concentrations of polonium ^{210}Po and radiolead ^{210}Pb than tubular mushrooms, but a broader study is recommended. ^{137}Cs is an anthropogenic contaminant present in the environment as a result of global atmospheric fallout. An assessment of the values of annual radiation doses and cancer risk related to ^{137}Cs, ^{40}K, ^{210}Po, and ^{210}Pb consumed with chanterelle showed that ^{137}Cs and ^{210}Po induce a similar risk, but 2-3 orders of magnitude higher than that of ^{40}K and ^{210}Pb.

sciforum-124939: Exploring the association between exposure to multiple toxic metals and endometriosis risk using Bayesian Kernel Machine Regression: evidence from peritoneal fluid

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Introduction: Endometriosis is a chronic gynecological disorder affecting approximately 7–10% of menstruating individuals worldwide. Despite its high prevalence, the etiopathogenesis of endometriosis remains largely unclear. Emerging evidence suggests that environmental contaminants such as cadmium (Cd), nickel (Ni), and lead (Pb) may contribute to its development.

Methods: Peritoneal fluid (PF) samples were obtained from 50 subjects (25 controls and 25 patients with endometriosis) attending the Gynecology Service of San Juan University Hospital in Spain between June 2020 and September 2022. Samples were processed and analyzed by inductively coupled plasma tandem mass spectrometry (Agilent 8900 ICP-MS/MS). Statistical analyses were conducted using IBM SPSS Statistics version 28.0 (IBM, Armonk, NY, USA) and Bayesian Kernel Machine Regression (BKMR) was performed in R (version 4.4.3, package “bkmr” and “ggplot2”) to provide new insights into the effects of Cd, Pb, and Ni on endometriosis risk.

Results: Cadmium levels were significantly higher in the endometriosis group compared to the control group (0.71 ± 0.94 vs. 0.25 ± 0.22 µg/L, p=0.009). The BKMR model using PF concentrations of Cd, Ni, and Pb revealed a positive trend in endometriosis risk with increasing metal exposure. However, this combined effect was not statistically significant, and none of the metals showed an independent association with the disease.

Conclusions: Although no statistically significant associations were observed, the positive trend in the combined effect of Cd, Ni, and Pb suggests a potential role of metal mixtures in endometriosis pathogenesis. This lack of statistical significance may be related to sample size limitations and inherent variability in peritoneal fluid composition. Nevertheless, the observed trend is consistent with the previous literature on the endocrine-disrupting properties of these metals. These findings highlight the importance of considering environmental mixtures in research on reproductive health and gynecological diseases, and emphasize the need for larger studies to better understand these associations.

sciforum-128362: From bacteria to fish: ecotoxicological insights into the bioinsecticide Spinosad

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Background: Spinosad, a natural bioinsecticide derived from *Saccharopolyspora spinosa*, is widely used in agriculture due to its high selectivity toward target pests and low environmental persistence. However, its increasing application raises concerns about its potential toxic effects on non-target species, especially under environmentally relevant exposure scenarios. This study aimed to evaluate the acute toxicity and sublethal biochemical effects of Spinosad across multiple aquatic species, representing different trophic levels.

Methods: A multi-species ecotoxicological assessment was conducted to evaluate the sensitivity of model aquatic species to Spinosad. Standardized acute toxicity tests were performed with *Aliivibrio fischeri* (bacteria), *Raphidocelis subcapitata* (algae), *Daphnia magna* (crustacean), and *Danio rerio* embryos (fish). In addition, biochemical biomarkers were analyzed in *D. magna* and *D. rerio* to assess oxidative stress (catalase [CAT], glutathione S-transferase [GST] activities), lipid peroxidation (thiobarbituric acid reactive substances [TBARSs]), and neurotoxicity (acetylcholinesterase [AChE] inhibition) effects.

Results: Spinosad exhibited a wide range of toxicities among the tested species, with EC_{50} values of 105.66 mg/L for *A. fischeri*, 3.93 mg/L for *R. subcapitata*, 0.018 mg/L for *D. magna*, and 1.37 mg/L for *D. rerio embryos*, indicating increasing sensitivity from prokaryotes to invertebrates. Biochemical assays revealed that even at environmentally relevant concentrations (~0.4 μg/L reported in surface waters), Spinosad induced significant oxidative stress, enhanced lipid peroxidation, and inhibited AChE activity in *D. magna* and *D. rerio* embryos, suggesting sublethal but ecologically relevant effects.

Conclusions: The ecotoxicological profile of Spinosad demonstrates its high toxicity to aquatic invertebrates and its potential to disrupt key physiological processes in fish at low concentrations. These findings highlight the need for more comprehensive environmental risk assessments that consider both acute and chronic toxicity and sublethal biomarker responses, particularly under realistic exposure scenarios. Monitoring Spinosad levels in freshwater ecosystems is crucial in order to safeguard aquatic biodiversity and guarantee the health status of aquatic ecosystems.

sciforum-125638: Genotoxicity and cytotoxicity induced by water and sediment samples from river systems in *Vicia faba* root cells

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In the context of the Anthropocene, river ecosystems have been profoundly altered by the intensification of anthropogenic activities that modify their physical, chemical, and biological characteristics. The continuous discharge of urban, industrial, and agricultural effluents has generated a substantial deterioration in water quality, compromising biodiversity and ecosystem functions. Globally, it is estimated that approximately 50% of major river systems are polluted; in Mexico, this figure reaches nearly 60%, underscoring the urgency of implementing bioindicator tools for environmental assessment and monitoring. The objective of this study was to evaluate the genotoxic and cytotoxic potential of water and sediment samples from the Briones and Negros rivers (Tlaxcala, Mexico) by applying the micronucleus (MN) test and the comet assay in Vicia faba cells. Spot sampling was carried out during the rainy and dry seasons at five representative sites. The results showed statistically significant increases (p 0.05) in MN frequency, DNA fragmentation, and a reduction in the mitotic index (MI) in most of the samples evaluated compared to negative controls. Marked spatial and temporal variability was observed, suggesting differential exposure to toxic agents. The presence of compounds such as polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides, and heavy metals is postulated as a possible cause of the observed effects. These findings confirm the existence of contaminants with genotoxic and cytotoxic potential in the studied water bodies, which represent not only a threat to the ecological integrity of aquatic ecosystems but also a latent risk to human health. The implementation of comprehensive genotoxicological monitoring programs is recommended, as well as the development of strategies for ecological restoration and mitigation of anthropogenic impacts.

sciforum-126411: Growth Response and Phytoremediation of Copper and Chromium in Dumpsite Leachate by Common duckweed (*Lemna minor* L.): A Case Study of A Market Dumpsite in Maiduguri, Nigeria

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Water safety in low- and middle-income countries is an issue of serious concern globally. Heavy metals in leachates from residential dumpsites and other businesses affect water quality due to their non-biodegradability and toxicity. Copper (Cu) and chromium (Cr) in water pose a danger to local ecosystems and public health. This study determined the growth response and phytoremediation of Cu and Cr in market dumpsite leachate using a floating aquatic plant, common duckweed (*Lemna minor*), as a locally applicable, cost-effective and eco-friendly solution. The plant was exposed to different concentrations of leachate for 14 days. Growth and the physicochemical parameters were measured. Ourresults showed a significant reduction in Co, Cr, electrical conductivity (EC), total dissolved solids (TDS), salinity, oxidation-reduction potential (ORP), and dissolved oxygen (DO) at 50% v/v concentration of the leachate. The pH increased from slightly alkaline to more alkaline at the same concentration. The number of fronds, biomass, relative growth rate, and chlorophyll contents decreased significantly at 100% v/v. This finding indicates that *L. minor* can tolerate and remediate 50% v/v of dumpsite leachate. Further studies arerecommended to evaluate other environmental and eco-physiological factors to improve the phytoremediation of leachate using this plant in Maiduguri metropolis and beyond.

sciforum-125488: In silico study of organophosphorus pesticides' ability to bind to the ABCG2 transporter in the context of health risks associated with breastfeeding.

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Introduction

ATP-binding cassette transporter G2 (ABCG2) is an efflux transporter responsible for pumping compounds out of cells. It influences systemic exposure and pharmacokinetics of compounds by reducing their absorption in the gastro-intestinal tract and regulating tissue distribution and excretion. The ABCG2 protein is responsible for the detoxification of tissues, but also for multi-drug resistance in cancer therapies. One of the possible routes for the excretion of compounds facilitated by ABCG2 is via mother's milk, so the binding of compounds to this transporter may be a risk factor during breastfeeding. In this study, organophosphorus pesticides were analyzed in the context of their ability to reach mother's milk by facilitated rather than passive diffusion, using the ABCG2 transport protein.

Material and Method

A total of 18 organophosphorus pesticides were subjected to molecular docking using the AutoDock Vina method. The 3D cryo-electron microscopy structure of the ABCG2 transporter bound to a ligand denoted as BWQ (PDB code: 6FFC) was obtained from the RCSB Protein Data Bank as a template for in silico calculations. The structure of the target protein was prepared by removing heteroatoms, crystallographic water and ions. The dimensions of a docking grid box were 30 Å x 30 Å x 30 Å, and the center coordinates were 131, 127 and 145 (x, y and z, respectively).

Results

It was established that the organophosphorus pesticides exhibit relatively strong affinities for the studied transporter (ca. -7 to -10 kcal/mol) and the protein–ligand interactions occur mainly by hydrogen bonds, carbon–hydrogen bonds, π–π stacking or van der Waals forces. The main aminoacid residues responsible for the binding of each pesticide to the target protein were identified.

Conclusions

Based on the results of in silico calculations, it may be concluded that the studied pesticides are likely to reach mother's milk by facilitated diffusion or mixed mechanisms. Further studies of the stability of protein–pesticide complexes are underway.

sciforum-124640: Influence of urban pollution and smoking in human salivary nitrate concentrations:negative result

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Urban runoff is a major source of nitrate pollution in rivers, posing significant risks to environmental health and public safety, especially in densely populated cities [1]. Additionally, due to the aging process used to make cigars, cigar tobacco contains high concentrations of nitrogen compounds, including nitrates [2]. When ingested, nitrate can react with amines and amides to form N-nitroso compounds (NOCs), which may cause cancer in humans [3]. It is known that salivary glands actively concentrate plasma nitrate into saliva, leading to salivary nitrate levels about 10 times higher than in plasma [4]. Considering that urban or smoker populations might have higher nitrate exposures, we hypothesized that such exposure could be detected through increased salivary nitrate levels. Twenty-one saliva samples were collected in Portugal, comprising 11 samples from rural residents (3 non-smokers and 8 smokers) and 10 from urban residents in Lisboa (5 non-smokers and 5 smokers). After centrifugation and dilution, nitrate levels were determined based on a previously established method using UV spectrophotometry [5]. Mann--Whitney tests were performed to assess differences between groups. Data analysis by rural/urban residence showed no significant difference ($p>0.05$), with similar salivary nitrate levels: 4.36±0.28 and 4.40±0.26 mg/L in rural and urban populations, respectively. Similar results ($p>0.05$) were found when considering smoking as a factor, with 4.45±0.36 mg/L in non-smokers and 4.42±0.46 in smokers. These findings suggest that salivary nitrates do not reflect nitrate exposure due to urban living or smoking, or that nither factor substantially increases nitrate body burden. As this study is preliminary, further research with a larger sample is needed for clarification.

sciforum-117043: Ion chromatographic profiling of major anions in sweet corn genotypes: implications for food safety and health risks

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Sweet corn is an important crop and a high-demand commodity, generating substantial revenue in both its fresh and processed forms; it holds significant value in human nutrition due to its rich content of carbohydrates, dietary fiber, vitamins, and essential minerals, serving as a good source of energy while supporting digestive health. Monitoring the major inorganic anions in sweet corn kernels is essential for evaluating food safety compliance, quality attributes, and agricultural impact; while anions such as phosphate, sulfate, and chloride contribute to nutritional benefits, elevated levels of nitrate and nitrite pose potential health risks. Consequently, monitoring these anions is critical for consumer safety, supports quality control during processing, and provides insights into soil fertility and fertilizer efficiency. This study aimed to determine the major inorganic anions in twelve sweet corn genotypes from the University of Agricultural Sciences and Veterinary Medicine Cluj Napoca. Ion chromatographic analysis was performed using a Shimadzu instrument with non-suppressed conductivity detection, equipped with an Allsep Anion 7u column, achieving simultaneous determination of chloride, nitrite, nitrate, phosphate, and sulfate in under 15 minutes. Minimal sample preparation involved blending of representative kernels in ultrapure water, followed by membrane filtration. The results revealed distinct chromatographic fingerprints among genotypes: phosphate concentrations reached 58.65 mg/kg, chloride concentrations reached 27 mg/kg, sulphate concentrations reached 14.23 mg/kg, and nitrate concentrations reached 7.15 mg/kg, while nitrite was detected in only three samples, with a the maximum concentration of 0.41 mg/kg. These findings highlight significant variability in anion content across sweet corn genotypes, demonstrating that ion chromatography is a reliable and efficient tool for assessing sweet corn's nutritional quality and safety. By identifying potential food hazards and promoting environmental sustainability, these findings support improved agricultural practices and breeding programs and the development of functional foods that cater to health-conscious consumers.

sciforum-130027: Leukocyte Telomere Length and PM2.5 Exposure Among Adults in Chiang Mai, Thailand

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Telomere length (TL) is a critical biomarker of cellular aging and has been increasingly associated with fine particulate matter (PM2.5) exposure. This study investigates the profile of leukocyte TL with ambient $PM_{2.5}$ exposure among adults residing in Chiang Mai, Thailand. A total of 182 participants were enrolled, consisting of 72% females, aged between 23 and 66 years, and stratified into three age groups: under 35 (n = 36), 35–49 (n = 88), and 50 years old or older (n = 58). Relative TL was measured from blood leukocytes using quantitative polymerase chain reaction (qPCR), with results expressed as the telomere-to-single-copy gene (T/S) ratio. $PM_{2.5}$ levels were retrieved from local monitoring stations and averaged across lag periods (in weeks). The mean TLs for participants aged 35, 35–49, and ≥50 were 0.83 ± 0.17, 0.81 ± 0.15, and 0.82 ± 0.13, respectively ($P > 0.05$), with no significant differences observed in age, BMI, smoking status, or gender among the groups. The mean PM2.5 concentration for Lag03 (3 weeks prior) was 45.9 ± 2.92 μg/m³, ranging from 42.6 to 51.2 μg/m³. Adjusting for age, BMI, smoking status, and gender, the multivariable linear regression model showed that $PM_{2.5}$ Lag03 was a significant predictor of TL, indicating that higher short-term $PM_{2.5}$ exposure was associated with longer relative TL (B = 0.019, 95% CI = 0.11–0.29, β = 0.368, p 0.001). In this study, TL was similar across the three age groups, while the overall TL values were much shorter than those found in a previous study of healthy nonsmokers in Chiang Mai (TL range: 1.35–1.00). Differences may stem from environmental exposures, measurement methods, or lifestyle. Further studies should explore the effects of PM2.5-bound chemicals, such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals, especially in the context of long-term exposure.

sciforum-124824: Multiple Physiological Alterations in a Cosmopolitan Fish, *Cyprinus carpio* Exposed to Malathion

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Organophosphates (OPs), commonly used pesticides to increase agricultural production with minimal labor efforts, unknowingly affect non-target animals. Amongst OPs, malathion (MAL) is a neuro- and immunotoxic and widely used. This investigation aimed to understand the multiple physiological responses in common carp exposed to MAL. In this study, acute toxicity test showed 6.75 mg/L as LC50 in 96 h, following which, a separate sublethal toxicity test was conducted (28 d), having environmentally realistic (2.618 μg/L) and higher concentrations (0.675 & 1.35 mg/L). In higher exposures, selected transcripts such as acetylcholinesterase (*Ache*) and component complement-3 (*c3*) levels significantly decreased. While, hematological parameters [(total erythrocytes (TEC), hemoglobin (Hb), hematocrit (Ht), Mean Corpuscular Hemoglobin (MCH), and Mean Cell Hemoglobin Concentration (MCHC)] reduced with an increase in MAL levels except for total leucocytes (TEC), which increased significantly (P0.05). Further, histomorphology of the brain revealed disparaging alterations such as degenerated neurons, pyknosis, vacuolization, increased fibrous components, and focal necrosis with MAL exposure. Whereas gills showed hyperplasia, telangiectasia, and fused lamellae, and kidney revealed damaged glomeruli, increased lumen, and exudates. While the liver exhibited a shrunken central vein, thickened bile duct, and dilated portal vein, with exposure. Collectively, the study revealed that MAL is neuro- and immuno-toxic and damages the microarchitecture of the tissues. The non-judicious application of MAL leads to harmful effects, hence, usage should be monitored regularly.

sciforum-125580: Pesticide Residues as a Converging Threat to Ecosystem Integrity and Public Health

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Introduction: Pesticides, while integral to modern agricultural practices, pose substantial risks to both environmental integrity and human health. Their extensive application results in the pollution of air, water, soil, flora, and animal feed, resulting in bioaccumulation within the food chain. Furthermore, research indicates that pesticide residues are among the most prevalent dietary pollutants. **Methods**: A comprehensive literature search was conducted across four major databases—PubMed, Google Scholar, NIH, and ScienceDirect. Relevant and recent studies focusing on pesticide residues in food products and their environmental and health impacts were selected. **Results**: Numerous studies have confirmed that persistent pesticide residues are contributing to reduced soil biodiversity, water contamination, and the decline of non-target species such as pollinators, aquatic organisms, and mammals. Furthermore, pesticides disrupt beneficial soil microorganisms, affect food safety, and contribute to long-term environmental degradation through bioaccumulation and chemical stability. Human exposure generally occurs through ingestion, inhalation, and skin contact, especially via the intake of contaminated food and water. Pesticides are linked to several health effects, including acute poisoning, endocrine disruption, reproductive dysfunction, immunosuppression, neurological illnesses, and various types of cancer. **Conclusions**: Achieving meaningful progress requires a concerted effort from all stakeholders—governments must implement robust regulatory frameworks and incentives, farmers should embrace agroecological strategies such as integrated pest management and crop diversification, and consumers need to support sustainably grown foods while minimizing waste. By fostering collaboration across sectors, we can move toward resilient food systems that prioritize environmental sustainability and human health.

sciforum-125584: Physicochemical Alterations of LDPE Microplastics During Simulated Gastrointestinal Digestion

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Microplastics (MPs) are widespread environmental contaminants that are increasingly detected in food chains and human tissues. While traditionally considered chemically inert, recent studies suggest that MPs may undergo surface and chemical transformations upon exposure to physiological environments. The human gastrointestinal (GI) tract presents dynamic conditions, including enzymatic activity, pH shifts, bile salts, and microbial interactions, which can modify the structure and behavior of MPs. These digestion-related transformations may influence MPs' bioavailability, toxicity, and ability to interact with biological systems.

This study investigated the surface-level transformations and chemical composition of low-density polyethylene (LDPE), a polymer commonly found in food packaging, during simulated gastrointestinal digestion. LDPE samples were subjected to a standardized in vitro digestion protocol that mimicked oral, gastric, and intestinal phases. Samples were collected at each stage and analyzed using Fourier-transform infrared spectroscopy (FTIR) to assess the surface chemical changes.

The FTIR spectra revealed consistent differences between the virgin and digested LDPE samples. The digested samples exhibited lower overall transmittance, suggesting surface alterations. The reduction in the intensity of the CH_2 rocking peak (~719 cm^{-1}) indicated a potential decrease in crystallinity. The methyl group peak (~1379 cm^{-1}) was absent, and the CH_2 bending region (~1460 cm^{-1}) showed slight shifts and intensity changes, possibly linked to the degradation or structural rearrangement of the polymer chain. Additionally, a new band appeared at approximately 2070 cm^{-1} in the oral and gastric phases, which may be associated with degradation products or contaminant residues.

These findings demonstrate that gastrointestinal conditions can alter the physicochemical properties of LDPE microplastics, particularly at the surface level. Such modifications could enhance their ability to adsorb or transport toxic substances, potentially increasing biological interactions and health risks. Understanding these transformations is critical for the accurate toxicological risk assessment of ingested MPs.

sciforum-130035: Potential of wood-based activated carbon to mitigate toxic element uptake in spinach for safe consumption

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Toxic elements (TEs) are characterized by high toxicity, even at low concentrations, and have the potential to induce various harmful effects in living organisms. Pollution with TEs constitutes a major concern in the agricultural sector, as they decrease crop growth, yield, and food quality. Soil amendments derived from agricultural byproducts and waste can improve physicochemical properties, fertility, and plant growth in TE-contaminated soils by providing nutrients and reduce the TEs' bioavailability. Due to its high surface area, porosity, and adsorption capacity, activated carbon emerges as a promising solution for removing TEs, increasing soil nutrient levels, and improving soil water holding capacity and aeration, consequently improving crop nutrition. A pot experiment was conducted to study the effect of wood-based activated carbon on the growth of spinach and the bioavailability of Cd and Cr in soils artificially contaminated at a concentration level of 10 mg/kg. Mixtures of TE-contaminated soil and wood-based activated carbon at 0% (control), 0% (contaminated control), 1.0%, 1.5%, and 2% were prepared in plastic pots and used as substrates for cultivating 15-day-old nursery spinach (*Spinacia oleracea* L. var. Matador) plants. The utilization of 2% wood-based activated carbon significantly increased shoot weight, as well as soil pH and organic matter content. The application of 2% wood-based activated carbon also reduced TE concentrations by 35% for Cd and 55% for Cr in shoots, and by 45% for Cd and 50% for Cr in roots, respectively, compared to the contaminated control group. Amendment with 2% wood-based activated carbon can immobilize Cd and Cr in soil and increase the chlorophyll and carotenoid contents in spinach grown in soils artificially contaminated with Cd and Cr. However, further research is needed to identify the optimal application rate and long-term effects of wood-based activated carbon amendments to enhance soil quality and promote plant growth in contaminated soils.

sciforum-129981: RNA m6A reader YTHDF3/UBE2G2 m6A methylation/ACSL4 ubiquitination axis-facilitated cell ferroptosis to mediate benzene hematotoxicity and the protective effect of melatonin

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Introduction: Long-term benzene exposure results in hematotoxicity. N6-methyladenosine (m6A) is a type of post-transcriptional modification and plays roles in various diseases. However, the role of m6A modification in benzene hematotoxicity is still unclear.

Methods: m6A epitranscriptomic and RNA-seq analyses were conducted to explore the effect of benzene on the m6A level and expression of mRNAs. Benzene-induced hematotoxicity mouse models and melatonin intervention models were constructed, and RIP, MeRIP, and Co-IP assays were used to investigate the role of m6A in benzene hematotoxicity and the protective effect of melatonin.

Results: We found that benzene altered m6A methylation of various mRNAs and identified a key m6A-methylated mRNA, ubiquitin-conjugating enzyme E2 G2 (UBE2G2), through GO analysis. m6A reading proteins recognized m6A modifications to regulate mRNA's fate. By searching an m6A target prediction website, we discovered that the m6A reader YTHDF3 bound with the UBE2G2 m6A site, and we also validated their interactions via RIP and MeRIP assays. Mechanistically, benzene exposure resulted in low expression of YTHDF3, which down-regulated the mRNA's stability and expression of UBE2G2 through the recognition of m6A modification. Moreover, overexpression of YTHDF3 mitigated UBE2G2 reduction, which further confirmed their regulatory relationship. UBE2G2 regulates proteins' ubiquitination to affect their expression. Through a Co-Immunoprecipitation assay and functional analysis, we demonstrated that ubiquitination modified ACSL4 due to UBE2G2-mediated benzene-induced lipid peroxidation and ferroptosis. Moreover, melatonin alleviated benzene-induced hematotoxicity by modulating the YTHDF3/UBE2G2/ACSL4 axis.

Conclusions: The m6A reader YTHDF3/UBE2G2 m6A methylation/ACSL4 ubiquitination axis facilitated cell ferroptosis to mediate benzene hematotoxicity, and melatonin had an alleviating effect on benzene hematotoxicity.

sciforum-130054: The association between organophosphate insecticide metabolites (DAPs) and COPD: multi model epidemiological analysis and network toxicology analysis

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Background and Aims

In the general population, there is little epidemiological evidence linking exposure to organophosphate pesticides (OP) to lung function. The aim of this study is to explore the relationship between urinary OP metabolites and chronic obstructive pulmonary disease (COPD).

Material and method

9291 participants (including 2598 patients with chronic obstructive pulmonary disease) were included in the National Health and Nutrition Examination Survey from 1999 to 2012 and from 2015 to 2017. We used weighted logistic regression, combined with quantile g calculation (Qg) and weighted quantile sum (WQS) regression to evaluate the relationship between individual or mixed exposure to OP and COPD, and further explored the molecular mechanism of increased COPD risk caused by OP exposure through bioinformatics analysis, providing ideas for the prevention and treatment of COPD.

Result

Dimethyl phosphate (DMPT) (OR=1.15, 95% CI: 1.01, 1.22), diethyl thiophosphate (DEPT) (OR=1.29, 95% CI: 1.21, 1.38), dimethyl dithiophosphate diester (DMDTP) (OR=1.25, 95% CI -1.20, 1.29), and diethyl dithiophosphate (DEDTP) (OR=1.54, 95% CI: 1.40, 1.70) are significantly associated with an increased risk of COPD. The QG results showed that mixed OP exposure significantly increased the risk of COPD (OR=1.58, 95% CI: 1.47, 1.70, P0.001), and the weights of DMPT, DEPT, DMDTP, and DEDTP were relatively high. In the WQS model, co exposure to OP mixture is significantly associated with an increased risk of COPD. (OR=1.8; 95% CI: 1.67, 1.94). The COPD target genes associated with OPs exposure are mainly enriched in pathways related to inflammation, infection, metabolism, and hormone regulation.

Conclusion

Exposure to OPs increases the risk of COPD through a mixed effect, emphasizing the significant impact of OPs and the need to prioritize the regulation of high-risk components such as DMPT, DEPT, DMDTP, and DEDTP.

sciforum-129241: The Ecotoxicological Effects of Metformin under Global Warming Scenarios: *Daphnia magna* and *Danio rerio* Insights

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Background: Diabetes Mellitus (DM) is a major global health issue, affecting over 500 million people. Metformin (MET), an antihyperglycemic drug prescribed for Type II DM treatment, is frequently detected in aquatic environments due to its widespread use and poor removal capacity from wastewater. Concomitantly, freshwater ecosystems are also threatened by other environmental stressors, including global warming, making it necessary to understand the interactions between anthropogenic and climate-related pressures. This study aimed to assess the ecotoxicological effects of metformin on *Daphnia magna* and *Danio rerio* under rising temperature scenarios. **Methods:** *D. magna* acute immobilization (48 h; 0.00–120 mg MET/L; 20 ± 1°C) and *D. rerio* Fish Embryo Acute Toxicity (FET) (96 h; 0.00–3000 mg MET/L; 26 ± 1°C) assays were performed following OECD guidelines. *D. magna* feeding inhibition assays (24 h; 0.00–80 mg MET/L; 20 ± 1°C) were conducted following previous works (standard temperature). The same bioassays were also performed with a 4°C temperature increase (projections by the IPCC until 2100), i.e., 24 ± 1°C for *D. magna* and 30 ± 1°C for *D. rerio*. **Results:** At standard temperature, MET induced acute toxicity in *D. magna* (LC_{50} (48 h) = 70.64 mg/L; EC_{50} (48 h) = 53.67 mg/L) and reduced feeding rate (EC_{50} = 54.18 mg/L). In *D. rerio*, MET had no significant effects on mortality and hatching but induced malformations (scoliosis and edema). MET exposure induced oxidative stress and neurotoxicity in *D. magna* and altered the homeostasis of the antioxidant and detoxification enzymes in *D. rerio* larvae. Increased temperature influenced MET's toxic effects, affecting individual and sub-individual responses. **Conclusions:** This study showed that increased temperatures (based on global warming projections) influence MET toxicity at the individual and sub-individual level, with *D. magna* showing higher sensitivity. The combined effects of rising temperatures and MET pollution underscore the vulnerability of freshwater environments.

sciforum-127813: The Hidden Threat of Combined Stressors: The Influence of Temperature and pH on Antibiotic Toxicity in *Danio rerio*

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Background: Aquatic ecosystems are increasingly subjected to overlapping stressors, including rising temperatures, pH variations, and antibiotic contamination (e.g., sulfamethoxazole—SMX, trimethoprim—TRIM, and their mixture—MIX). These abiotic factors may interact in complex ways, altering antibiotic toxicity and impairing key biological processes in aquatic organisms. This study aims to contribute significant data to bridge the gap regarding the combined impacts of environmental stressors, particularly in a climate change context, underscoring the need for integrative studies. **Methods:** We evaluated the chronic effects of environmentally relevant concentrations of SMX (150 µg/L), TRIM (30 µg/L), and their mixture (150 µg SMX/L + 30 µg TRIM/L) on *Danio rerio* after exposure to various i) temperatures (26, 28, and 32 °C) and ii) pH values (6.5, 7.5, and 9.0). A multi-biomarker approach was applied to assess antibiotic ecotoxicity and the biological health status of *D. rerio*. **Results:** Temperature and pH variations affected the antibiotic's toxicity to *D. rerio*. At 28 °C, SMX and MIX exhibited moderate toxicity, inducing significant biological alterations (neurotoxicity and DNA damage), while TRIM showed only slight toxicity, mainly altering antioxidant/detoxification defenses. At 32 °C, MIX emerged as the most toxic compound, causing genotoxic and histopathological damage. In terms of the influence of pH, SMX had a greater impact under low-pH conditions (pH 6.5 and 7.5), leading to oxidative stress, lipid peroxidation, and DNA damage. In contrast, TRIM and MIX showed increased toxicity at neutral-to-alkaline pH (7.5 and 9.0), with notable impairment of antioxidant defenses, as well as DNA and histopathological injuries. **Conclusions:** The results highlight the urgent need for integrated studies that address chemical pollutants and climate change-related stressors. Ignoring these combined pressures could lead to long-term impacts on aquatic biodiversity and ecosystem stability. These findings reinforce the importance of comprehensive risk assessments that consider the potential amplification of pharmaceutical toxicity under changing environmental conditions.

sciforum-124522: The potential for fetal lead exposure in utero due to contamination of cow's milk or soy-based beverages sold on the Portuguese market

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Pollution with lead (Pb) constitutes a primary route for the contamination of foods like cow's milk (CM) or soya beverages (SBs), which are frequently consumed on a daily basis [1]. Even at low exposure levels, Pb is toxic; no level is safe, with effects seen at blood Pb concentrations of just 3.5 µg/dL [2], which is the current Blood Lead Reference Value of the Centers for Disease Control and Prevention. In alignment with this value, the US Food and Drug Administration (FDA) establishes an Interim Reference Level (IRL) for dietary Pb of 8.8 µg/day for females of childbearing age (FCBAs), considering the potential for fetal Pb exposure [3]. The objective of this work was to assess whether the exposure to Pb of FCBAs through the consumption of CM or SB brands available on the Portuguese market was higher than the FDA's IRL. The lead levels of 14 CM and 14 SB brands were determined by Atomic Absorption Spectrophotometry. Three CM or SB consumption scenarios were considered: the estimated adult CM consumption in Portugal [4], and the minimum and maximum recommended CM consumption (MinC and MaxC) [5]. For the estimated CM intake, totalling 0.1 L/day, all the analysed samples exceeded the FDA's IRL. However, for MinC (0.5 L/day), 42 and 21% of the CM and SB brands, respectively, surpassed the IRL; in this scenario, the mean Pb exposure from the 14 analysed CM brands was 9.66 µg/day, and the mean Pb exposure from the 14 SB brands was 6.72 µg/day. Regarding MaxC (0.75 L/day), 64 and 42% of the analysed CM and SB brands, respectively, surpassed the FDA's IRL; the mean Pb exposure from the CM brands was 14.49 µg/day, and from the SB brands, it was 10.08 µg/day. Although CM constitutes a higher contributor to dietary Pb exposure than SBs, greater efforts must be made to control the exposure of FCBAs to Pb through the consumption of both food products.

sciforum-125585: The toxicological effects of α-cypermethrin on placental oxidative balance in a rat model

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α-Cypermethrin, a synthetic pyrethroid, is highly lipophilic, allowing it to accumulate in fatty tissues, the liver, and the brain, and potentially cross the placental barrier. Although α-cypermethrin primarily acts by disrupting neuronal sodium channel function, its potential to induce oxidative stress highlights an additional pathway of toxicity. Pyrethroids are nowadays recognized as potential endocrine disruptors, with oxidative stress suggested as a mechanism linking exposure to adverse health outcomes. This study aimed to investigate the effects of α-cypermethrin exposure on oxidative stress induction by analyzing relevant biomarkers (malondialdehyde, MDA; reactive oxygen species, ROS; reduced glutathione, GSH; and activities of catalase, CAT, superoxide dismutase, SOD, and glutathione peroxidase, GPx) in the placentas of pregnant rats exposed to 1, 10, or 19 mg/kg/day throughout gestation. A dose-dependent increase in ROS production and lipid peroxidation, as indicated by elevated MDA levels, was observed. These elevated MDA concentrations likely resulted from the lipophilic nature of α-cypermethrin, which facilitates its penetration into cell membranes, promoting lipid peroxidation. GSH levels remained unchanged across all exposure groups. Although CAT and GPx activities decreased, SOD activity was consistently elevated in all samples, indicating compensatory activation of the antioxidant defense system. The most pronounced disruption of oxidative--antioxidant balance occurred at the lowest tested dose (1 mg/kg). These findings suggest that α-cypermethrin induces oxidative stress in sensitive tissues such as the placenta, potentially contributing to disruption of the endocrine system.

sciforum-125623: Update on pesticides in European agriculture: toxicity, persistence and ecosystem risks

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To meet the global demand for food due to the world's rapidly growing population , pesticides are widely used worldwide. Modern agriculture has been enhanced by the use of pesticides to control many phytopathogenic infections. In 2020, pesticide concentrations exceeded the threshold of concern at 22% of European river and lake sampling points. Likewise, 83% of agricultural soils tested in 2019 contained pesticide residues. Fungicides and bactericides was the top selling pesticide group in 2022. In agriculture, the use of agrochemicals is justified for three main reasons: (a) increased production, (b) improved crop quality, and (c) reduced labor and energy consumption in production. Tang et al., (2021), found that 64% of the world's agricultural land (roughly 24.5 million km²) is at risk of pesticide contamination due to the presence of more than one active ingredient, and 31% is at high-risk zones. This staggering figure emphasizes the need for heightened safety measures and public awareness of pesticide use. The extensive persistence of these inputs results in their potential bioaccumulation in non-target organisms, resulting in their detection across diverse biotic matrices. Given the interconnectedness of organisms in trophic networks, these residues can spread through trophic transfer and affect food webs. The greater the volume of pesticides applied on land, the greater the spread to the aquatic ecosystem through meteorological activities, creating serious ecotoxicological risks. Therefore, the aim of this systematic review is to investigate the most widespread pesticide formulations used on crops, their acute and chronic toxicity, persistence and associated risks to human health.

sciforum-130059: Volatile organic compounds in indoor air of residences of fungus-related allergic airway disease patients

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Introduction: Allergic bronchopulmonary mycosis (ABPM) is an allergic airway disorder caused by fungal colonization within the respiratory tract. Although pharmacological treatment can lead to temporary remission, the recurrence rate remains high. Therefore, controlling fungal contamination in residential environments is considered essential for both the prevention and management of ABPM and/or other fungus-related allergic airway diseases. The aim of this study was to assess the state of fungal contamination in indoor environments through the observation of volatile organic compounds (VOCs). Methods: Two survey visits were conducted during the autumn seasons of 2020 and 2021 at 17 residences of patients diagnosed with fungus-related allergic airway diseases. VOCs in the indoor air of living rooms were collected using a passive flux sampler over a 24-hour period in principle. Following collection, 23 types of VOCs were quantified by gas chromatography–mass spectrometry and converted to air concentrations using theoretical sampling rates. These VOC concentrations were then compared with the fungal contamination inside air conditioners installed in the respective living rooms. Results: Indoor air concentrations of 23 VOCs—considered to originate from building materials, microorganisms, and the human body—were obtained. No consistent trends were observed in the levels or compositions of VOCs among the 17 residences. However, geosmin concentrations in indoor air showed significant correlations with fungal contamination detected on the heat exchanger (r=0.47, p =0.006) and vents (r=0.37, p=0.034) of the air conditioners used in these residences. Conclusion: Geosmin in indoor air may serve as an indicator of fungal contamination within air conditioner units, which are often not visibly contaminated.

Session 5. Exploring Non-Model Species for Ecotoxicology

sciforum-118132: Assessing the impact of air pollution on the associated outcomes of bird species in North China Plain

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Background and Objective: Air pollution in the North China Plain frequently exceeds WHO limits and is linked to human respiratory diseases, but its effects on birds remain understudied. This study examines the impacts of air pollutants (AQI, CO, O3, SO2, smoke, and particulate matter) on bird health and behavior in the region, focusing on House sparrows (Passer domesticus) and Rock pigeons (Columba livia). This study includes data from the literature review in December 2023, using Clarivate Analytics

Methods: Data on average air pollution levels, respiratory disease incidence, and behavioral changes were collected from publicly available sources spanning from 2011 to 2023. The study included data from 12 bird colonies and approximately 500 individual birds across the North China Plain. These comprised both migratory and resident species, with a focus on sparrows and pigeons due to their prevalence in the region. The primary species analyzed were House sparrows (Passer domesticus) and Rock pigeons (Columba livia). Behavioral changes were assessed using direct observational studies that were in controlled and natural environments to record alterations in foraging, vocalization, and mobility, respectively. GPS tracking for pigeons was used to monitor flight patterns and homing speed under varying AQI conditions. Respiratory health was evaluated through post-mortem examinations of deceased birds (e.g., lung tissue analysis for lesions or particulate matter accumulation) and non-invasive biomarkers (e.g., nasal swabs and blood tests for inflammatory markers) in live specimens.

Key Findings: High fine particle concentrations were linked to acute respiratory infections and lung damage in sparrows. AQI significantly affected pigeon behavior, with 415 pigeons returning home faster under severe pollution (AQI 144).

Conclusions: Air pollutants are strongly associated with respiratory diseases and behavioral shifts in birds. Mitigating air pollution is critical for avian conservation in the region.

sciforum-130060: Biodegradation of Dianix Yellow Brown Azo Dye by *Paramecium jenningsi* Isolated from Industrial Wastewater

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Introduction:

Azo dyes are widely used in textile industry processes. Due to their persistent and recalcitrant nature, they are classified as xenobiotic compounds resistant to biodegradation. However, recent studies suggest that under specific environmental conditions, certain microorganisms can transform these toxic dyes into colorless, non-toxic compounds or even achieve complete mineralization. This study investigates the biodegradation efficiency of a newly isolated *Paramecium* species in azo dye-contaminated industrial wastewater.

Methods:

A *Paramecium* strain was isolated from industrial wastewater and identified as *P. jenningsi* via 18S rRNA sequencing (NCBI Accession No. MZ540265). Growth optimization was conducted at varying pH (6, 6.5, 7, 7.5, 8, and 8.5) and temperatures (20°C, 25°C, 30°C, and 35°C). Under optimum conditions, *P. jenningsi* was exposed to 20 ppm Dianix Yellow Brown (DYB) azo dye for 30 days. Growth kinetics, morphological changes, and vacuole activity were monitored to assess physiological responses. DYB decolorization was measured using a UV spectrophotometer at 260 nm over 0, 48, 96, and 144 hours. FTIR was used to assess functional group changes, and GC-MS was used to identify dye-degradation metabolites.

Results:

Under optimum pH 7.0 and 25°C, *P. jenningsi* exhibited distinct growth phases, with a 26-fold increase in growth by day 14 in 20 ppm DYB compared to the control. However, reductions in mitosis, motility, and vacuole activity indicated mild DYB toxicity. By 144 hours, 85.43% DYB decolorization was observed. FTIR revealed the loss of azo (-N=N) and amine (C-N) groups, alongside the formation of hydroxyl (-OH) and carbonyl (-C=O) groups, indicating dye transformation. GC-MS profiling suggested a two-step degradation: by day 4, formation of 4-tert-butylaniline, N-trimethylsilyl, 3-hydroxyanthranilic acid, and bis(2-ethylhexyl) phthalate indicated azo bond cleavage; by day 8, pentacosane, octacosane, and eicosane suggested further DYB breakdown into less toxic compounds.

Conclusions:

This study highlights *P. jenningsi* as a promising tool for the bioremediation of azo dye-contaminated wastewater.

sciforum-130087: Comparative Proteomic Analysis of Cadmium Stress Response in a Newly Identified *Paramecium* Species isolated from industrial wastewater

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Introduction:

Microbial-mediated bioremediation offers a sustainable solution for detoxifying polluted environments, but its molecular mechanisms remain poorly understood. Recent advances in multi-omics approaches, particularly transcriptomics, proteomics, and metabolomics, have enabled detailed insight into cellular responses to environmental stressors. In this study, a mass spectrometry-based quantitative proteomic profiling approach was applied to investigate alterations in protein expression in *Paramecium multimicronucleatum* exposed to cadmium (Cd^{2+}), a toxic heavy metal known to cause cellular stress.

Methods:

A mass spectrometry-based quantitative proteomic approach was applied to analyze protein abundance changes in *P. multimicronucleatum* after Cd^{2+} exposure as compared to a control. Samples were processed using the Proteome Discoverer software to identify and quantify peptide spectral matches, total peptides, and proteins. Differential abundance was determined using statistical analysis ($p \leq 0.05$).

Results:

The proteomic analysis identified 7,416 peptide spectral matches, corresponding to 2,824 unique peptides and 989 proteins. Among these, 29 proteins showed statistically significant differential abundance in cadmium-treated samples. Six proteins were upregulated, while twenty-three were downregulated. These proteins were functionally linked to stress responses, energy metabolism, protein degradation, cell growth, and hormone processing.

Conclusions:

This comprehensive comparative proteomic analysis provides valuable insights into the molecular adaptations of *Paramecium* under cadmium stress. The findings contribute to our understanding of metal detoxification pathways, supporting future studies on bioremediation strategies for environmental sustainability.

sciforum-125558: Maternal Transfer of Persistent Organic Pollutants in Green Sea Turtles: Implications for Reproductive Success

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Persistent Organic Pollutants (POPs), including polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and polybrominated diphenyl ethers (PBDEs), are widespread environmental contaminants known to bioaccumulate in marine organisms. On São Tomé Island, where five of the seven sea turtle species occur, green turtles (*Chelonia mydas*) are known to nest regularly. This study assessed POP levels (PCBs, OCPs, and PBDEs) in nesting females and in their eggs to evaluate maternal transference and explore associations with egg morphology, composition, and quality, as well as reproductive success (e.g., hatching rate and emergence rate). Blood samples from nesting females and yolk samples from their freshly laid eggs were analysed, with POPs detected in both, confirming maternal transfer. Transfer rates varied across compounds, influenced by lipophilicity and specific congener properties, indicating distinct transfer efficiencies and pathways. ΣPCBs showed the highest concentrations, followed by ΣOCPs and ΣPBDEs. The yolk of sea turtle eggs, rich in lipids, is the primary energy and nutrient source for developing embryos. Fatty acids (FAs)—the functional components of these lipids—play key roles in membrane structure, metabolism, and embryonic growth. POPs detected in maternal blood were associated with changes in yolk FA profiles, especially within the polar lipid fraction, crucial for metabolic and structural functions. OCPs in maternal blood strongly influenced phospholipid-associated FAs in the yolk, potentially affecting key processes like phospholipid synthesis and eicosanoid production. Maternal blood PCBs levels were associated with reduced egg diameter and yolk weight. Additionally, PBDE-47 levels in egg yolks were linked to lower hatching success, suggesting that contaminant-driven disruption of lipid metabolism may impair embryonic development. This study provides novel data on POP contamination in green turtles from São Tomé, highlighting how maternal exposure can influence egg quality and reproductive output. The findings emphasise the need for continued monitoring and informed conservation strategies for the endangered species.

sciforum-122205: Optimisation of three-dimensional cultures of the RTL-W1 liver cell line to model polycyclic aromatic hydrocarbon effects on liver detoxification

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Climate change-induced stress and increased aquatic pollution, including persistent pollutants such as polycyclic aromatic hydrocarbons (PAHs), disrupt biological functions. Although 3D cell culture systems can be used to better understand these effects, their use in fish studies is currently limited. In this vein, developing and characterising new models is of extreme importance, as these may help to disclose pollutant effects on temperature increase scenarios.

To generate spheroids from the rainbow trout liver-derived RTL-W1 cell line, four cell densities — 10,000, 20,000, 40,000 and 60,000 cells per well — were cultured in 96-well ultra-low attachment (ULA) plates at 18 ºC, with or without centrifugation after seeding. Over 18 days in culture, the spheroids were assessed for viability (using alamar blue and lactate dehydrogenase (LDH) assays), biometry (diameter, area and sphericity) and morphology (optical and electron microscopy). Protein expression of cytochrome P450 (CYP) 1A was assessed by immunocytochemistry (ICC) at 10, 14 and 18 days in culture. To determine its suitability for ecotoxicology research, spheroids (60,000 cells) were exposed from the 10th to the 14th day in culture to two concentrations of the model PAH benzo(k)fluoranthene (BkF), at 18 and 23 ºC. CYP1A immunolabeling and mRNA expression were evaluated after the exposures.

In all culture densities, spheroids' diameter and area decreased over time, while sphericity and viability increased. The biometric parameters remained stable from the 10th day onward. Centrifugation did not impact the spheroids' formation dynamics. Morphological analysis showed unscathed cells and organelle content compatible with hepatocytic differentiation. Spheroids expressed CYP1A in ICC, denoting its functionality. BkF-treated spheroids exhibited increases in both ICC and mRNA expression, but there were no variations in gene expression across temperatures.

The generated spheroids appear to be a promising alternative model for studying PAHs and warming effects on fish liver detoxification.

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