



IOCXe

2026
Conference

The 1st International Online Conference on Xenobiotics

22-23 June 2026 | Online

Program and Abstract Book

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The 1st International Online Conference on Xenobiotics

22–23 June 2026 | Online



Organizing Committee

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Prof. Dr. Stefano Magni

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Table of Contents

Welcome from the Chairs.....	1
Keynote Speakers.....	3
Invited Speakers	4
Program at a Glance	5
IOCXe2026 Program.....	6
Poster List	10
Session 1. Environmental Toxicity, Bioaccumulation and Remediation Strategies.....	15
Session 2. Nanotoxicology and Targeted Pharmacology of Nanomaterials.....	52
Session 3. Emerging Chemicals: Environment Risks and Health Effects	59
Session 4. (Micro)plastic Pollution in Environment and Human.....	108

Welcome from the Chairs

I am pleased to announce **the 1st International Online Conference on Xenobiotics (IOCXe2026)**, organized by the *Journal of Xenobiotics (JoX)* (ISSN: 2039-4713, Impact Factor: 4.4, CiteScore: 6.0), a peer-reviewed and open access journal published by MDPI. This virtual conference will take place online from **22 to 23 June 2026**.

This conference aims to provide a global platform for scientists and researchers to engage in open discussions, address emerging challenges, and share their latest research achievements in the field of xenobiotics.

The conference sessions will include the following topics:

- S1: Environmental Toxicity, Bioaccumulation, and Remediation Strategies;
- S2: Nanotoxicology and Targeted Pharmacology of Nanomaterials;
- S3: Emerging Chemicals: Environmental Risks and Health Effects;
- S4: (Micro)plastic Pollution in the Environment and Human Health.

We invite the submission of abstracts, which will be evaluated by the Conference Committee. All accepted abstracts will be published on the conference website. Furthermore, all participants are encouraged to submit proceedings and full-length papers to the conference's Special Issue in *JoX*, with a **20% discount** on the article processing charge (APC) provided. There is no charge for a proceedings submission.

We warmly invite you to join this virtual event to exchange ideas, foster collaboration, and contribute to the success of IOCXe2026.



Prof. Dr. François Gagné
Conference Chair

Aquatic Contaminants Research
Division, Environment and Climate
Change Canada, Gatineau, QC, Canada



Prof. Dr. Stefano Magni
Conference Chair

Department of Biosciences,
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Milan, Italy



Journal of
Xenobiotics
an Open Access Journal by MDPI

The *Journal of Xenobiotics* (ISSN 2039-4713) is an international, peer-reviewed, open access journal. Our aim is to provide an advanced forum for studies related to all aspects of xenobiotics. The journal publishes reviews, regular research papers, and short communications as well as Special Issues on particular subjects. In addition, manuscripts regarding new and innovative research proposals and ideas are particularly welcome.

The aim of the *Journal of Xenobiotics* is to encourage scientists to publish their experimental and theoretical results in as much detail as possible. 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 should be provided so that the results can be reproduced. Electronic files or software regarding the full details of calculations and experimental procedure can be submitted as supplementary material, if it is not possible to publish them along with the text.

Impact Factor: 4.4 (2024); 5-Year Impact Factor: 5.7 (2024)

Keynote Speakers



Prof. Dr. Mohamed Banni

Laboratory of Agrobiodiversity and Ecotoxicology, Sousse University/Monastir University, Monastir, Tunisia

Prof. Mohamed Banni has held university accreditation in molecular toxicology for 51 years. He is currently leading a research group in the research laboratory of Agrobiodiversity and Ecotoxicology, Sousse University, that is working on ecotoxicological aspects in relation to the effects of emerging contaminants on cellular functions and molecular processes. He is a professor of molecular toxicology at the Higher Institute of Biotechnology, Monastir-Tunisia. He is a visiting professor at the University of Medicine Vanviteli (Napoli) and UPEC (Paris). He has supervised 22 doctoral theses and published 154 scientific articles with an H-index of 56 (number of citations: 8316). He is also a coordinator of the current European projects Next-Med, cross-border and Horizon.

Invited Speakers



Assoc. Prof. Nagaprasad Puvvada

Department of Chemistry, School
of Advanced Sciences, VIT-AP
University,
Amaravati, India



Dr. Célia Ventura

Department of Human Genetics,
National Institute of Health
Doutor Ricardo Jorge, I.P. (INSA),
Av. Padre Cruz, Lisbon, Portugal,
Centre for Toxicogenomics and
Human Health (ToxOmics), NOVA
Medical School, NOVA University
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Dr. Teresa D'Amore

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Rome, Italy



Prof. Dr. Thi-Cuc Le

Department of Marine
Environmental Engineering,
National Kaohsiung University of
Science and Technology,
Kaohsiung, Taiwan



Dr. Christina Emmanouil

School of Spatial Planning and
Development, Aristotle University
of Thessaloniki,
Thessaloniki, Greece

Program at a Glance

	Day 1 22 June 2026	Day 2 23 June 2026
Morning	Session 3. Emerging Chemicals: Environmental Risks and Health Effects	Session 1. Environmental Toxicity, Bioaccumulation, and Remediation Strategies
	Break	
Afternoon	Session 4. (Micro)plastic Pollution in the Environment and Human Health	Session 2. Nanotoxicology and Targeted Pharmacology of Nanomaterials

IOCXe2026 Program

22 June 2026 (Monday)

Session 3. Emerging Chemicals: Environmental Risks and Health Effects

Time: 9:00 (CEST, Basel) | 3:00 (EDT, New York) | 15:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
9:00–9:05	<i>Opening Remark from Conference Chairs</i>	
9:05–9:10	Prof. Dr. Lin-Chi Wang Prof. Dr. Thi-Cuc Le Session Chairs	<i>Welcome from Session Chairs</i>
9:10–9:30	Prof. Dr. Thi-Cuc Le Invited Speaker	Advanced Environmental Monitoring of Airborne Contaminants: Measurement Technologies and Characterization of Ultrafine Particles, VOCs, and POPs
9:30–9:50	Dr. Teresa D'Amore Invited Speaker	From Mechanisms to Decisions: Adverse Outcome Pathways Reshaping the Future of Risk Assessment
9:50–10:05	Jazbia Kanwal Oral Speaker	Perceived BTEX Exposure and Occupational Safety Knowledge, Attitudes, and Practices among Petrol Station Attendants in Islamabad, Pakistan
10:05–10:20	Salman Zeb Oral Speaker	Occurrence, Source Profiles, and Human Exposure to PBDEs and Alternative Brominated Flame Retardants in Vehicle Dust from a Hot-Climate Region
10:20–10:35	Dimitra Florou Oral Speaker	FPSE–LC–MS/MS as a Reliable Tool for Quantifying Drugs of Abuse in Oral Fluid
10:35–10:50	Darija Obradovic Oral Speaker	Biomimetic insights into toxicokinetics and health risks of organic environmental pollutants
10:50–11:05	Tarek M. Abdelghany Oral Speaker	Methylimidazolium Ionic Liquids as Persistent Xenobiotics: Mitochondrial Injury and PDC-E2 Modification Relevant to Autoimmune Liver Disease
11:05–11:20	Daniela Rebelo Oral Speaker	How Climate-Driven Temperature Rise Modulates 4-Chloroaniline Toxicity in <i>Danio rerio</i>
11:20–11:35	Emma Rowan Oral Speaker	Assessing the Sublethal Impacts of Tobacco-Derived Compounds Using <i>Daphnia</i> as a Model Organism
11:35–11:40	Svetlana Fa Nedeljkovic Flash Poster Presenter	Embryonic exposure to di(2-ethylhexyl) phthalate disturbs DNA methylation status of the ovaries in adult female zebrafish and the early development of F1 generation
11:40–11:45	Nicolae Bogdan Stoica Flash Poster Presenter	Acute Aquatic Toxicity of Nepeta Cataria Essential Oil Compared with cis-Trans Nepetalactone in <i>Raphidocelis subcapitata</i> and <i>Daphnia pulex</i> (OECD 201/202)
11:45–11:50	Bárbara S. Diogo Flash Poster Presenter	Interactive effects of temperature, pH, and antibiotics reshape zebrafish physiological stability
11:50–11:55	Anne Leung Flash Poster Presenter	The Impact of Cigarette Filters on Aquatic Ecosystems Using <i>Daphnids</i> as Model Organisms
11:55–12:00	Nabil Bouarra Flash Poster Presenter	QSRR modeling for GC-MS retention prediction of emerging Xenobiotic contaminants: a robust in silico tool for environmental screening and risk assessment

Session 4. (Micro)plastic Pollution in the Environment and Human Health
Time: 14:00 (CEST, Basel) | 8:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:05	Prof. Dr. Tiziana Cappello Session Chair	<i>Welcome from Session Chair</i>
14:05–14:35	Prof. Dr. Mohamed Banni Keynote Speaker	Environmental microplastic: from Agricultural soils to the marine environment
14:35–14:50	K Abirami Arasu Oral Speaker	Fungal-Assisted Biodegradation of Bioplastics: A Comparative Analytical Study
14:50–15:05	Khouloud BOUKADIDA Oral Speaker	Differential Disruption of Morphogenesis and Biomineralization in Mussel Larvae Exposed to Environmental Microplastics and Diuron
15:05–15:20	Stefano Magni Oral Speaker	Tire Road Wear Particles (TRWPs) from different asphalts: an ecotoxicological comparison on zebrafish larvae
15:20–15:35	Natalia Lisiecka Oral Speaker	Aged polyethylene microplastics as active modifiers of plant exposure to agrochemicals
15:35–15:50	Mariachiara Galati Oral Speaker	Polylactic acid bioplastics (PLA BPs): A threat to the reproductive health of the Mediterranean mussel <i>Mytilus galloprovincialis</i>
15:50–16:05	Siwar Abouda Oral Speaker	Unveil new insights into microplastic and benzo[a]pyrene toxicity in the seaworm Hediste diversicolor coelomic fluid: A transdisciplinary approach
16:05–16:20	Sabrina Balsamo Oral Speaker	Polystyrene microplastic beads and the mussel <i>Mytilus galloprovincialis</i> : an encounter that should never have happened.
16:20–16:35	Anna Parus Oral Speaker	Microplastics as Modulators of Xenobiotic Bioavailability and Phytotoxicity in Soil
16:35–16:40	Marta Pereira Flash Poster Presenter	Microplastic Bioaccumulation and its Trophic Implications in <i>Corbicula fluminea</i>
16:40–16:45	Vesela Yancheva Flash Poster Presenter	Occurrence and Effects of Microplastics in the Black Sea: Evidence from Mussels, Water and Sediments
16:45–16:50	Samuel Fernandes Santos Flash Poster Presenter	Beyond monitorization: ecological evaluation of the Douro estuary and its microplastic distribution
16:50–16:55	Natalia Bolocan Flash Poster Presenter	Thermodynamic Insights into (Micro)plastic Pollution in the Environment: Interfacial Processes, Chemical Synergism, and Ecological Implications
16:55–17:00	Sara Santos Flash Poster Presenter	Contaminant Mixtures and Warming: Bioaccumulation and Organismal Stress in an Invaded Freshwater Trophic Chain

23 June 2026 (Tuesday)

Session 1. Environmental Toxicity, Bioaccumulation, and Remediation Strategies**Time: 9:00 (CEST, Basel) | 3:00 (EDT, New York) | 15:00 (CST Asia, Beijing)**

CEST Time	Speaker	Title
9:00–9:05	Prof. Dr. Xiao-Jun Luo Session Chair	<i>Welcome from Session Chair</i>
9:05–9:25	Dr. Christina Emmanouil Invited Speaker	Assessment of Environmental Impacts of Biosolids through Multispecies Bioassays
9:25–9:45	Dr. Zhenguo Chen Invited Speaker	Occurrence and Fate, and Chiral Signatures of p-Phenylenediamines and Their Quinones in Wastewater Treatment Plants
9:45–10:00	Muhammad Ikram Nabeel Oral Speaker	Advanced Doped and Composite Graphitic Carbon Nitride Photocatalysts for Efficient Degradation of Organic Pollutants under Visible Light
10:00–10:15	Ben Mimouna Safa Oral Speaker	Mechanistic Insights into Early-Life Cadmium-Induced Cognitive Dysfunction in Adult Rats and the Therapeutic Role of Zinc
10:15–10:30	Leonid Antonov Oral Speaker	Complex mixtures of pollutants in freshwater: Using <i>Daphnia magna</i> to reveal hidden risks
10:30–10:45	Nuno Faria Oral Speaker	Chitosan-Niobium nanocomposites Reduce Ciprofloxacin and Silver Nanoparticle Impacts in Freshwater Ecosystems
10:45–11:00	Maria João Viana Oral Speaker	Assessing urban stormwater impacts on <i>Lemna minor</i> using sub-individual biomarkers
11:00–11:15	Olga M. Lage Oral Speaker	Addressing the Cyanobacterial Bloom Challenge: A Spatio-Temporal Sediment Analysis of Reservoirs and Artificial Lakes Across the SUDOE Region within the Framework of the Cyan'EAU Project
11:15–11:20	Sherlyn C. Tipayno Flash Poster Presenter	Bioremediation Potential of Heavy Metal and Pesticide-Tolerant Poacea Endophytes from an Open Pit Mining Area in Benguet, Philippines
11:20–11:25	Nadeem Ali Flash Poster Presenter	Occurrence and Tissue-Specific Distribution of Arsenic and Other Potentially Toxic Elements in Retail Meats: Implications for Dietary Risk Assessment
11:25–11:30	Cristina Firincă Flash Poster Presenter	Innovative Integrated Platform Combining a Myco-Phytoremediation System with Portable Electrochemical Sensing for Sustainable Remediation of Heavy Metal-Contaminated Soils
11:30–11:35	Duha Hammad Flash Poster Presenter	Surface-Specific Retention and Biointeraction of Xenobiotic Airborne Particulate Matter on Adaxial and Abaxial Leaf Surfaces of <i>Ruscus aculeatus</i>
11:35–11:40	Antonio Peña-Fernández Flash Poster Presenter	Preliminary Evaluation of Novel Surfactant-Based Decontaminants for Skin Exposure to Phorate, a Simulant of the VX Nerve Agent
11:40–11:45	Eva Fernández-Gómez Flash Poster Presenter	Assessment of the content of potentially hazardous elements in agricultural soils of several municipalities in the Province of Valencia (Spain)
11:45–12:00	François Gagné Oral Speaker	The Pyruvate–Glyoxalate Pathway as a Toxicity Assessment Tool of Xenobiotics: Lessons from Prebiotic Chemistry.

Session 2. Nanotoxicology and Targeted Pharmacology of Nanomaterials

Time: 14:00 (CEST, Basel) | 8:00 (EDT, New York) | 20:00 (CST Asia, Beijing)

CEST Time	Speaker	Title
14:00–14:05	Dr. Keith R. Brunt Session Chair	<i>Welcome from Session Chair</i>
14:05–14:25	Prof. Dr. Nagaprasad Puvvada Invited Speaker	Melanoma Immunotherapy by Nanosphere-Vaccine-Elicited CD4 ⁺ and CD8 ⁺ T-Cell Response for Tumor Regression
14:25–14:45	Dr. Célia Ventura Invited Speaker	The effect of nanomaterials on the methylation of the genome of human cells
14:45–15:00	Muhammad Waqas Oral Speaker	AI-Guided Nanotoxicological and Immunopharmacological Evaluation of Ligand-Functionalized Polymeric Nanoparticles in Targeted Cancer Therapy
15:00–15:15	Yadullah Baqir Oral Speaker	Marine-Derived Silver Nanoparticles for Aquaculture: A Systematic Evaluation of Synthesis-Performance Relationships and Nanotoxicological Implications
15:15–15:30	Vladimir A. Shipelin Oral Speaker	Nanosized Titanium Dioxide (E171) in Russia: Particle Size Analysis and Perspectives to Hygienic Regulation
15:30–15:45	Federico Ferretti Oral Speaker	Impact of Dietary Xenobiotics on the Intestinal Activity of Sodin 5: Implications for RIP-Based Nanotherapeutics
15:45–16:00	Bienvenue Habiyambere Oral Speaker	Turmeric Phyto-NanoParticle (TPNP) enhances cellular bioavailability and anti-inflammatory effect of curcuminoids in human monocytes / macrophages
16:00–16:05	Arisbel Cerpa-Naranjo Flash Poster Presenter	Study of the cytotoxicity of pegylated expanded graphene oxide in human endothelial cells.
16:05–16:10	<i>Closing Remark from Conference Chairs</i>	

Poster List

Submission ID	Authors	Title
Session 1. Environmental Toxicity, Bioaccumulation and Remediation Strategies		
sciforum-160347	Kalina Zhivkova, Stoycho Dimitrov Stoev, Krasimira Zhelyazkova Gospodinova, Dimitrinka Stoycheva Zapryanova	Pathological, Biochemical and Immunological Studies on Experimental Ochratoxin a Toxicosis in Rabbits
sciforum-167589	Diptarup Mallick	Environmental Rectification Through Microbial Bioremediation: Principles and Strategies
sciforum-168461	Duha Hammad, Takahiko Miyazaki	Surface-Specific Retention and Biointeraction of Xenobiotic Airborne Particulate Matter on Adaxial and Abaxial Leaf Surfaces of <i>Ruscus aculeatus</i>
sciforum-170193	Ligia Vasconcelos, André Porto	In silico ecotoxicological evaluation of hydroxylated progesterone biotransformation products generated by the marine-derived fungus <i>Penicillium oxalicum</i> CBMAI 1996
sciforum-172412	Camilla Della Torre, Marta Turano, Silvia Giorgia Signorini, Stefania Crespi, Matteo Pegoraro, Lisa Bonciani	Use of <i>Balanophyllia europaea</i> as a biological model for monitoring the Mediterranean coralligenous biocenosis: the SIMBIOSI project
sciforum-173360	Marina Rubio Bellido, Belén Rodríguez Morillo, Alba Lara Moreno, Fernando Madrid Díaz, Jaime Villaverde Capellán	Enhanced biodegradation of phenylurea herbicides in polluted soils using a combined bioaugmentation and biostimulation technology
sciforum-173366	Belén Rodríguez Morillo, Marina Rubio Bellido, Inés Aguilar Romero, Jaime Villaverde Capellán, Fernando Madrid Díaz	Phenylurea Herbicide Biodegradation in Aqueous Solution using bioaugmentation strategies with <i>Advenella</i> sp. JRO
sciforum-173851	Alejandro Alejos-Campo, Eva Fernández-Gómez, Luis Roca-Pérez, Oscar Andreu-Sánchez, Rafael Boluda	Xenobiotics Persistence in Mediterranean Soil: Effects of Compost Application on Their Dissipation
sciforum-173905	nadeem ali, Ahmed Saleh Summan	Occurrence and Tissue-Specific Distribution of Arsenic and Other Potentially Toxic Elements in Retail Meats: Implications for Dietary Risk Assessment
sciforum-174287	Eva Fernández-Gómez, Giuliano Blancato, Luis Roca-Pérez, Rafael Boluda	Assessment of the content of potentially hazardous elements in agricultural soils of several municipalities in the Province of Valencia (Spain)
sciforum-174390	Sara Gaida, Leilei Zhang, Iteb Boughattas, Mohamed Banni, Sabine Hattab	Pollution-Driven Metabolomic Evidence of Biochar and Compost Effects on a Key Soil Organism
sciforum-174400	Ioana Catalina Gifu, Raluca Ianchis [†] , Lucian Gabriel Zamfir, Silviu Preda, Cristina Firincă, Iuliana Răut, Mariana Constantin, Mihaela Doni, Ana Maria Gurban	Innovative Polysaccharide-Derived Hydrogels for Sustainable Decontamination of Antibiotic-Polluted Matrices
sciforum-174403	Cristina Firincă, Lucian Gabriel Zamfir, Mariana Constantin, Iuliana Răut, Ionuț Adrian Cepleanu-Pascu, Ioana Cătălina Gifu, Mihaela Doni, Ana Maria Gurban	Innovative Integrated Platform Combining a Myco-Phytoremediation System with Portable Electrochemical Sensing for Sustainable Remediation of Heavy Metal-Contaminated Soils

sciforum-174416	Anastasya Balakina, Nikita Trusov, Anton Konev, Victor Tutelyan	Toxic Effects of Alternaria Fungi Metabolites on the Antioxidant Defense System of Rats
sciforum-174441	Franciele de Fatima Domingos, Milena Moreira Grilo, Bianca Ribeiro Martins, Larissa Fonseca Andrade Vieira	Ecotoxicological effects of the commercial fungicide NATIVO® on early development of crop plant species.
sciforum-174452	Yasser Essadki, El Mehdi Darrag, Soukaina El Amrani Zerrifi, Mohamed Haida, Afaf Krimech, Rosario Martins, Alexandre Campos, Vitor Vasconcelos, Fatima El Khalloufi, Brahim Oudra, Nouredine Bouaicha	In Vitro and In Silico Modulation of Microcystis aeruginosa and Chlorella sorokiniana Growth and Physiology by Volatile Extracts of the lichen Pseudevernia furfuracea
sciforum-178251	Hanen Chaabani, Hiba Hamdi, Moncef Mokni, Yosra Guedri, Imen Ayed Boussema, Salwa Abid-Essefi	Molecular insights into the renal and hepatic toxicity of the fungicide Trifloxystrobin
sciforum-179113	Abdulwaris Tijani, Gbenga Ayodele	Effect of Morinda Lucida Leaf Powder as a Natural Feed Additives in Animals for Mitigating Antibiotic Residues in the Environment: A Systematic Review
sciforum-179187	Geraldine P. Tica-a, Natasha C. Cayaban, Desiree F. Padkiw, Sherlyn C. Tipayno	Bioremediation Potential of Heavy Metal and Pesticide-Tolerant Poacea Endophytes from an Open Pit Mining Area in Benguet, Philippines
sciforum-179481	asma mnassri, Imen Ayed-Boussema, Le-Hoa Mai, Thi-Van-Ha Nguyen, Karima Rjiba, Sophie Brouard, Salwa ABID-ESSEFI	Cyproconazole, a triazole fungicide, drives human immune dysfunction by impairing regulatory B cell activity and inducing T cell senescence
sciforum-179501	Meriem FERFAR, Youssouf DRIOUCHE, Amina Dridi, Nabila Meksem, Fares Hamoud	Germination and Physiological Responses as Early Biomarkers of Xenobiotic-Induced Phytotoxicity in Triticum durum
Session 2. Nanotoxicology and Targeted Pharmacology of Nanomaterials		
sciforum-174533	Arisbel Cerpa-Naranjo, María Fuencisla Guilsanz-Muñoz, Javier Perez-Piñeiro, María S. Fernandez-Alfonso, Marta Sanz-Gómez, Elvira Bragado-García	Study of the cytotoxicity of pegylated expanded graphene oxide in human endothelial cells
sciforum-179472	Federico Ferretti, Chiara Perrone, Massimo Bortolotti, Francesco Biscotti, Sara Ragucci, Nicola Landi, Antimo Di Maro, Andrea Bolognesi, Letizia Polito	Impact of Dietary Xenobiotics on the Intestinal Activity of Sodin 5: Implications for RIP-Based Nanotherapeutics
Session 3. Emerging Chemicals: Environment Risks and Health Effects		
sciforum-146509	Nataliia Tkachuk, Liubov Zelena, Yaroslav Novikov	Bioassay study of released compounds to assess the safety of popular children's toys
sciforum-168908	Abdul Saboor Noori	Emerging Chemical Exposure Risks in Afghanistan: The Role of INGOs in Health Protection and Environmental Education
sciforum-171167	Bárbara S. Diogo, Sara Rodrigues, Sara C. Antunes	Interactive effects of temperature, pH, and antibiotics reshape zebrafish physiological stability
sciforum-173559	Marta Rojais, Sara C. Antunes, Sara Rodrigues	From Algae to Fish: Unravelling the Toxic Effects of Metformin in Freshwater Ecosystems
sciforum-173868	Samuel Oluwasegun Adesida, Chibuisi Gideon Alimba	Xenobiotic contaminants emitted from Landfill Fires and Associated Public Health Impacts: A Systematic Review
sciforum-173931	Cecília Rodrigues, Maria João Rocha	Honey as an Indicator of Environmental PAH Contamination

sciforum-174041	Vladimir Shipelin, Tatyana Selezneva	Analysis of the Effect of the α -Amylase Enzyme Preparation from the Genetically Modified Strain <i>Komagataella phaffii</i> 2xAmy-BaLi-a-II-ZeoR-(Y-5231) on the Behavioral Reactions of Male Wistar Rats
sciforum-174361	Gracia Luque, Marta Koziarska, Eva Peralta, Pilar Ortiz, Anna Kostka, Alicia Ruiz-Rodríguez, Agnieszka Gruszecka-Kosowska, Margarita Aguilera	Xenobiotics from Water to the Gut: Monitoring Environmental BPA and Assessing Its Gut Bacterial Tolerance for Health Risk and Biodegradation
sciforum-174407	Nidia Pérez García, María Arroyo, Pilar Ortiz, Gracia Luque, Margarita Aguilera, Alicia Ruiz	In silico workflow determining Metagenome-Assembled Genomes (MAGs) from a pediatric cohort exposed to obesogenic xenobiotics revealed different quality metrics
sciforum-174432	Teresa Chianese, Sabrina Balsamo, Luigi Rosati, Rosaria Scudiero	Using the field lizard as a model to study the impact of glyphosate on soil-dwelling vertebrates
sciforum-174467	P. Barciela, A. Perez-Vazquez, M. Carpena, Miguel A. Prieto	What neurological evidence has been reported on the long-term effects of human exposure to mixtures of environmental neurotoxicants?
sciforum-174517	Beatriz Machado, Ricardo Ferraz, Piedade Barros	Ecotoxicological assessment of valproic acid in aquatic organisms
sciforum-175344	Anne Leung, Konstantinos Grintzalis	The Impact of Cigarette Filters on Aquatic Ecosystems Using Daphnids as Model Organisms
sciforum-177874	Luka Kazensky, Ivana Banić, Ivana Vrhovac Madunić, Vedran Micek, Katarina Matković, Marko Gerić, Marija Jelena Lovrić Štefiček, Jasmina Rinkovec, Ivana Jakovljević, Vilena Kašuba, Mirta Milić, Mirjana Turkalj, Davorka Breljak, Gordana Pehnec, Bojana Žegura, Mario Lovrić, Jon Switters, Francesco Mureddu, Goran Gajski	From Homes to Cells: Assessing Genome Damage Induced by Indoor PAH Mixtures
sciforum-177884	Gabriel Cornetta Ferraz Ribeiro, Leandro Cardoso de Moraes, Vitória Regina Lima de Oliveira	In Silico Assessment of Interactions Between Pharmaceutical Contaminants and Human Metabolic Enzymes Using Molecular Docking
sciforum-178120	Abdulwaris Tijani, Gbenga Ayodele	Antibiotic Residues In The Environment: Drivers Of Antimicrobial Resistance In Ecosystems—A Systematic Review
sciforum-178643	Ana López-Moreno, Alfonso Torres-Sánchez, Alicia Ruiz-Rodríguez, Margarita Aguilera	Perinatal and Direct Bisphenol A Exposure Shape Gut Microbiota and Behavior in a Sex-Specific Manner In mice
sciforum-179013	Patrícia Hockicková, Alžbeta Kaiglová, Soňa Kucharíková	Behavioral and reproductive consequences of <i>Caenorhabditis elegans</i> embryos after exposure to low doses of bisphenol A and its substitutes
sciforum-179173	Vladimir Shipelin, Tatyana Selezneva	Hygienic Assessment of Alimentary Exposure to Stable Strontium in Russia: A Risk Analysis
sciforum-179180	Vítor Faria, Agostinho Cruz, Piedade Barros	Individual and Combined Ecotoxicity of Albendazole, Metronidazole and Ibuprofen in Freshwater Algae and Agricultural Plants

sciforum-179197	Giada Caorsi, Cristina Cremonesi, Stefano Magni, Camilla Della Torre, Andrea Paolo Binelli	Multi-tier Assessment of ecotoxicity of a PEG-Based Pharmaceutical on Danio rerio Embryos: Are Additives the Missing Piece?
sciforum-179202	Gabriel Cornetta Ferraz Ribeiro, Leandro Cardoso de Moraes, Vitória Regina Lima de Oliveira	In silico evaluation of emerging pharmaceutical contaminants and their interactions with human proteins: implications for environmental toxicity
sciforum-179300	Yaliana Tafurt Cardona, Paula Suares-Rocha, Thaís Cristina Casimiro Fernandes, Karen C.M. Moraes, Maria Aparecida Marin-Morales	Cytotoxic, genotoxic, and mutagenic effects of the mixture of dyes used in the formulation of black hair dye
sciforum-179320	Nabil Bouarra, Soumaya Kherouf, Loubna Nouri, Adhya eddine Hamitouch, Khaldoun Bachari	QSRR modeling for GC-MS retention prediction of emerging Xenobiotic contaminants: a robust in silico tool for environmental screening and risk assessment
sciforum-179426	Andra Maria Paun, Catalina Mares, Maria Mernea, Speranta Avram	Predicting the Health Effects of AhR Ligands: Bioinformatic Risk Assessment of Environmental Pollutants and Dietary Compounds
sciforum-179488	Andrej Rondoš, Alžbeta Kaiglová, Soňa Kucharíková, Roksolana Fromel, Ján Janošovský	Phenolic Compounds from Rapeseed Protein Side Stream as Potential Emerging Xenobiotics
sciforum-179489	Surajit De Mandal	Pathogen Detection and Functional Gene Analysis of Microbial Communities in a Waste-Impacted River System
sciforum-179494	Mariem Ben Rhouma, Lina Chouchene, Kaouthar Kessabi, Sana Boughammoura, Asma Haddadi, Massimo Venditti, Imed Messaoudi	Maternal Bisphenol S exposure impairs testicular function in adult Wistar rat offspring via thyroid axis disruption
sciforum-179619	Jayasutha Jayram, Vaishnavi K, Shreedevi G	Prospective Surveillance of Emerging Chemical Poisoning and its Impact on Health in a South Indian Tertiary Hospital
Session 4. (Micro)plastic Pollution in Environment and Human		
sciforum-172911	Samuel Fernandes Santos, Luis R. Vieira, Isabel Iglesias, Sandra Nogueira, Garry F. Kett, Isabel Sousa Pinto, Sara C. Antunes	Beyond monitorization: ecological evaluation of the Douro estuary and its microplastic distribution
sciforum-173869	Mattia Alessi, Stefano Magni, Andrea Binelli, Cristina Cremonesi, Silvia Giorgia Signorini, Giada Caorsi, Giovanni De Bernardi, Sara Castiglioni, Noelia Salgueiro-Gonzalez, Camilla Della Torre	Plastic contamination in different streams of Lake Orta (Northern Italy)
sciforum-174028	Catarina Guimarães, João Martins, Luis R. Vieira, Isabel Iglesias, Sandra Nogueira, Gary F. Kett, Isabel Sousa-Pinto, Sara C. Antunes	Linking Human Activities to Microplastic Pollution: Evidence from Marina da Afurada
sciforum-174031	Vladimir Shipelin	Micro- and Nanoplastics in Food Products and Drinking Water: Risk Assessment, Analytical Methods, and Regulatory Framework Development
sciforum-174172	Ivana Mikavica, Dragana Ranđelović, Miloš Ilić, Ksenija Jakovljević, Dušan Milojkov, Katarina Pantović Spajić, Jelena Mutić	FTIR-based insight into nickel binding mechanisms in soil containing polystyrene microplastics

sciforum-174175	Ivana Mikavica, Dragana Randelović, Miloš Ilić, Ksenija Jakovljević, Tomica Mišljenović, Katarina Pantović Spajić, Jelena Mutić	Redistribution of Ni in soil containing polystyrene microplastics: evidence from sequential extraction
sciforum-174420	María Arroyo, Nidia Pérez, Victoria Romero, Eva Peralta, Alicia Ruiz-Rodríguez, Margarita Aguilera	Gut plastizyme: Systematic Review to identify gut microbiota enzymesproposed as plastic degradation resources
sciforum-176246	Lobna Lajmi, Vanessa Charrier, Thierry Leste Lasserre, Nora Abrous, Imed Messaoudi	Impact of Prenatal Polystyrene Microplastic Exposure on Neurodevelopment and Hippocampal Neurogenesis
sciforum-178396	Sudha Jaachak, Lakshmanan Govindan	Synergistic Testicular Toxicity Induced by Arsenic and Microplastics and Its Attenuation by Imperatorin in Wistar Rats
sciforum-178779	Rabia Akram, Rehana Iqbal, Riaz Hussain	Xenobiotic Bisphenol A (C ₁₅ H ₁₆ O ₂) from (Micro)plastic Pollution: Oxidative Stress and Genotoxic Effects in <i>Aristichthys nobilis</i>
sciforum-179092	Chiara Francesca Trisoglio, Emanuele Crepet, Elia Nalini, Alice Elisea Lazzarin, Francesco Bonasoro, Stefano Magni, Alessandra Costanzo, Carlo Polidori	Limited Uptake and Effects of End-of-life Tire particles in the gut of the Pavement Ant, <i>Tetramorium immigrans</i> : A First Assessment
sciforum-179163	Oxana Spinu, Natalia Bolocan, Igor Povar	Thermodynamic Insights into (Micro)plastic Pollution in the Environment: Interfacial Processes, Chemical Synergism, and Ecological Implications
sciforum-179198	Cristina Cremonesi, Giada Caorsi, Stefano Magni, Camilla Della Torre, Andrea Paolo Binelli	Flocculation as a Control Strategy for Plastic Removal in Wastewater Treatment Plants
sciforum-179492	Marta Pereira, Janeide Padilha, Ronaldo Sousa	Microplastic Bioaccumulation and its Trophic Implications in <i>Corbicula fluminea</i>
sciforum-179497	Sara Santos, Janeide Padilha, Ronaldo Sousa, Arunava Pradhan, Amílcar Teixeira, Juliana Souza-Kasprzyk, Wiktoria Zawrzykraj, Przemysław Niedzielski	Contaminant Mixtures and Warming: Bioaccumulation and Organismal Stress in an Invaded Freshwater Trophic Chain

Session 1. Environmental Toxicity, Bioaccumulation and Remediation Strategies

sciforum-174452: *In Vitro* and *In Silico* Modulation of *Microcystis aeruginosa* and *Chlorella sorokiniana* Growth and Physiology by Volatile Extracts of the lichen *Pseudevernia furfuracea*

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Natural compounds extracted from lichens represent a promising ecological alternative for controlling algal and cyanobacterial blooms in aquatic ecosystems. This study examines the anticyanobacterial and antimicroalgal potential of two volatile fractions (HE1 and HE2) extracted from the lichen *Pseudevernia furfuracea* (L.) Zopf., harvested from two Moroccan biotopes. Furthermore, the potential anticyanobacterial and antimicroalgal response mechanisms were investigated by analyzing the activity of antioxidant enzymes in the cyanobacterial species *Microcystis aeruginosa* and the green microalga *Chlorella sorokiniana* cells. In addition, a molecular docking analysis was performed to predict experimental results, providing a mechanistic understanding of the main interactions of the identified compounds with cyanobacterial and microalgal targets. The results showed that both fractions (HE1 and HE2) inhibited the growth of *M. aeruginosa* and *C. sorokiniana*, with inhibition zone diameters of 12.6–13.7 and 20.7–20.9 mm, respectively. Minimum inhibitory concentrations (MICs) ranged from 375 to 750 µg/mL. In liquid culture, both HE1 and HE2 fractions reduced cell density by more than 98% after 8 days of exposure and decreased chlorophyll-a and protein levels by more than 80% compared to the controls. Furthermore, HE1 and HE2 induced distinct oxidative responses: *M. aeruginosa* exhibited early and significant increases in superoxide dismutase (SOD) and catalase (CAT) activities, as well as high malondialdehyde (MDA) levels, while *C. sorokiniana* showed slower and more moderate activation, indicating greater resistance to oxidative stress. Molecular docking analysis (−3.9 to −8.4 kcal mol^{−1}) identified abietatriene, δ-cadinene, guaiaac acetate, atraric acid, and chloroatranol as the main bioactive compounds in the two volatile fractions (HE1 and HE2) extracted from the lichen *P. furfuracea*. In conclusion, the volatile extracts of *P. furfuracea* exert potent and species-specific inhibitory effects on cyanobacteria and microalgae through oxidative and metabolic interferences, confirming their potential as ecofriendly agents to limit cyanobacterial and algal proliferation.



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sciforum-149272: Preliminary Evaluation of Novel Surfactant-Based Decontaminants for Skin Exposure to Phorate, a Simulant of the VX Nerve Agent

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Effective skin decontamination is critical during mass-casualty incidents involving organophosphorus nerve agents, where dermal exposure and persistence can drive morbidity. We performed a preliminary *in vitro* evaluation of two novel surfactant-based formulations (University of Alcalá) intended for shower-based decontamination following VX exposure, using ¹⁴C-phorate as a safer physicochemical simulant. Experiments followed OECD Test Guideline 428 using static Franz-type diffusion cells with dermatomed porcine skin. A 10 µL droplet of ¹⁴C-phorate was applied to the skin, and decontamination was initiated 60 min post-exposure using an ORCHIDS-style protocol: (i) no decontamination (control), (ii) warm water shower (90 s), (iii) 0.5% v/v Formulation 1 (1 min) + water rinse (30 s), or (iv) 0.5% v/v Formulation 2 (1 min) + water rinse (30 s), each followed by active drying with a microfibre cloth (n = 6 diffusion cells/group). Radioactivity was quantified by liquid scintillation counting in receptor fluid, donor chamber, skin surface, skin, shower effluent, and cloth; autoradiography with ImageJ was used to quantify lateral spreading. Non-parametric statistics used Kruskal–Wallis with Dunn's multiple comparisons. Both surfactant formulations significantly reduced the bioavailable dose (receptor fluid + skin surface + skin) versus untreated controls, with decontamination efficacies of 93 ± 48% (Formulation 1, *p* 0.05) and 96 ± 45% (Formulation 2, *p* 0.05), whereas water alone achieved 88 ± 35% and was not significant. Water-only decontamination exhibited a rinse-in (“wash-in”) effect, with approximately doubled simulant penetration into skin versus untreated controls; both surfactant formulations negated this effect. Autoradiography/ImageJ showed that both formulations significantly reduced lateral spreading compared with controls (*p* 0.05), whereas water did not. Across the three shower decontamination arms, the largest recovered fraction was consistently captured by the microfibre cloth (~20–40%), underscoring active drying as a key contributor; Formulation 2 yielded ~two-fold higher cloth recovery than Formulation 1, although this difference was not statistically significant. These initial results support further testing of surfactant-based technologies as rapid and effective tools for chemical incident response and highlight their potential for future field deployment.



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sciforum-174090: Bioprotective potential of lichen extract (*Pseudevernia furfuracea*) and its stimulating effect on the growth of radish (*Raphanus sativus* L.) and its tolerance to stress induced by cyanobacterial microcystins

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Climate change and anthropogenic pollution are leading to the eutrophication of aquatic ecosystems, creating favorable conditions to the proliferation of cyanobacteria. Some cyanobacteria species produce cyanotoxins, including microcystins (MCs), which can contaminate irrigation water and thus negatively affect crop productivity, and consequently food security and human health. To mitigate these impacts, lichen extract represents a promising source of bioactive compounds for sustainable agriculture. These extracts are known to stimulate plant growth, improve nutrient uptake, and increase tolerance to environmental stress. In this context, the potential of aqueous extract of *Pseudevernia furfuracea* was evaluated with regard to its effect on the growth and stress resilience of radish (*Raphanus sativus* L.) grown hydroponically and exposed to MCs. Two concentrations of MCs (10 and 40 µg/L) and a lichen extract (0.1 and 1 g/L) were applied individually or in combination for 45 days. Exposure to MCs alone inhibited growth, reduced chlorophyll and protein levels, and induced oxidative stress, as evidenced by elevated levels of malondialdehyde (MDA), polyphenols, and sugars, as well as increased activity of antioxidant enzymes such as superoxide dismutase (SOD), catalase (CAT), and peroxidase (POD). In contrast, the combined application of the lichen extract and MCs mitigated these adverse effects, restoring growth parameters, chlorophyll, protein, and sugar levels, while strengthening antioxidant defense systems. The results obtained highlight the effectiveness of *P. furfuracea* extract as a natural biostimulant capable of improving radish growth and its tolerance to MC-induced stress.



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sciforum-174275: Addressing the Cyanobacterial Bloom Challenge: A Spatio-Temporal Sediment Analysis of Reservoirs and Artificial Lakes Across the SUDOE Region within the Framework of the Cyan'EAU Project

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The occurrence of phytoplankton blooms dominated by potentially toxic cyanobacteria has been widely observed across aquatic ecosystems of Europe, especially in the SUDOE regions, leading to contamination events and restrictions on water use for human purposes. These occurrences represent a growing threat to water quality, public health and local ecosystems. Their multifactorial origin requires close cooperation between the scientific community and public entities. Within the framework of the Interreg Sudoe Cyan'EAU project, we aim to develop realistic and actionable tools and solutions for water resource managers to support the prevention, early detection, and remediation of cyanobacterial blooms. A crucial step toward this objective is the identification and understanding of the trigger factors of cyanobacterial bloom development. For this purpose, we carried out a multidisciplinary study focused on spatio-temporal sediment analysis of reservoirs and artificial lakes across the SUDOE region. Sediment cores were collected at five aquatic ecosystems across Portugal, Spain, and France. Each core was sectioned into distinct layers, which were analyzed for various parameters, including dating, cyanotoxins, cyanobacterial community composition, and physicochemical characteristics (e.g. nutrients, pH). The analyses combined radiometric, chromatographic, molecular biology, and physicochemical techniques. This approach would allow us to reconstruct the historical dynamics of cyanobacterial proliferation preserved in the sediment layers and to identify key drivers of bloom development. These insights will guide the development of future strategies aimed at bloom prevention and the sustainable management of water resources.

Acknowledgements

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sciforum-164069: Advanced Doped and Composite Graphitic Carbon Nitride Photocatalysts for Efficient Degradation of Organic Pollutants under Visible Light

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This work presents the design, synthesis, and application of advanced doped and composite graphitic carbon nitride (g-C₃N₄)-based photocatalysts for the efficient degradation of diverse organic pollutants under visible light. Sulfur, yttrium-, tellurium-, and strontium-doped g-C₃N₄, as well as 2D Z-scheme S-g-C₃N₄/WO₃ composites, were synthesized using facile thermal polymerization, two-step pyrolysis, one-pot calcination, and wet-impregnation methods. These materials exhibited significantly enhanced photocatalytic performance compared to pristine g-C₃N₄, achieving up to 99% degradation of industrial dyes such as methylene blue, acid orange 7, and congo red, as well as pharmaceutical contaminants including acetaminophen and 5-fluorouracil. The reaction kinetics followed pseudo-first-order models, with substantially higher rate constants and shorter half-lives for the doped and composite catalysts. Mechanistic studies, supported by radical scavenger tests and LC-MS analysis, revealed superoxide radicals and photogenerated holes as the primary active species, with minor contributions from hydroxyl radicals and electrons. Structural, optical, and electrochemical characterizations confirmed improved charge separation, band gap tuning, and stability of the synthesized photocatalysts. Biocompatibility tests using seeds demonstrated negligible toxicity and potential applicability in environmentally friendly water treatment. These findings underscore the versatility and efficiency of doped and composite g-C₃N₄ photocatalysts for sustainable remediation of various organic pollutants.



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sciforum-174292: Assessing urban stormwater impacts on *Lemna minor* using sub-individual biomarkers

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Background

Urban stormwater runoff transports complex contaminant mixtures into freshwater ecosystems, potentially impairing primary producers and disrupting key physiological functions. Biomarkers such as photosynthetic pigments, antioxidant enzyme activities, and lipid peroxidation are sensitive tools for detecting early biochemical stress in aquatic plants. This study aimed to evaluate the effects of urban stormwater runoff on sub-individual biomarkers in the macrophyte *Lemna minor*.

Methods

Water samples were collected in autumn 2025, after a rainfall event, from three Portuguese waterbodies (Este River, Sousa River, Vale das Flores Stream) at upstream, outlet discharge, and downstream sites. Bioassays were conducted with filtered and unfiltered water samples to distinguish dissolved from particle-bound contaminants. *L. minor* was exposed to a water sample following the standard guideline for 7 days. Afterward, biochemical biomarkers were quantified, including total chlorophyll content and carotenoids, antioxidant enzyme activities (catalase, CAT; glutathione S-transferases, GSTs), and lipid peroxidation (malondialdehyde, MDA content).

Results

A decrease in pigment content was observed in both treated water samples, indicating a disruption of photosynthetic processes. Overall, antioxidant defense mechanisms were activated, as shown by the increased activities of CAT and GSTs. The rise in MDA levels further suggests lipid peroxidation and cellular damage across all water samples. Moreover, these effects were more pronounced in the unfiltered samples, underscoring the relevance of particulate-bound toxicants. Vale das Flores stream exhibited the strongest responses, with an increase in CAT and GSTs activities and MDA content, as well as a reduction in pigment levels. Additionally, the outlet discharge and downstream samples induced a more pronounced biochemical response in *L. minor*.

Conclusions

This integrated biomarker approach proved sensitive to detecting sub-individual effects of urban stormwater runoff. These findings highlight the value of biochemical indicators for assessing contaminant effects on primary producers and support their use in water-quality and ecotoxicological monitoring of urban freshwater systems.



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sciforum-174287: Assessment of the content of potentially hazardous elements in agricultural soils of several municipalities in the Province of Valencia (Spain)

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Environmental research and public health face significant challenges when addressing the study of agricultural soils. Preserving soils and crops is crucial for food quality, as well as for advancing progress toward the Sustainable Development Goals and fulfilling the objectives of the 2030 Agenda. Agricultural soils in the Valencian region are under strong pressure from human activities (industrialization, urban development, intensive agriculture, and tourism). The presence of high concentrations of potentially hazardous elements (PHEs) such as As, Cd, Co, Cr, Cu, Ni, Pb, and Zn poses a risk in agricultural soils due to their toxicity, persistence, and ability to bioaccumulate in crops, potentially entering the food chain.

In this study, 25 agricultural soil samples from 17 municipalities in the L'Horta and La Ribera districts (Valencia) were analyzed and evaluated. The determination of PHEs was carried out by microwave-assisted digestion in a strongly acidic medium and quantified by ICP-OES. In addition, regulatory standards and contamination indices were applied to assess soil quality from a contamination perspective. Concentrations of Cd, Cr, Cu, Pb, and Zn in some soils exceeded the reference values established by the Autonomous Communities of Aragon, Catalonia, and Madrid. Contamination ranged from moderate to severe and was associated with anthropogenic sources. Furthermore, the application of the indices confirmed the existence of a potential contamination risk, with Cu, Pb, Sr, and Zn showing the highest risk levels.

These findings highlight the need to adopt soil management and monitoring measures in the most affected areas in order to prevent risks to food safety and public health.



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sciforum-179187: Bioremediation Potential of Heavy Metal and Pesticide-Tolerant Poacea Endophytes from an Open Pit Mining Area in Benguet, Philippines

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Heavy metal and chemical pesticides are two of the most common pollutants in agricultural soils in Benguet, a province in the highlands of northern Philippines, where mining and agriculture are the biggest drivers of the economy. We isolated endophytes from *Poaceae* grasses, ubiquitously growing in an open-pit mining area in Itogon, Benguet, with tolerance to high concentrations of lead, mercury, zinc, cadmium, and copper. Interestingly, these bacteria and fungi also showed tolerance to at least 3000ppm of the organophosphate pesticides, chlorpyrifos and malathion. We suspect that the cross-protection came about as adaptive responses against oxidative stress, known to be induced by both agents. Ten highly tolerant bacterial and eight fungal isolates were tested for their ability to exhibit radical scavenging activity and produce protective biosurfactants and degradative enzymes. Under HM stress, the fungi *Bjerkandera*, *Penicillium*, and *Aspergillus* showed the highest antioxidant activity among the isolates. To further assess their potential to promote crop growth while reducing oxidative stress, we screened these isolates for common PGP traits. Seven of the bacterial isolates were positive for nitrogen fixation. Furthermore, species belonging to *Acinetobacter*, *Pseudomonas*, *Staphylococcus*, and *Bacillus* showed the highest solubilization activity for phosphate and zinc, as well as high IAA and ammonia production of up to 87.25 and 117.76 ppm, respectively. This suggests promising roles in growth enhancement, making available limiting soil nutrients, and thus, reducing the need for fertilizer input. Although microbial tolerance to HM was directly correlated to soil HM concentration, the latter was not found to be correlated with pesticide tolerance. This suggests that the development of cross-protection for these two stressors may not necessarily occur through common mechanisms. Nonetheless, these findings provide foundational data for the development of microbial consortia and formulations for bioremediation of persistent soil pollutants and sustainable promotion of soil health and crop productivity.



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sciforum-179405: Chitosan-Niobium nanocomposites Reduce Ciprofloxacin and Silver Nanoparticle Impacts in Freshwater Ecosystems

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Freshwater ecosystems, among the most biodiverse on Earth, are increasingly threatened by emerging contaminants, such as antibiotics and engineered nanoparticles. Ciprofloxacin (CIP) and silver nanoparticles (Ag-NPs) enter aquatic environments primarily through inefficient wastewater treatment, making freshwater systems their ultimate repository. These contaminants can disrupt key ecosystem processes, such as organic matter decomposition driven by microbial communities like aquatic hyphomycetes. In this study, eco-sustainable chitosan–niobium oxide nanocomposite membranes (CS–NbO) were developed, characterized, and applied as a novel remediation strategy for the removal of CIP and Ag-NPs, both individually and in combination. The membranes were successfully synthesized and characterized, using contact angle measurements, scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy - attenuated total reflectance (FTIR-ATR) and SEM- energy dispersive X-ray (SEM-EDX). Results showed increased hydrophilicity and distinct structural modification following crosslinking, supporting their suitability for contaminant adsorption. Dynamic light scattering (DLS) analysis confirmed the stability and low polydispersity of Ag-NPs in aqueous media. CS–NbO membranes were further evaluated through biological assays assessing oxidative stress responses in fungal communities. Activities of antioxidant enzymes, including catalase and glutathione S-transferase, increased in microcosms exposed to untreated CIP and/or Ag-NPs, indicating induced oxidative stress. In contrast, these responses were significantly reduced in microcosms treated with CS–NbO membranes. Leaf litter decomposition was not significantly affected. Overall, our findings highlight that CIP and Ag-NPs pose potential risks to aquatic fungal communities and the ecosystem functions. Importantly, CS–NbO nanocomposite membranes emerge as eco-friendly materials to mitigate the impacts of emerging contaminants in freshwater ecosystems.



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sciforum-179504: Complex mixtures of pollutants in freshwater: Using *Daphnia magna* to reveal hidden risks

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Freshwater ecosystems are increasingly exposed to complex cocktails of chemicals, including pharmaceuticals, pesticides, and metals derived from human activity. Traditional environmental risk assessment remains largely based on single-chemical testing, which fails to capture the combined and potentially synergistic effects of these contaminants under realistic exposure conditions. In this study, the freshwater sentinel species *Daphnia magna* were used to investigate the biological impacts of a six-component xenobiotic mixture comprising three common pharmaceuticals (propranolol, diltiazem, metformin), two metals (nickel and lithium), and one herbicide (glyphosate) under standardised laboratory conditions. Acute and chronic toxicity were assessed using toxicity curves and survival plots, respectively, while sub-lethal endpoints, including filtration rate, growth, and key enzymatic activities, were evaluated to detect early biological responses. The mixture exhibited greater toxicity than individual compounds, indicating non-additive interactions. Beyond mortality, mixture induced concentration-dependent response across all endpoints. There was a clear decline in growth over 7, 14 and 21 days of exposure, while enzymes and feeding rate changed dose-dependently. This study highlights the limitations of conventional single-chemical risk assessment in predicting the ecological risks of xenobiotic mixtures. Building on these laboratory findings, ongoing work aims to evaluate how natural river water matrices modulate mixture toxicity and whether laboratory-derived biomarkers retain predictive value under more environmentally realistic exposure conditions. This integrative approach supports the development of daphnid-based New Approach Methodologies (NAMs) for improved early warning strategies in freshwater monitoring.



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sciforum-179481: Cyproconazole, a triazole fungicide, drives human immune dysfunction by impairing regulatory B cell activity and inducing T cell senescence

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Background

Triazole fungicides, including cyproconazole (CPZ), are among the most widely applied agricultural chemicals globally. While their endocrine-disrupting properties are recognized, their impact on human lymphocyte homeostasis, particularly on immunoregulatory and senescence-associated mechanisms, remains poorly characterized.

Objective

This study investigated the cellular and molecular mechanisms by which CPZ induces immunotoxicity in primary human immune cells, with a focus on regulatory B cell (Breg) function and T lymphocyte senescence.

Methods

Primary peripheral blood mononuclear cells (PBMCs) and purified B and T lymphocyte subsets isolated from healthy donors were exposed to CPZ (30–200 μ M, 24–72 h). Cell viability, proliferation, and cell cycle distribution were assessed by flow cytometry. Breg immunosuppressive capacity was evaluated in lymphocyte co-culture assays. T cell senescence was characterized by quantification of surface markers (CD57, CD28, CD27, PD-1) and SASP-associated cytokine secretion by ELISA. Data were analyzed by one-way ANOVA with Tukey post-hoc testing.

Results

CPZ concentration- and time-dependently impaired B cell homeostasis and abrogated Breg-mediated immunosuppression, resulting in a shift toward a pro-inflammatory cytokine milieu. Concurrently, CPZ drove T lymphocytes toward a senescent phenotype, characterized by G0/G1 cell cycle arrest, apoptosis resistance, downregulation of co-stimulatory molecules (CD28, CD27), and acquisition of a Senescence-Associated Secretory Phenotype (SASP) with elevated pro-inflammatory cytokine release (p0.05).

Conclusion

CPZ disrupts human immune regulation through two converging mechanisms: dismantling Breg-mediated immunological tolerance and accelerating T cell-driven chronic inflammation. These findings provide a mechanistic basis for reconsidering the immunotoxicological risk profile of triazole fungicides and support revised regulatory safety thresholds for occupational and environmental exposures.



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sciforum-174441: Ecotoxicological effects of the commercial fungicide NATIVO® on early development of crop plant species

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The use of pesticide in modern agriculture has raised concerns about impacts on non-target organisms, especially in the early stages of plant development, when sensitivity to chemical stressors tends to be higher. The commercial fungicide formulation, NATIVO®, which combines tebuconazole (triazole) and trifloxystrobin (strobilurin), represents an efficient agronomic strategy due to its different modes of action, but this combination may intensify adverse effects on the environment. This study investigated the phytotoxic potential of NATIVO formulation on *Lactuca sativa* and *Triticum aestivum* seeds, according to OECD 208 and ISO 18763 guidelines. Eight concentrations were evaluated, equivalent to 0.2–18.6 mg/L of tebuconazole (TEB) and 0.1–9.3 mg/L of trifloxystrobin (TRI), in addition to negative and positive controls. After incubation for 72h at 24°C in the dark, germination rate, germination speed index (GSI), and root and aerial growth were analyzed. The results showed greater sensitivity of *L. sativa*, with a significant reduction in GSI at higher concentrations and consistent inhibition of root and shoot growth at all concentrations tested, indicating compromised initial vigor. In *T. aestivum*, the response was less pronounced, although root growth was reduced at all concentrations, suggesting that the root system is one of the main targets of the formulation. The commercial formulation NATIVO® demonstrated significant phytotoxic potential, indicating that exposure to commercial mixtures may pose a real risk to the initial establishment of agricultural crops and non-target species. These findings reinforce that the effects observed are not restricted to the isolated active ingredients, but result from the interaction between components of the formulation, highlighting the need for ecotoxicological approaches that consider the commercial product as a whole for a more realistic environmental risk assessment.



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sciforum-179113: Effect of *Morinda lucida* Leaf Powder as a Natural Feed Additives in Animals for Mitigating Antibiotic Residues in the Environment: A Systematic Review

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Introduction

The extensive use of antibiotics in livestock production has led to the release of residues into soil, water, and agricultural ecosystems, contributing to antimicrobial resistance and environmental contamination. Sustainable alternatives that reduce antibiotic use are therefore urgently needed. *Morinda lucida*, a tropical medicinal plant rich in bioactive compounds such as flavonoids, alkaloids, and phenolics, has been investigated as a phytogetic feed additive with antimicrobial and detoxifying properties. This systematic review evaluates the potential of *Morinda lucida* leaf powder to mitigate environmental antibiotic residues from livestock production.

Methods

A systematic search was conducted following PRISMA guidelines in Scopus, Web of Science, PubMed, and Google Scholar. Studies published between 2000 and 2025 were screened using keywords related to *Morinda lucida*, phytogetic feed additives, antibiotic residues, environmental contamination, and livestock production. The search identified 156 records, with 121 remaining after duplicates removal. After title and abstract screening, 47 full-text articles were assessed, and 20 studies met the inclusion criteria for qualitative synthesis.

Results

The studies indicate that phytogetic feed additives containing bioactive compounds such as flavonoids, tannins, and alkaloids exhibit antimicrobial, antioxidant, and immunomodulatory effects, improving animal health and reducing disease incidence. Reduced antibiotic use correlates with lower levels of residues entering the environment via manure and runoff. Several studies also reported enhanced gut microbial balance and growth performance in animals supplemented with plant-based additives.

Conclusions

Morinda lucida leaf powder shows promise as a sustainable feed additive capable of mitigating antibiotic use and environmental residues from livestock production. Further experimental and field studies are needed to determine optimal inclusion levels and assess long-term ecological impacts on soil and water quality.



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sciforum-173360: Enhanced biodegradation of phenylurea herbicides in pollute soils using a combined bioaugmentation and biostimulation technology

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Pesticides are pollutants of significant environmental concern due to their widespread occurrence across diverse ecosystems. Among them, phenylurea herbicides (PUHs) are reported to be some of the most extensively used compounds in agriculture. To remediate soils contaminated with these organic pollutants, bioaugmentation and biostimulation have emerged as increasingly important green technologies over the past two decades. In addition, cyclodextrins (CDs) have been proposed as environmentally friendly alternatives to organic solvents or synthetic surfactants to improve the solubilization, makes these compounds more bioaccessible and subsequent removal of hydrophobic contaminants from soils.

The aim of this study was to assess the natural attenuation of two PHUs, 3-(3-chloro-4-methylphenyl)-1,1-dimethylurea (chlorotoluron, CHL) and 1,1-dimethyl-3-(4-isopropylphenyl)urea (isoproturon, ISP) and the feasibility of using hydroxypropyl- β -cyclodextrin (HP β CD) or/and in combination with a PHUs degrading bacterial consortium (BC) in three real contaminated soils at an initial concentration of 10 mg kg⁻¹. In this way, we intend to confirm whether the satisfactory results previously obtained in solution tests could be effectively transferred to soil conditions at contaminated sites.

The three soils showed natural bioremediation capacity: CHL degradation ranged 29.6-76.6%, whereas ISP ranged 41.9-99.2%. These rates were improved by using the BC increasing degradation (CHL: 94.4-99.9%; ISP: 98.2-100%). In contrast, reduction in biodegradation rates were recorded when using HP β CD (CHL: 12.7-60.4%; ISP: 44.8-97.0%). When BC and HP β CD were used simultaneously, no improvement was observed compared to using only BC.

Based on these findings, it can be concluded that BC constitutes an effective consortium for the biodegradation of multiple PUHs in contaminated soils, without requiring the addition of HP β CD to enhance the solubility or bioaccessibility of these compounds in solution.



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sciforum-178057: Environmental Fate and Bioaccumulation of Antibiotic Xenobiotics in Aquatic Ecosystems: Ecotoxicological Risks and Bioremediation Approaches

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Introduction

Pharmaceutical antibiotics are ubiquitous emerging contaminants in surface waters due to incomplete removal in wastewater treatment and runoff from aquaculture/agriculture. Reported concentrations span 1 ng/L to tens of µg/L in water and up to hundreds of ng/g in sediment. This study assesses the environmental fate of representative antibiotics in water, sediment, and biota, quantifies bioaccumulation and ecological risk, and explores biological remediation strategies.

Methods

Water, sediment, and aquatic organism samples were collected from effluent-impacted streams and aquaculture sites. Target antibiotics were quantified by LC-MS/MS. Bioaccumulation factors (BCF) were estimated for target compounds in fish/invertebrates, and risk quotients were calculated per EU guidelines. Controlled lab studies tested bioremediation: batch and pilot tests using microbial consortia, algal reactors, and constructed wetlands, monitoring antibiotic removal over time.

Results

All three antibiotic classes were detected in water and sediment (tens–hundreds ng/g) at impacted sites. Fish and invertebrates bioaccumulated drugs: calculated BCFs reached $O(10^2)$. Computational modeling confirmed that sulfonamides have high biomagnification potential, whereas tetracyclines degrade more readily. Ecological RQs were generally 1, but some values approached approx. 0.5–0.6. Sediments acted as long-term reservoirs of antibiotics, posing a risk of remobilization. In pilot treatments, bioremediation removed substantial fractions of pollutants, and algal consortia degraded approx. 77% of sulfamethoxazole (10 ppb spiked) in 7–10 days, and constructed wetland systems have shown 28–100% removal of various antibiotics depending on design.

Conclusions

Aquatic environments are chronically contaminated by antibiotic xenobiotics, leading to measurable bioaccumulation and sub-lethal ecological stress. Although acute risk quotients are moderate, the persistence and trophic transfer of certain antibiotics imply long-term hazards and promotion of AMR. Integrated biological treatments show promise: microbial/plant-based systems can significantly remove antibiotics.



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sciforum-167589: Environmental Rectification Through Microbial Bioremediation: Principles and Strategies

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Introduction

Environmental pollution has reached critical levels globally, necessitating the development of natural and sustainable restoration techniques. Bioremediation emerges as a vital ecological tool, utilizing living organisms such as bacteria, fungi, and algae to remove, transform, or detoxify hazardous contaminants. By leveraging microbial metabolic processes, complex pollutants—including hydrocarbons, pesticides, and heavy metals—are converted into innocuous substances like water and carbon dioxide, restoring ecosystems to their original state.

Methods

The study categorizes bioremediation into two primary strategies: in-situ and ex-situ. In-situ methods treat contaminants directly at the site of pollution and include techniques such as bioaugmentation (adding specialized microbes), biostimulation (adding nutrients), bioventing, and biosparging. Ex-situ methods involve the removal of contaminated materials for external treatment, utilizing solid-phase systems like land farming and biopilling, or slurry-phase systems such as bioreactors. These processes rely on specific microbial genera, notably *Pseudomonas*, *Mycobacterium*, and *Aspergillus*, to facilitate biodegradation.

Results

Bioremediation provides a cost-effective and eco-friendly alternative to traditional physicochemical treatments. It ensures the persistent removal of a wide array of xenobiotics. However, the study identifies specific limitations: the technique is less effective against radioactive and certain organometallic compounds. Additionally, microbial metabolism may occasionally produce toxic secondary metabolites, and the process often requires lengthy durations and rigorous monitoring to ensure complete decontamination.

Conclusion

Bioremediation represents a significant advancement in environmental management, offering a pathway toward sustainable development. While technical challenges remain regarding specific non-biodegradable pollutants, the strategic application of microbial degradation is essential for mitigating the adverse effects of industrialization and maintaining ecological balance.



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sciforum-173710: Evaluation of *Bacillus pumilus* for Pharmaceutical Removal from Contaminated Water

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Pharmaceuticals in aquatic environments are a global concern, driving the search for sustainable removal technologies. Bioremediation is promising due to its environmental compatibility and low cost. *Bacillus* species are attractive candidates because of their metabolic versatility, resilience, and ability to remove emerging contaminants. However, improving removal efficiency remains essential for wastewater treatment.

This preliminary study evaluates the potential of *Bacillus pumilus* to remove ibuprofen, carbamazepine, diclofenac, and naproxen from contaminated water, supporting future optimization studies of this bacterial system.

The bacterium was cultivated in modified Marchlewicz et al. (2016) medium at 30 °C and 200 rpm, starting at an OD600 of ~0.03. Batch assays were performed with and without glucose (1 g L⁻¹) in 200 mL cultures containing individual pharmaceuticals (2–8 mg L⁻¹) or a mixture of the four compounds (2 mg L⁻¹ each) for 50 h. Growth was monitored by OD600 and residual pharmaceutical concentrations were quantified by HPLC–UV/Vis.

Controls with heat-inactivated cells and without glucose were included to assess adsorption onto bacterial biomass.

Culture medium composition affected growth, with glucose as an essential carbon and energy source. *B. pumilus* grew with all pharmaceuticals, although inhibition increased with concentration, strongest for ibuprofen (8 mg L⁻¹).

Pharmaceutical removal occurred under all conditions, reaching 50-h efficiencies of 6.8–11.5% (ibuprofen), 23–27% (naproxen), 10–15.5% (diclofenac), and 6.9–14.4% (carbamazepine). Removal was highest during the first 6 h of incubation. In fact, 25–88% of total removal occurred during the lag phase (2 h), when cell proliferation was minimal, indicating adsorption onto bacterial biomass as the predominant initial mechanism, followed by slower removal during subsequent growth phases.

In summary, *Bacillus pumilus* removed the tested pharmaceuticals, with adsorption playing a major role in the initial phase. Although efficiencies were moderate, the results highlight its potential for pharmaceutical removal and support further optimization for wastewater treatment applications.

Marchlewicz A. et al., 2016. *Water Air Soil Pollut.* 227(6).



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sciforum-179501: Germination and Physiological Responses as Early Biomarkers of Xenobiotic-Induced Phytotoxicity in *Triticum durum*

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The extensive application of xenobiotics in modern agriculture has generated growing concern due to their potential adverse effects on non-target plant species and overall ecosystem stability. In this context, the present study evaluates the phytotoxic effects of sulfonylurea herbicides on *Triticum durum*, with particular emphasis on germination behavior and key physiological parameters as early and sensitive indicators of plant stress.

The results obtained from germination tests revealed a clear dose-dependent inhibition, characterized by significant reductions in germination percentage, germination index, and germination rate. These findings confirm that the initial stages of plant development are highly vulnerable to xenobiotic exposure. Complementary physiological assessments demonstrated substantial disturbances, including a marked decrease in relative water content, a significant reduction in chlorophyll pigments (chlorophyll a, chlorophyll b, and total chlorophyll), and a pronounced inhibition of root respiratory activity. Such physiological impairments reflect disruptions in water balance, photosynthetic efficiency, and overall metabolic processes.

The combined analysis of germination and physiological responses highlights their effectiveness as early-warning indicators of sub-lethal phytotoxicity. These parameters provide a reliable and integrative approach for assessing plant sensitivity to environmental contaminants. The outcomes of this study emphasize the ecological implications of herbicide persistence and dispersion in agroecosystems, and support the use of these biomarkers in environmental monitoring and risk assessment strategies.



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sciforum-170193: In silico ecotoxicological evaluation of hydroxylated progesterone biotransformation products generated by the marine-derived fungus *Penicillium oxalicum* CBMAI 1996

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Understanding the environmental behavior of recalcitrant molecules, particularly steroidal compounds, is essential for assessing their long-term ecological impact. The marine environment represents a major sink for substances widely consumed by modern societies, including pharmaceuticals and hormones that tend to bioaccumulate in aquatic organisms and interfere with biological processes due to their intrinsic endocrine activity. Progesterone is a widely used hormone and was therefore selected as the target compound in this study.

Recent studies demonstrated that the marine-derived fungus *Penicillium oxalicum* CBMAI 1996, isolated from the sponge *Chelonaplysilla erecta*, promotes progesterone bio-oxidation, yielding three novel hydroxylated products—15 β -hydroxyprogesterone (1), 7 β ,15 β -dihydroxyprogesterone (2), and 2 β ,15 β -dihydroxyprogesterone (3)—whose structural elucidation has been previously reported in the literature. In the present work, the computational platforms ECOSAR 2.0 and SwissADME were employed to estimate lipophilicity (log K_{ow}) and predict acute and chronic ecotoxicological effects. These validated *in silico* approaches enable rapid environmental hazard screening and support the interpretation of how enzymatic oxidation may influence the environmental persistence of steroidal contaminants.

Simulations of the derivatives revealed a consistent decrease in molecular lipophilicity, with log K_{ow} values of 3.20, 2.25, 2.44, and 4.02 for compounds 1–3 and progesterone, respectively, accompanied by reduced predicted ecotoxicity toward representative aquatic organisms, including fish, daphnids, and green algae. Acute fish toxicity values (LC₅₀, mg L⁻¹) were 121, 506, 164, and 25, whereas predicted chronic toxicity values (mg L⁻¹) were 82, 1030, 137, and 2.6. These findings indicate that microbial hydroxylation substantially alters the physicochemical and toxicological profiles of progesterone-derived products, suggesting a progressive attenuation of environmental risk.

Overall, the predicted reduction in hydrophobicity relative to the parent hormone indicates lower bioaccumulation potential, while ecotoxicological modeling highlights microbial oxidation as a relevant natural process contributing to the environmental attenuation and prospective degradation of persistent steroids in marine ecosystems.



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sciforum-174403: Innovative Integrated Platform Combining a Myco-Phytoremediation System with Portable Electrochemical Sensing for Sustainable Remediation of Heavy Metal-Contaminated Soils

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Hexavalent chromium (Cr^{6+}) is a persistent, bioaccumulative, and highly toxic contaminant of major environmental concern. Biological remediation strategies have emerged as cost-effective, sustainable, and efficient alternatives to conventional treatments (<https://doi.org/10.3390/jox15030063>); however, large-scale applicability is often limited by the lack of rapid, simple, and reliable in situ monitoring methods for target xenobiotics.

This study proposes an integrated approach combining bioaugmentation and phytoextraction using a novel native consortium of *Trichoderma* spp. in synergy with *Tagetes erecta*, a species known for its strong rhizosphere activity and high stress tolerance. Simultaneously, real-time electrochemical detection of Cr^{6+} was implemented, enabling continuous, minimally invasive in situ monitoring and supporting the development of an efficient closed-loop soil restoration framework (Figure 1).

Soil samples with varying chromium concentrations were collected from three locations in Bucharest. Metallotolerant fungi isolated from the most contaminated site were evaluated for Cr tolerance, removal efficiency, and plant growth-promoting traits (<https://doi.org/10.1016/j.ecoenv.2019.109734>). Selected strains were identified by qPCR, assembled into a resistant consortium, and applied to contaminated soils. The reduction of Cr^{6+} to Cr^{3+} was assessed via chromate reductase activity using 1,5-diphenylcarbazide and monitored over 8 weeks in soil solution collected with suction lysimeters. Detection was performed using miniaturized amperometric sensors modified with nanomaterials and Prussian blue. *Tagetes erecta* was cultivated in treated soils for 12 weeks, while chromium accumulation in roots, shoots, and soil was determined by ICP-OES, and bioconcentration and translocation factors were calculated.

The developed Cr-tolerant consortium (*Trichoderma harzianum*, *T. virens*, *T. atroviride*) achieved up to 95% Cr^{6+} removal within 8 weeks through enzymatic reduction, while enhancing plant growth and chromium uptake. Electrochemical detection showed high sensitivity ($329.12 \text{ mA/M}\cdot\text{cm}^2$), a linear range of 10–1500 μM , and a detection limit of 9.4 μM , demonstrating excellent reproducibility and stability.

This integrated strategy supports sustainable soil restoration through synergistic bioremediation and real-time electrochemical monitoring.



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sciforum-174400: Innovative Polysaccharide-Derived Hydrogels for Sustainable Decontamination of Antibiotic-Polluted Matrices

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The continuous increase of antibiotic residues in water and food poses significant environmental and public health risks, highlighting the need for efficient and sustainable decontamination methods. The novelty of this study lies in the direct coupling of an adsorption system based on polysaccharide hybrid hydrogels with an electrochemical aptasensor platform, allowing real-time monitoring of the efficiency of the tetracycline removal process from water (Figure 1). The proposed system integrates the remediation and detection in a novel architecture, providing continuous feedback on the process efficiency [<https://doi.org/10.3390/pharmaceutics15020373>].

Salecan-Clay-Biopolymer hydrogels act as active matrix for capture and removal of tetracycline from aqueous media based on electrostatic interactions and hydrogen bonds, while the aptasensor, functionalized with tetracycline-specific aptamers, ensures selective and sensitive detection of residual concentrations. Carboxylate groups of the biopolymer and hydroxyl groups of Salecan synergistically enhance adsorption, while the aromatic rings of tetracycline can participate in π - π interactions. The incorporation of inorganic nanofillers further improves performance by increasing surface area, active site density, and additional binding interactions [<https://doi.org/10.1016/j.molliq.2025.127383>].

Physicochemical characterization showed that these innovative hydrogels exhibit adsorption capacities of 100 to 500 mg/g for tetracycline, depending on the crosslinking degree and functionalization, with removal efficiencies of 90% under optimal pH and dosage conditions. Adsorption kinetics follow a pseudo-second-order model, indicating chemisorption dominance. Hydrogels also demonstrate good regeneration, maintaining high efficiency over multiple cycles, supporting their sustainability for water treatment.

The tetracycline-specific electrochemical aptasensor was placed directly in the treated aqueous environment, enabling continuous, selective, and sensitive monitoring of residual tetracycline. This allowed dynamic assessment of the decontamination process and demonstrated high efficiency in real-time evaluation.

Through this approach, an in situ antibiotic decontamination and monitoring system is obtained, which combines efficient remediation with selective real-time detection, opening up prospects for smart water treatment systems and in situ monitoring of emerging contaminants.



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sciforum-179360: Integrating ESG Risk Frameworks with Environmental Toxicity Assessment: A Multi-Criteria Approach for Prioritizing Xenobiotic Remediation

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The increasing prevalence of environmental systems presents complex challenges that extend beyond conventional toxicity and persistence-based assessments. While existing Environmental, Social, and Governance (ESG) metrics in sectors such as pharmaceuticals and biotechnology incorporate indicators related to chemical management, emissions, and regulatory compliance, they largely lack explicit integration of quantitative toxicological parameters that determine long-term ecological and human health impacts. This disconnect results in a critical misalignment between reported sustainability performance and actual environmental risk, particularly in high-exposure contexts such as densely populated and resource-constrained regions. This study proposes a novel, integrative framework that combines environmental toxicology within ESG risk assessment to enable scientifically grounded prioritization of xenobiotic remediation. Using a multi-criteria decision-making (MCDM) approach, the framework develops a composite risk index that combines environmental indicators (toxicity, persistence, bioaccumulation), social dimension (population exposure, vulnerability, water dependency), and governance factors (regulatory effectiveness, monitoring capacity). Representative xenobiotics, including pharmaceuticals, pesticides, and heavy metals, are evaluated using secondary datasets, with the Analytic Hierarchy Process (AHP) applied for indicator weighting and prioritization. The proposed framework advances ESG assessment from compliance-based reporting toward impact-oriented evaluation. The framework is particularly relevant for emerging economies, where episodic pollution events and infrastructural constraints amplify exposure risks. By bridging toxicological science with ESG decision-making, this approach offers a scalable and policy-relevant tool for improving environmental risk governance and enabling more informed investment and remediation strategies.



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sciforum-178817: Mechanistic Insights into Early-Life Cadmium-Induced Cognitive Dysfunction in Adult Rats and the Therapeutic Role of Zinc

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Cadmium (Cd) is a widespread environmental contaminant and a significant risk factor for neurodevelopmental disorders. However, the molecular mechanisms underlying its long-term neurotoxic effects remain incompletely understood. In this study, we investigated the impact of early-life Cd exposure on synaptic signaling pathways critical for brain development and function, with a particular focus on zinc-dependent mechanisms.

Using a rat model of maternal Cd exposure during gestation and lactation, we demonstrate that Cd markedly disrupts zinc homeostasis in the brain by downregulating the synaptic zinc transporter ZnT3, leading to reduced zinc availability at glutamatergic synapses. This deficiency impairs activation of the neurotrophic receptor TrkB and alters brain-derived neurotrophic factor (BDNF) signaling. Consequently, key components of synaptic plasticity are affected, including a significant reduction in the NMDA receptor subunit NR2A, decreased expression of the postsynaptic density protein PSD95, and inhibition of the ERK1/2 signaling pathway.

These molecular alterations are associated with long-lasting deficits in learning abilities and motor function in adult offspring, highlighting the enduring impact of developmental Cd exposure. Importantly, zinc supplementation effectively restores ZnT3 expression, reactivates TrkB-BDNF and NMDAR signaling pathways, and significantly improves neurobehavioral outcomes.

Overall, our findings identify the Zn-BDNF-NMDAR signaling axis as a critical target of Cd-induced neurodevelopmental toxicity and suggest that zinc supplementation may represent a promising therapeutic strategy to mitigate the adverse effects of environmental Cd exposure.



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sciforum-178251: Molecular insights into the renal and hepatic toxicity of the fungicide Trifloxystrobin

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Introduction

Although the European Food Safety Authority (EFSA) previously identified potential Trifloxystrobin (TFX)-induced nephrotoxicity and hepatotoxicity, the underlying molecular mechanisms remain poorly understood. This study investigated TFX-induced toxicity using *in vitro* (HEK-293T and Hep-G2) and *in vivo* (Wistar rats) models.

Methods

Rats received oral TFX for 28 days, while cells were treated for 24 hours. Assessments included histopathology, serum biochemistry, and acetylcholinesterase (AChE) activity. Oxidative stress (ROS, MDA, SOD, CAT, GPx, GST) and genotoxicity (Comet assay, γ H2AX) were evaluated. Apoptosis was quantified *in vitro* via Rhodamine-123 (Rh-123), Acridine Orange/Ethidium Bromide (AO/EB) and Caspase-3 activity and *in vivo* through p53, Bax, and Bcl-2 immunohistochemistry expression.

Results

TFX caused significant renal tubular dilatation and hepatocellular necrosis, supported by IC₅₀ values of 40 μ M (HEK-293T) and 50 μ M (Hep-G2). TFX inhibited AChE activity and elevated serum biomarkers (CREA, BUN, ALT, AST) in a dose-dependent manner. Mechanistically, TFX triggered robust oxidative stress and DNA double-strand breaks. *In vitro* results demonstrated that TFX induces apoptotic cell death in a concentration- and caspase-dependent manner, characterized by loss of mitochondrial membrane potential (Rh-123), morphological changes (AO/EB) and increased Caspase-3 activation. Notably, NAC pretreatment significantly attenuated TFX-induced apoptosis, confirming that oxidative stress is the primary driver of cell death. These findings were corroborated *in vivo* by the upregulation of p53 and a pro-apoptotic shift in the Bax/Bcl-2 ratio in renal and hepatic tissues.

Conclusion

TFX-induced nephrotoxicity and hepatotoxicity are primarily driven by oxidative stress, DNA damage and toxic AChE inhibition. The transition from cellular injury to organ dysfunction is mediated by a caspase-dependent apoptotic pathway. These results provide a comprehensive molecular framework for the systemic toxicities previously reported by regulatory authorities.



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sciforum-173905: Occurrence and Tissue-Specific Distribution of Arsenic and Other Potentially Toxic Elements in Retail Meats: Implications for Dietary Risk Assessment

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Data on arsenic (As) and other potentially toxic elements (PTEs) in Pakistani retail meats are limited, constraining evidence-based dietary risk assessment and management. This study aimed to determine the concentrations and profiles of As and seven other PTEs (Cr, Ni, Mn, Pb, Cd, Cu, Zn) in commonly consumed meats and to evaluate the associated non-carcinogenic health risks. Ninety-two paired liver and muscle samples from broiler chicken, goat (mutton), and beef cattle were collected from four cities across the Indus Plain and analyzed using inductively coupled plasma mass spectrometry (ICP-MS). Dietary exposure was evaluated using estimated daily intake (EDI), target hazard quotient (THQ) and hazardous index (HI) under typical and high-consumption scenarios. Overall, Zn and Cu exhibited the highest concentrations, followed by Mn and Cr, whereas As, Pb, Ni, and Cd occurred at comparatively lower but environmentally relevant levels. Beef liver exhibited the highest contamination levels, exceeding FAO/WHO permissible limits for Pb, Cu, and Cd in up to 40 % of samples. In contrast, mutton and beef muscle contained the highest As and Zn concentrations, while chicken muscle showed elevated Cr levels. Multivariate statistical analysis revealed three dominant co-variation patterns, suggesting potential contamination pathways: (i) geogenic groundwater sources enriched with As, Cr, and Ni; (ii) atmospheric and industrial dust inputs linked with Pb, Cd, and Mn; and (iii) mineral-enriched feed additives potentially contributing to elevated Zn and Cu, particularly in poultry. Under high-consumption scenarios, THQ values for As, Cr, Cu, and Zn exceeded the safety threshold (THQ > 1), highlighting beef products as the dominant source of chronic dietary risk. Overall, the findings highlight pronounced tissue- and species-specific accumulation trends, and emphasizes the urgent need for stricter feed and water quality control measures to minimize dietary exposure to PTEs.



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sciforum-179540: Parallel assessment of the effects of early life exposure to bisphenol S and inhibition of nuclear receptor of thyroid hormones on bone development

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Environmental exposure to endocrine-disrupting chemicals has become a growing public health concern, particularly during critical periods of development. Bisphenol S (BPS), a widely used substitute for bisphenol A (BPA), has attracted increasing attention due to its potential endocrine-disrupting properties, especially its effects on thyroid function. Given reported interactions of BPS with thyroid hormone nuclear receptors (THNRs) and the essential role of thyroid hormones in fetal growth and skeletal development, we hypothesized that maternal exposure to BPS may impair pre- and postnatal bone development through disruption of thyroid homeostasis. To test this hypothesis, pregnant and lactating Wistar rats were exposed daily to BPS (0.2 mg/kg) or to the thyroid hormone receptor antagonist AT1-850 (10 nmol/rat), used here as a mechanistic reference compound. In 20-day-old male fetuses, both treatments induced significant abnormalities in the axial skeleton. By postnatal day 21, male offspring exhibited marked histological alterations in bone structure, increased oxidative stress, and a significant downregulation of key osteogenic markers, including RUNX2, alkaline phosphatase (ALP), collagen type I alpha 1 (Col1 α 1), and osteocalcin (OCN). Notably, similar patterns were observed following exposure to BPS and AT1-850. These findings suggest that BPS exposure during critical developmental windows may impair bone development, potentially through disruption of maternal thyroid hormone signaling pathways.



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sciforum-160347: Pathological, Biochemical and Immunological Studies in Experimental Ochratoxin a Toxicosis in Rabbits

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Ochratoxin A (OTA) is a fungal mycotoxin that affects animal and human health. Rabbits are very sensitive to OTA, but there is limited data about deleterious effects on these animals. This study was aimed to evaluate pathological changes and potential immunosuppression in young New Zealand White rabbits exposed to 2 ppm OTA in the diet for 30 days. All rabbits were immunized against RHDV, and blood samples for serological examination were collected before immunization and on day 28 afterward. The blood for clinical biochemistry and samples from internal organs for pathomorphological investigations were taken at the end of the experiment. A potent immunosuppressive effect of OTA on the humoral immune response against RHDV was observed, evidenced by a decrease in antibody titers ($p < 0.005$). The immunosuppressive effect of OTA caused the occurrence of a secondary infection (pasteurellosis), which resulted in the death of two rabbits from the OTA-exposed group. Biochemical investigations revealed decreased levels of glucose and increased levels of creatinine, BUN, triglycerides, ALT, AST, and ALP. Pathomorphological investigations revealed the strongest damage in the liver, kidneys, spleen, and thymus, except in cases of secondary pasteurellosis, where the strongest damage was found in the lung. In the kidneys, the main degenerative changes were found in the epithelium of proximal tubules. Liver damage included degeneration in hepatocytes and Kupffer cell activation. In the spleen and thymus, degenerative lesions and/or cell depletion were seen. Lung damage, especially in cases of secondary Pasteurellosis, included purulent or croupous pneumonia, fibrinous pleurisy, and thrombosis of vessels. In conclusion, it was found that immunosuppression was the first pronounced toxic effect of OTA that may manifest clinically before pathological and biochemical changes. Humoral immunity was affected to the extent of allowing the development of clinical disease and death of rabbits at only 2 ppm OTA in the ration.



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sciforum-173366: Phenylurea Herbicide Biodegradation in Aqueous Solution using bioaugmentation strategies with *Advenella* sp. JRO

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Phenylureas are among the most widely used herbicide families worldwide for weed control. However, the mobility of these compounds and their degradation metabolites poses risks to animals, plants, aquatic invertebrates, microbial communities, and humans. *Advenella* sp. JRO (AFQG01000022) has previously been identified as an efficient biodegrader of diuron, the most commonly used phenylurea herbicide. Building on this knowledge, the aim of the present study was to evaluate the potential of this strain to degrade other widely used phenylurea herbicides: chlorotoluron, isoproturon, fluometuron, and linuron. HPLC-UV methodology for pesticide detection in solution showed the limited biodegradation capacity of this strain, achieving only 28, 40, 42 and 59 % degradation rate of solutions with 10mgL⁻¹ as single initial concentration of chlorotoluron, isoproturon, linuron and fluometuron, respectively, and with very high DT₅₀ according to kinetic models (range 342-3636 days), so *Advenella* sp. JRO cannot be considered as a valid method to biodegrade these phenylureas.

To enhance degradation rate, *Advenella* sp. JRO was also tested as part of consortia with *Arthrobacter* sp. N2 (AF235091) and *Variovorax* sp. SRS16 (DQ432053), two strains that previously had shown toxicity reductions and mineralization increases in diuron-contaminated soils by removing toxic metabolites. When these strains were combined, biodegradation significantly improved. The consortium composed of *Advenella* sp. JRO and *Variovorax* sp. SRS16 achieved 84% and 96% degradation (DT₅₀: 3 and 7 days) of chlorotoluron and fluometuron, respectively. Similarly, the triad formed by *Advenella* sp. JRO, *Variovorax* sp. SRS16, and *Arthrobacter* sp. N2 degraded 98% of isoproturon (DT₅₀: 7 days).

This study demonstrates, for the first time, the ability of *Advenella* sp. JRO to degrade chlorotoluron, fluometuron, isoproturon, and linuron. Furthermore, the engineered consortium formed with *Arthrobacter* sp. N2 and *Variovorax* sp. SRS16 represents a promising strategy for improving bioaugmentation protocols aimed at the bioremediation of soils contaminated with phenylurea herbicides.



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sciforum-179466: Phytotoxicity of 2,4-Dinitrotoluene on Growth and Metabolism of *Oryza sativa*

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The persistence of xenobiotic substances in the environment, including propellants, explosives, and pyrotechnic compositions, has become a global threat. Previous research has shown that nitroaromatics have an adverse influence on plant growth and development. Therefore, this study aims to examine how 2,4-dinitrotoluene (DNT) affects *Oryza sativa* physiologically and biochemically. The detrimental effects of DNT on *O. sativa* growth parameters (germination, viability, and electrolyte leakage) were seen at various concentrations (0, 0.025, 0.05, and 0.1%, w/v). It was discovered that these growth characteristics were sensitive to DNT, and that increases in DNT concentrations had detrimental effects. To further comprehend their harmful effects, a variety of biochemical (reactive oxygen species; ROS, malondialdehyde; MDA) and molecular investigations were carried out. When DNT concentrations increased, ROS and MDA levels significantly increased (superoxide radicals: 1.33-3.12, hydrogen peroxide: 1.54-1.89, and MDA: 2.8-5.65 times). Additionally, the plant system contains a range of enzymatic antioxidants to combat ROS and the harmful reactions they cause. The level of enzymatic antioxidants (superoxide dismutase, catalase, and ascorbate peroxidase) was measured spectrophotometrically in the current study, and the results show that exposure to DNT has a major impact on antioxidant levels. In conclusion, DNT exposure causes phytotoxic effects on *O. sativa*, which can be seen by evaluating physiological and biochemical processes. The degree of damage was found to be strongly associated with the DNT content.



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sciforum-174390: Pollution-Driven Metabolomic Evidence of Biochar and Compost Effects on a Key Soil Organism

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Evaluating the fertility of agricultural soils through biodiversity is essential for sustainable agriculture. Using biochar, compost and their combination become an option to increase soil fertility and rehabilitate degraded land. However, the potential negative effect of these amendments remains poorly understood. This study explored the risks associated with biochar and compost using the earthworm *Eisenia Andrei*, a key soil organism and bioindicator, exposed to biochar 2% (20gkg⁻¹ soil), and compost 1% (10gkg⁻¹ soil) and their mixture in two soil types (organic and conventional) for 7 and 14 days. To assess cytotoxic and genotoxic effects, lysosomal membrane stability (LMS) and micronucleus (MNi) assays were performed. Biochemical biomarkers, including catalase (CAT), glutathione S-transferase (GST), malondialdehyde (MDA), and acetylcholinesterase (AChE) for neurotoxicity, were analyzed. Additionally, earthworm gut metabolomic profiles were examined. Our Results revealed a significant decrease in lysosomal membrane stability (LMS) and an increase in DNA damage (MNi). Neurotoxicity responses varied between organic and conventional soils. Biochemical analysis indicated oxidative stress, as presented by alterations in CAT, GST, and MDA, with the strongest effects observed under combined biochar-compost exposure in both soil types. Moreover, biochar and compost significantly modulated metabolites associated with oxidative stress, inflammatory processes, amino acid biosynthesis, energy metabolism, and nucleic acid pathways, with stronger perturbations under co-exposure. Overall, these findings provide new insights into the toxic mechanism of biochar and compost exposure in earthworms, and highlight the role of the soil management practices in biological responses from multiple perspectives.



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sciforum-168461: Surface-Specific Retention and Biointeraction of Xenobiotic Airborne Particulate Matter on Adaxial and Abaxial Leaf Surfaces of *Ruscus aculeatus*

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Airborne particulate matter (PM) represents a complex class of environmental xenobiotics composed of mineral particles, heavy metals, persistent organic compounds, and environmentally persistent free radicals that pose significant risks to ecosystems and human health. Vegetation functions as a biological interface where xenobiotic particles are intercepted and retained through physicochemical interactions, surface adsorption, and biological processes occurring at the phyllosphere. Understanding surface-specific plant-xenobiotic interactions is therefore critical for predicting contaminant fate, residence time, and exposure mitigation in urban environments.

This study evaluates the surface-specific retention of xenobiotic PM on the adaxial and abaxial leaf surfaces of *Ruscus aculeatus*, a low-stature urban shrub exposed to near-road emissions at a roadside site on the Kyushu University campus, Fukuoka, Japan, located approximately 1 m from a main roadway. Two independent sampling campaigns were conducted, with 20 leaves collected per campaign. Particulate mass deposition was quantified using a modified gravimetric mass filtration protocol, separating coarse (10–100 μm), fine (2.5–10 μm), and submicron (0.2–2.5 μm) particle fractions.

Ruscus aculeatus accumulated a cumulative particulate load of 54.8 $\mu\text{g}\cdot\text{cm}^{-2}$ across both leaf surfaces, representing the integrated particulate load derived from the independently quantified deposits on the abaxial surface (30.3 $\mu\text{g}\cdot\text{cm}^{-2}$) and the adaxial surface (24.5 $\mu\text{g}\cdot\text{cm}^{-2}$). Retention was higher on the abaxial surface than on the adaxial surface, indicating clear surface-specific differences in particulate accumulation. Coarse particles dominated total mass accumulation, whereas fine particles showed enhanced stabilization on the sheltered abaxial surface.

Microstructural leaf features, including grooves and vein networks, promoted mechanical trapping, reduced resuspension, and increased particle residence time, suggesting enhanced potential for bio-interface interactions and transformation processes. These findings highlight the importance of leaf surface morphology in regulating plant-xenobiotic interactions, influencing environmental fate, and reducing near-ground exposure risks. The results support the strategic use of shrub vegetation as a complementary biological filter for mitigating airborne xenobiotic contamination in urban landscapes and provide a mechanistic basis for plant selection in nature-based air quality management strategies.



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sciforum-178563: The Pyruvate–Glyoxalate Pathway as a Toxicity Assessment Tool of Xenobiotics: Lessons from Prebiotic Chemistry

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There is an urgent need to evaluate the toxicity of xenobiotics and environmental mixtures for preventing loss in water quality for the sustainability of aquatic ecosystems. A simple prebiotic chemical pathway based on malate formation from pyruvate (pyr) and glyoxalate (glyox) is proposed as a quick and cheap screening tool for toxicity assessment. The hypothesis of this simple assay is that chemicals hindering the formation of biochemical precursors (malate) in conditions of prebiotic Earth before the appearance of structured life forms could form the basis of toxicity. Moreover, this early pro-metabolic pathway relies principally on aldol condensation reaction. Hence, this assay is based on the pyr and glyox reactions in the presence of Fe(II) as source of electron using temperatures between 40-70°C and leading to biologically relevant precursors such as oxaloacetate and malate. Malate and oxaloacetate are important intermediates of energy metabolism including sugars and lipids. Incubation of pyr and glyox at 40–70 °C in the presence of reduced iron Fe(II) led to malate formation following the first 3 h of incubation. The addition of various xenobiotics/contaminants (silver, copper, zinc, cerium IV, samarium III, dibutylphthalate, 1,3-diphenylguanidine, carbon-walled nanotube, nanoFe₂O₃ and polystyrene nanoparticles) led to inhibitions in malate synthesis at various degrees. Based on the concentration inhibiting malate concentrations by 20% (IC₂₀), the following potencies were observed: silver ~ copper ~ 1,3-diphenylguanidine ~ carbon-walled nanotube ~ zinc ~ samarium dibutylphthalate ~ samarium Ce(IV) ~ nFe₂O₃ ~ polystyrene nanoplastics. The IC₂₀ values were also significantly correlated with the reported trout acute lethality data, suggesting its potential as an alternative toxicity test. The pyr-glyox pathway was also tested on surface water extracts (C18), identifying the most contaminated sites from large cities and municipal wastewater effluents dispersion plume. The inhibition potencies of the selected test compounds revealed that not only prooxidants but also chemicals hindering enolate formation, nucleophilic attack of carbonyls and dehydration involved in aldol-condensation reactions were associated with toxicity. The pyr-glyox pathway is based on prebiotic chemical reactions during the emergence of life and represents a unique tool for identifying toxic compounds individually and in complex mixtures.



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sciforum-174416: Toxic Effects of *Alternaria* Fungi Metabolites on the Antioxidant Defense System of Rats

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Recent studies indicate substantial contamination of food products with *Alternaria* toxins (ATs), which are toxic metabolites produced by mold fungi of the genus *Alternaria*. Their ability to exert cyto- and genotoxic effects may pose a significant risk for human health. The most widespread AT is tenuazonic acid (TeA), which is currently not regulated in food products. In this regard, the aim of the present study was to investigate the effects of ATs, and in particular TeA, on the antioxidant defense system of the organism.

A single oral administration of pure TeA (30 mg/kg b.w.) or an extract containing a mixture of ATs: TeA (30 mg/kg b.w.), alternariol (0.276 mg/kg b.w.), alternariol monomethyl ether (0.902 mg/kg b.w.), and tentoxin (0.018 mg/kg b.w.) was used to evaluate their effects on antioxidant parameters in male Wistar rats.

A strain of the fungus *Alternaria alternata* was isolated from barley grain and cultivated on tomato paste. The mixture of ATs was extracted from the resulting substrate using a solvent system (ethyl acetate, formic acid). After evaporation, the extract was dissolved in methanol.

To assess the effects on the antioxidant defense system in rats, the following parameters were analyzed: malondialdehyde (TBARS, HPLC-FLD); conjugated dienes (spectrophotometric assay following Folch extraction); protein carbonyl derivatives (spectrophotometric detection after DNPH derivatization and gel filtration); antioxidant defense enzymes (FRAP assay and catalase activity); and expression of antioxidant defense-related genes (real-time RT-PCR).

It was found that both the AT mixture and TeA reduced total antioxidant activity and induced oxidative stress, as evidenced by increased levels of its markers: malondialdehyde, conjugated dienes, and protein carbonyl derivatives; decreased activity of antioxidant defense enzymes, and altered expression of the corresponding genes. Notably, the AT mixture demonstrated more pronounced effects.

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sciforum-179502: Toxicity of chemicals, binary and triple mixtures on daphnids–Molecular responses to understand pollution

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The impact of pollutants in the environment necessitates the improvement of monitoring techniques. Current detection of pollutants relies on analytical methods to capture their presence, which cannot provide any mechanistic or prognostic insight into their action. Consecutively, risk assessment is moving more towards the incorporation of novel approach methodologies in regulatory practices. Daphnids, as sentinel species, have acquired a strong place in ecotoxicological studies mainly due to their geographic distribution, clonal reproduction and ecoresponsive nature. In this study, glyphosate, lithium and metformin were used as indicative pollutants representing different categories: herbicides, metals and pharmaceuticals. Daphnids were exposed to single pollutants, three combinations of binary mixtures and their triple mixture. Key enzyme activities and mortality were assessed at 24 and 48 hours on a range of concentrations. Lithium was the most toxic of the three chemicals and acute toxicity in mixtures was synergistically enhanced. In the triple mixture, activities of alkaline phosphatase and lipase were decreased dose-dependently, while no significant difference was observed for acid phosphatase. Glutathione S-transferase and beta galactosidase increased dose-dependently. These findings showcase metabolic alterations in the metabolism of daphnids in response to these chemicals and their triple mixture, which could be used as sensitive endpoints to predict and understand chemical pollution. Finally, a preliminary study of untargeted metabolomics showed clear metabolic shifts in response to the concentration of the triple mixture.



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sciforum-172412: Use of *Balanophyllia europaea* as a biological model for monitoring the Mediterranean coralligenous biocenosis: the SIMBIOSI project

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The coralligenous biocenosis represents an essential ecosystem, susceptible to the effects of anthropogenic and environmental disturbances is at risk of disappearing unless we intensify our efforts to protect them.

In this context, the SIMBIOSI project aimed to develop sensitive and effective analytical tools to determine the presence of emerging contaminants and their potential deleterious effects on the Mediterranean coralligenous biocenosis, using the solitary, zooxanthellate coral *Balanophyllia europaea* as biological model.

The project involved the analysis of the presence of new emerging contaminants not covered by current regulations, in the water column and in madreporal specimens. The contaminants considered are titanium-based nanomaterials released from sunscreens (nano-TiO₂), rare earth elements and micro and nanoplastics.

A total of fifteen organisms were collected in July and in August at a depth of 5 metres off the coast of Calafuria (Leghorn, Italy). Simultaneously, chemical and physical parameters of the water were acquired using a multiparametric probe. Titanium dioxide, including n-TiO₂ was analyzed using ICP-MS coupled with SEM microscopy to evaluate their size and shape. For plastics, the monomer content of PCV (vinyl chloride) and PS (styrene) was analyzed using VOC GC/MS. The analysis of rare earth elements was carried out using ICP-MS.

Results showed very low levels of rare earth elements and trace metals in corals and the absence of PVC and PS and TiO₂. The analysis of water parameters showed a slight fluctuation of temperature and pH over time.

Our results highlighted the possibility to use *B. europaea* to evaluate the condition of the coralligenous biocenosis in relation to environmental contamination.

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sciforum-173851: Xenobiotics Persistence in Mediterranean Soil: Effects of Compost Application on Their Dissipation

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The presence of organic contaminants in agroecosystems poses a significant risk to ecosystem health and food safety. These xenobiotics enter soils through sewage sludge application, reclaimed wastewater irrigation, and livestock manure, where they disrupt soil microbial diversity and functionality and impair key edaphic processes such as nutrient cycling and organic matter decomposition. Their persistence enables accumulation in plant tissues and biomagnification across trophic levels, posing risks to ecosystem health and food safety. A persistence study evaluated the behaviour of two pesticides (trifloxystrobin and pendimethalin) and two pharmaceutical products (mebendazole and venlafaxine) in a Mediterranean Alfisol soil type, as well as the effect of adding biowaste—compost on their dissipation. A microcosm assay monitored their concentrations over 21 days. Determination of these compounds in the soil matrix was performed using QuEChERSER liquid-phase extraction method followed by UHPLC-MS/MS quantification. Trifloxystrobin showed rapid degradation in soil, while mebendazole exhibited high persistence in unamended soil and venlafaxine showed very high persistence in both soils. Pendimethalin dissipation was intermediate. Compost significantly accelerated the degradation of pendimethalin and mebendazole, and also promoted venlafaxine degradation. These results reinforce the need to control xenobiotic contamination in intensive agricultural systems. In the Valencian Community, uptake and accumulation of organic contaminants in plant tissues has been observed, threatening food safety through bioaccumulation and biomagnification. The validation of soil bioremediation strategies using quality organic amendments like compost, together with robust analytical methods (QuEChERSER-UHPLC-MS/MS), is key to generating information that supports specific regulations and healthy soils to mitigate the ecotoxicological effects of these contaminants.



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Session 2. Nanotoxicology and Targeted Pharmacology of Nanomaterials

sciforum-179227: AI-Guided Nanotoxicological and Immunopharmacological Evaluation of Ligand-Functionalized Polymeric Nanoparticles in Targeted Cancer Therapy

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Background

Polymeric nanoparticles enable targeted drug delivery in cancer therapy, yet concerns regarding nanotoxicity and immune dysregulation limit their clinical translation. Artificial intelligence (AI) offers a promising approach to predict and optimize nanoparticle safety profiles prior to experimental validation.

Objective

To develop an AI-assisted predictive framework for evaluating the nanotoxicological and immunopharmacological properties of folate-conjugated polymeric nanoparticles (FA-PNPs), followed by experimental validation in cancer and immune cell models.

Methods

An AI-based random forest model was first developed to predict nanoparticle toxicity using physicochemical parameters. FA-PNPs (mean size: 112 ± 8 nm; zeta potential: -18.6 ± 2.1 mV) were then synthesized and characterized. Predicted outcomes were validated experimentally using MTT cytotoxicity assays (MCF-7 and Jurkat cells, 24–72 h), ROS generation (DCFH-DA assay), cytokine profiling (IL-6, TNF- α , IFN- γ via ELISA), and fluorescence-based cellular uptake studies. Non-functionalized polymeric nanoparticles (PNPs) were included as controls for comparative analysis.

Results

The AI model demonstrated strong predictive performance (accuracy: 91.3%) and showed high correlation with experimental toxicity outcomes ($R^2 = 0.87$). FA-PNPs exhibited selective cytotoxicity toward MCF-7 cells ($IC_{50} = 42.7$ μ g/mL) compared to Jurkat cells ($IC_{50} = 91.5$ μ g/mL; $p < 0.01$). ROS generation increased by 2.8-fold in cancer cells versus 1.3-fold in immune cells. Pro-inflammatory cytokines IL-6 and TNF- α decreased by 34% and 29%, respectively, while IFN- γ increased by 21%. Compared to non-functionalized PNPs, FA-PNPs showed a 2.5-fold enhancement in cellular uptake.

Conclusion

This study demonstrates that AI-guided prediction combined with experimental validation provides a robust framework for assessing nanoparticle safety and efficacy. FA-PNPs exhibit enhanced targeting, reduced inflammatory toxicity, and favorable immunomodulatory effects, supporting their potential as safer precision nanotherapeutics for cancer treatment.



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sciforum-179472: Impact of Dietary Xenobiotics on the Intestinal Activity of Sodin 5: Implications for RIP-Based Nanotherapeutics

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Introduction

Ribosome-inactivating proteins (RIPs) are potent plant-derived enzymes widely investigated for experimental cancer therapy, particularly as toxic payloads in targeted nanoconjugates. Among RIPs, sodin 5, from the edible plant *Salsola soda*, has recently demonstrated significant cytotoxicity in colon cancer models. However, the impact of dietary xenobiotics, commonly present in the intestinal environment, on RIP activity remains poorly understood. This study aimed to evaluate whether selected dietary xenobiotics can modulate sodin 5 induced cytotoxicity in Caco-2 colon adenocarcinoma cells.

Methods

The cytotoxic effects of sodin 5 were assessed in Caco-2 cells through dose- and time-dependent experiments. Cell viability was measured using the MTS assay following treatment with sodin 5 alone or in combination with selected dietary xenobiotics (butylated hydroxyanisole, BHA; capsaicin; piperine; and caffeine). In parallel, the integrity of the epithelial monolayer was evaluated by measuring transepithelial electrical resistance (TEER) in Caco-2 monocultures.

Results

Sodin 5 significantly reduced Caco-2 cell viability starting from 10^{-8} M after 24h. At 72h, a pronounced reduction was already evident at 10^{-9} M, with an EC_{50} in the 10^{-7} M range. Co-treatment with dietary xenobiotics produced distinct modulatory effects. Capsaicin and piperine enhanced sodin 5 cytotoxicity, indicating a synergistic interaction, which was particularly marked for capsaicin. In contrast, caffeine did not significantly alter sodin 5 activity. Notably, BHA exerted a strong protective effect, reducing sodin 5 induced cytotoxicity from approximately 60% to 15%, supporting a role of oxidative stress in the mechanism of cell death. TEER measurements were consistent with viability data.

Conclusions

Dietary xenobiotics significantly influence sodin 5 cytotoxicity in intestinal cells, either enhancing or attenuating its effects. These findings highlight the importance of considering diet-derived compounds in the development of RIP-based nanotherapeutics and provide new insights into factors affecting their intestinal safety and efficacy.



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sciforum-174216: Marine-Derived Silver Nanoparticles for Aquaculture: A Systematic Evaluation of Synthesis–Performance Relationships and Nanotoxicological Implications

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Silver nanoparticles (AgNPs) synthesized via marine organisms have attracted growing attention as sustainable alternatives to conventional chemical and physical production methods, particularly for applications in aquaculture. Despite rapid advances in this field, existing research remains fragmented, with limited quantitative integration of synthesis parameters, nanoparticle physicochemical characteristics, and reported application outcomes. To address this gap, we conducted a systematic, literature-based data compilation and comparative analysis of published studies focusing on marine organism-mediated AgNP synthesis and aquaculture-related applications.

Peer-reviewed articles were systematically screened, and quantitative data were extracted to evaluate precursor concentration, biological source (including algae, bacteria, fungi, and cyanobacteria), synthesis conditions (pH, temperature, and reaction time), nanoparticle size distribution, morphology, characterization techniques, and reported functional performance. Comparative statistical analysis revealed distinct trends linking organism type to nanoparticle properties and application efficiency. Algae- and bacteria-mediated synthesis routes consistently yielded smaller, more uniform AgNPs, whereas fungal systems demonstrated enhanced capping efficiency and nanoparticle stability. Application-focused data showed substantial antimicrobial efficacy against aquaculture pathogens and promising antifouling performance. However, inconsistencies in ecotoxicological testing methods and reporting metrics highlight the urgent need for standardized evaluation frameworks.

By integrating synthesis parameters, structural characterization, functional outcomes, and sustainability considerations into a unified analytical framework, this review provides a structured understanding of current progress and limitations. Furthermore, it identifies critical methodological gaps, reporting inconsistencies, and scalability challenges, offering a roadmap for standardized experimental design, controlled nanoformulation development, and environmentally responsible deployment of marine-derived AgNPs within sustainable aquaculture systems.



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sciforum-174064: Nanosized Titanium Dioxide (E171) in Russia: Particle Size Analysis and Perspectives to Hygienic Regulation

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Introduction

The safety of E171 (TiO₂) is debated due to potential genotoxicity of its nanoparticles (NPs, 100 nm). EFSA concluded that a safe level cannot be established (EU ban since 2022), while other countries (USA, UK, Canada, Australia) permit its use under conditions. This work aimed to estimate a safe NP limit in E171 and screen Russian market samples.

Methods

Meta-analysis of oral toxicity studies of nano-TiO₂ (100 nm) was conducted. Ten E171 samples from the Russian market were analyzed by DLS (0.1% w/w in deionized water, 20 min sonication, 2 W/cm³). Number-based proportion of particles 100 nm was calculated.

Results

The meta-analysis revealed numerous effects of nano-TiO₂ in animals (biochemical alterations, oxidative stress, genotoxicity, immune and reproductive disorders), despite low bioavailability (0.1%). The lower 25th percentile NOAEL for nano-TiO₂ was 10 mg/kg bw/day. Using a safety factor of 100, a hypothetical safe intake of 0.1 mg/kg bw/day was derived. Total dietary exposure to TiO₂ is approximately 1 mg/kg bw/day (max. mean, mg/kg bw/day, based on JECFA 2024: USA - 0.19, Netherlands - 1.4, China - 0.3, Europe - 3.9). Thus, the NP fraction in E171 should not exceed 1% by mass (~20% by particle number) to stay below 0.1 mg/kg/day. DLS analysis revealed NPs in 7 out of 10 Russian samples, with their proportion reaching up to 7% by number, which is below the proposed safe limit.

Conclusion

Screening of ten E171 samples revealed a nanosized fraction in seven of them (up to 7% by number), which does not exceed the calculated safety level. The obtained results indicate the feasibility of introducing a hygienic standard limiting the nanoparticle content in E171 and the need for expanded monitoring of this food additive.

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sciforum-174533: Study of the cytotoxicity of pegylated expanded graphene oxide in human endothelial cells

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Carbon-based nanomaterials have attracted significant attention in biomedical research due to their unique properties and versatility. PEGylation has been widely used to improve graphene oxide stability and reduce toxicity in vitro, with PEG-GO showing low cytotoxicity in lymphoma cells and enhanced colloidal behavior in biological media. However, studies also indicate that PEGylated composites can interact with endothelial models under pathophysiological conditions, and surface modifications influence cellular uptake and internalization patterns.

In this study, pegylated expanded graphene oxide (EGO-PEG) was synthesized from expanded graphene oxide (EGO) to evaluate the impact of PEG functionalization on cytotoxicity in human endothelial cells. Structural and morphological characterization was performed using Infrared Spectroscopy (IR), Raman Spectroscopy (RS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Atomic Force Microscopy (AFM), confirming successful PEG conjugation through amide (NH-CO) bond formation.

Cytotoxicity was assessed in EA.hy926 endothelial cells cultured in DMEM, BSA, and FBS using the MTT assay. EGO-PEG exhibited reduced cytotoxicity and higher cell viability compared to non-pegylated EGO. However, no significant decrease in toxicity was observed in protein-rich media (FBS or BSA). TEM micrographs revealed EGO internalization within cytoplasmic vacuoles, indicating effective cellular uptake. Cell viability was primarily influenced by nanoparticle size, shape, and concentration, and intracellular EGO accumulation may contribute to mitochondrial dysfunction.

These findings demonstrate that PEG functionalization enhances the cytocompatibility of expanded graphene oxide, supporting its potential in nanomedical applications.



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sciforum-179277: Turmeric Phyto-NanoParticle (TPNP) enhances cellular bioavailability and anti-inflammatory effect of curcuminoids in human monocytes/macrophages

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The poor bioavailability of curcuminoids remains a major challenge to therapeutic use. This is largely due to their hydrophobicity, poor absorption, rapid metabolism, and short circulating half-life—limitations that are now being addressed through advances in nano- and micro-emulsion technologies. Curcuminoids and other water-insoluble phyto-polyphenols offer significant putative health benefits as anti-inflammatory, antioxidant, anticancer, radioprotective, and neuroprotective agents. Conventional emulsion-based delivery systems, such as liposomes, micelles, or solid lipid particles, rely on various emulsifying surfactants and/or excipients, some of which may themselves pose health risks. Here, we establish a novel class of all-natural, additive-free, oil-free, and emulsion-free Turmeric Phyto-NanoParticles (TPNPs) formulated directly from turmeric rhizomes and tested in a human monocyte/macrophage cell model to assess bioavailability kinetics and the efficacy of antioxidant and anti-inflammatory potential. TPNPs are enriched with curcuminoids (24.85% by mass), form a homogeneous nanoparticle distribution, exhibit higher antioxidant capacity, and demonstrate significantly improved cellular uptake in both monocytes and macrophages compared to conventionally purified curcuminoids. Favourable cellular pharmacodynamic anti-inflammatory effect of TPNPs was shown by increased levels of the cytoprotective enzyme heme oxygenase-1 (HMOX1), and a more effective reduction in lipopolysaccharide (LPS)-induced tumor necrosis factor (TNF) secretion compared to conventional curcuminoids. TPNPs could thus serve as a stable, non-synthetic, excipient-free formulation for safe and effective delivery of curcuminoids by nanocarriers for inflammatory conditions.



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Session 3. Emerging Chemicals: Environment Risks and Health Effects

sciforum-173159: FPSE–LC–MS/MS as a Reliable Tool for Quantifying Drugs of Abuse in Oral Fluid

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The widespread use of drugs of abuse (DOA) constitutes a significant public health and social concern, highlighting the need for sensitive and reliable analytical methods particularly for alternative biological matrices. Oral fluid (OF) has emerged as a valuable matrix for the detection of recent drug intake and is extensively employed in forensic and toxicological investigations. Fabric phase sorptive extraction (FPSE) is a recently introduced sample preparation technique, characterized by simplicity, cost-effectiveness, rapidness, low solvent consumption and high analytical performance. A fully developed and validated FPSE-based method for oral fluid analysis will be presented, employing liquid chromatography–tandem mass spectrometry (LC–MS/MS) for the quantitative determination of ten commonly encountered DOA and metabolites including morphine, codeine, 6-monoacetylmorphine (6-MAM), methadone, amphetamine, methamphetamine, 3,4-methylenedioxymphetamine (MDA), cocaine, benzoylecgonine (BE), and ecgonine methyl ester (EME). The method demonstrated excellent linearity for all analytes ($R^2 = 0.990\text{--}0.999$), with absolute recoveries ranging from 10 to 93%, coefficients of variation between 2 and 17%. Limits of detection (LOD) and quantification (LOQ) ranged from 0.01 – 2 ng/mL and 0.03 – 6 ng/mL, respectively. Autosampler stability (24h) and short-term (one week) freeze stability exceeded 95 % and 90 % for all analytes. No significant matrix effects, interferences from the analytes or carryover were observed. Overall, the presented FPSE-LC-MS/MS method provides a sensitive, selective, and environmentally friendly analytical approach for the determination of DOA in oral fluid.



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sciforum-149269: Palladium (Pd) in Urban Environments: Evidence, Implications, and the Need for Inclusion in Soil Pollution Monitoring

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Palladium (Pd), a platinum group element (PGE), is increasingly released into the environment due to its widespread application in catalytic converters, electronics, and hydrogenation catalysts. Despite its growing use, Pd remains largely unregulated in current soil pollution frameworks, and its environmental fate is not well characterised. This study indirectly assessed the presence of Pd in urban topsoils from Alcalá de Henares (Spain) by analysing 137 surface samples (0–3 cm depth) for platinum (Pt) and rhodium (Rh) using ICP-MS. Pd was inferred from well-documented co-emission patterns among PGEs, particularly from automotive catalytic converters, which release Pt, Rh and Pd in relatively stable ratios. Spatial mapping and multivariate statistical analysis demonstrated that Pt and Rh concentrations were elevated in areas affected by traffic and urban gardening activities. These elements clustered together in principal component analysis, suggesting a shared anthropogenic origin that likely includes Pd. Although Pd was not directly quantified, its presence is strongly supported by the overlapping spatial trends of Pt and Rh. The persistence and mobility of PGEs in soil—especially in fine-textured, organic-rich areas—suggest Pd may similarly accumulate and pose long-term exposure risks. Toxicological reference values for Pd are not yet established, precluding formal risk assessment. Nevertheless, biomedical studies suggest potential immunotoxic, cytotoxic and allergenic effects from chronic Pd exposure, particularly via inhalation of resuspended particles. This study underscores an urgent need for environmental surveillance studies that include Pd, and consideration of its toxicological relevance. Given its increasing industrial use and emerging evidence of harm, Pd should no longer be overlooked in urban pollution monitoring programmes.



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sciforum-161285: Perceived BTEX Exposure and Occupational Safety Knowledge, Attitudes, and Practices among Petrol Station Attendants in Islamabad, Pakistan

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Introduction

Petroleum derived volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (BTEX) are an emerging source of major environmental and occupational health hazards. In Pakistan, petrol pump attendants are continuously exposed, yet limited data exist regarding exposure levels as well as safety behaviors.

Objective

To assess the self reported BTEX exposure levels among petrol station attendants in Islamabad, Pakistan and to evaluate their knowledge, attitudes, and safety behaviors to prevent human induced occupational and environmental health risks.

Methods

A descriptive cross sectional study was conducted among male attendants (n=30) working in petrol stations in Islamabad, Pakistan (September–October 2025). Data was collected through convenient sampling using a bilingual semi structured questionnaire with questions regarding sociodemographic variables, exposure indicators, and KAP variables. A composite “Self-Reported Exposure Index” (score 0–12) quantified BTEX exposure which was categorized as low (0–3), moderate (4–7), and high (8–12). Descriptive statistics were performed using SPSS.

Results

More than half (53%) of participants reported high exposure scores to BTEX. Very high proportion of attendants reported frequent symptoms of headache (76.7%), cough (66.7%), and dizziness (60%). High proportion of attendants (86.7%) recognized glove use as protective, however less than half (43.3%) of the participants consistently wore them. Positive attitudes toward safety behaviors were reported by very high proportion of participants (97%), however they reported limited institutional support (40%) towards safety practices of employees.

Conclusion

The study reported high exposure of BTEX among petrol pump attendants. They were aware of the safety practices; however, they were still not following occupational safety practices to protect themselves and their environment from the hazards of VOCs. Strict policies should be made to enhance implementation of occupational and environmental safety practices in petrol pumps.



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sciforum-171950: Acute Aquatic Toxicity of *Nepeta Cataria* Essential Oil Compared with cis–Trans Nepetalactone in *Raphidocelis subcapitata* and *Daphnia pulex* (OECD 201/202)

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Nepetalactone (NL) is the main bioactive constituent of *Nepeta cataria* essential oil (EO). Although its biocidal potential is well established, defining potential impacts on non-target aquatic organisms is important for environmental risk assessment. This study evaluated the ecotoxicity of pure cis–trans NL with that of *N. cataria* EO (72% NL), using the freshwater microalga *Raphidocelis subcapitata*, and *Daphnia pulex*, following OECD 201 (algal growth inhibition) and OECD 202 (*Daphnia* acute immobilisation) guidelines. Negative controls and a methanol solvent control were included; algal tests were run at five concentrations in triplicate, while *Daphnia* were exposed to twelve concentrations, and all endpoints were based on analytically confirmed exposure levels. For *R. subcapitata*, pure NL produced an ErC50 (growth-rate inhibition) of 41.78 ppm and an EyC50 (yield inhibition) of 21.11 ppm. The EO was substantially more toxic, with an ErC50 of 1.40 ppm NL equivalents (1.94 ppm EO) and an EyC50 of 11.14 ppm NL equivalents (15.46 ppm EO). In *D. pulex*, pure NL yielded a 48 h EC50 of 54.93 ppm (175.81 ppm at 24 h). Again, the EO showed higher toxicity, with a 48 h EC50 of 8.38 ppm NL equivalents (22.75 ppm at 24 h, NL equivalents). Overall, acute effects across two trophic levels at concentrations that may be environmentally relevant were shown, but the EO consistently exceeded the toxicity of isolated NL. This points to contributions from minor constituents and/or synergistic interactions within the EO, underscoring that botanical biopesticide risk assessments should evaluate whole extracts rather than relying only on active-ingredient data. In parallel, docking of NL to environmentally relevant targets (estrogen and androgen receptors, and TRPA1) is underway using validated workflows (AutoDock Vina, Avogadro, PubChem) to explore plausible binding interactions.

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sciforum-179432: Analysis of selenium and heavy metals by ICP-MS in patients with long-term dental titanium and/or amalgam fillings: does selenium deficiency increase the accumulation of mercury and aluminium in patients?

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Mercury (Hg⁺⁺) release from dental amalgams can induce oxidative stress and contribute to cognitive impairments in patients with long-term dental amalgams. Furthermore, mercury and aluminium could accelerate the progression of neurological diseases.

Conversely, titanium alloy (Ti 6Al-4V) is a biocompatible biomaterial of interest in the field of odontology. Although titanium is generally considered safe for patients, recent studies have revealed certain adverse effects associated with this material. However, the link between selenium deficiency and accumulation of heavy metals (mercury and aluminium) and depression, has not been elucidated in patients with long-term dental titanium implants and/or amalgam fillings (at least 15 years in the mouth).

Our aim is determinate whether selenium deficit could increase the mercury and aluminium accumulation in patients with long-term titanium and dental implants (A + I group, n = 57) as compared their levels in participants with long-term dental amalgams alone (A group, n = 55), and control subjects (without dental biomaterials, n = 30). For this aim, we compared Se/Hg⁺⁺ and Se/Al ratios in hair samples by ICP-MS spectrophotometry between A+I, A, and control groups, while a Beck's test was performed to assess possible differences in depressive behaviour.

In our study, A+I patients had lower Se/Hg²⁺ and Se/Al ratios than the A group. This suggests that titanium contributes to selenium depletion, which indirectly leads to Hg²⁺ or Al tissue accumulation in participants with long-term titanium and dental amalgam fillings. As heavy metals contribute to Alzheimer's disease pathology, selenium supplementation could reduce their accumulation in patients with long-term dental biomaterials.

Conclusion

Patients with long-term titanium and dental amalgam fillings have selenium levels that contribute to mercury and aluminium accumulation.



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sciforum-174041: Analysis of the Effect of the α -Amylase Enzyme Preparation from the Genetically Modified Strain *Komagataella phaffii* 2xAmy-BaLi-a-II-ZeoR-(Y-5231) on the Behavioral Reactions of Male Wistar Rats

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Introduction

α -Amylases are widely used in the food industry as an enzyme preparation (EP) for the degradation of carbohydrates. The genetically engineered strain *K. phaffii* 2xAmy-BaLi-a-II-ZeoR-(Y-5231) is a modern biotechnological producer of this EP. Upon oral administration in an active form, α -amylase can potentially influence the level of releasing peptides that modulate the production of cholecystokinin, a mediator involved in the regulation of digestion and behavioral acts, including the feeling of satiety. The aim of this work was to assess the behavioral responses and motor activity of animals to exclude a possible neurotropic effect of the α -amylase EP.

Methods

The study was conducted on laboratory animals in a subacute experiment (90 days) with intragastric administration of the EP at doses of 1, 10, and 100 mg TOS/kg/day. Memory function was assessed using the passive avoidance conditioned reflex (CPAR) test on days 59, 60, and 80 of the experiment. Anxiety-like functions and locomotor activity were studied once using the Elevated Plus Maze (EPM) test.

Results

The study revealed no statistically significant differences between the experimental groups and the control group. The parameters of memory trace formation and retrieval in the CPAR test in animals administered the EP corresponded to the physiological norm and did not indicate any impairment of learning processes or memory consolidation. In the EPM test, the parameters of motor activity, orienting reactions, and anxiety levels in all experimental groups were within the range of values characteristic of control animals.

Conclusion

The patterns of behavioral and locomotor activity in all experimental groups corresponded to the normal reactions of the control group. The investigated α -amylase enzyme preparation does not possess neurotropic properties and does not affect the memory function of rats within the studied doses under 90-day exposure.

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sciforum-178120: Antibiotic Residues in the Environment: Drivers OF Antimicrobial Resistance in Ecosystems—A Systematic Review

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Introduction

The widespread use of antibiotics in human medicine, agriculture, and aquaculture has resulted in the accumulation of antibiotic residues in environmental matrices such as soil, surface water, sediments, and wastewater. These residues act as environmental contaminants that exert selective pressure on microbial communities, thereby promoting the emergence and dissemination of antimicrobial resistance (AMR).

Methods

A systematic literature review was conducted following PRISMA 2020 guidelines. Databases including Scopus, Web of Science, PubMed, and Google Scholar were searched for studies published in English between 2015 and 2025 using keywords such as “antibiotic residues,” “antimicrobial resistance,” “ARGs,” “soil,” “water,” “wastewater,” and “environment.” A total of 112 records were identified, and 35 studies met the inclusion criteria after screening.

Results

Antibiotic residues were reported in 29 of the 35 studies, with concentrations ranging from 1–500 ng/L in aquatic environments and up to 1200 µg/kg in soils and sediments. Tetracyclines (24 studies), sulfonamides (21), fluoroquinolones (20), and macrolides (18) were the most frequently detected classes. Antimicrobial resistance genes (ARGs), particularly tet, sul, and bla, were identified in 23 studies, with significant positive correlations ($r = 0.60\text{--}0.88$) between antibiotic concentrations and ARG abundance. Major contamination sources included wastewater treatment plants (26 studies), agricultural runoff (19), aquaculture systems (14), and pharmaceutical effluents (11).

Conclusions

Antibiotic residues are prevalent in environmental systems and contribute significantly to the spread of AMR. Strengthening environmental monitoring, improving waste management practices, and promoting responsible antibiotic use are important to mitigate resistance risks and protect ecosystem and public health.



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sciforum-179219: Assessing the Sublethal Impacts of Tobacco-Derived Compounds Using *Daphnia* as a Model Organism

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There is a growing global recognition of the devastating effects of pollution, which remains one of the most pressing environmental challenges of our time. Among its many sources, tobacco pollution represents an overlooked contributor with serious ecological consequences. While the health impacts of smoking are widely acknowledged, the environmental burden of tobacco production, consumption, and waste is equally alarming. Discarded cigarette butts, which constitute one of the most common forms of litter worldwide, can persist in the environment for up to fifteen years. During this time, they release a complex mixture of toxic chemicals including nicotine, heavy metals, and polycyclic aromatic hydrocarbons into surrounding soils and water bodies. This leaching process contaminates aquatic ecosystems, threatens wildlife, and contributes to the broader issue of chemical pollution. Addressing tobacco pollution, therefore, requires not only public health interventions but also improved waste management and policy measures to mitigate its long-term environmental impact.

Current pollution assessments primarily focus on the detection of chemicals in the environment to estimate water quality; however, these methods are often descriptive and insufficient for understanding ecological impacts. This limitation underscores the need for effect-based methods as more sensitive tools for risk assessment. Daphnids are key species in molecular ecotoxicology and serve as effective indicators of environmental health.

In this study, we employed a combination of phenotypic and holistic approaches to investigate the impact of extracts from tobacco on these aquatic organisms. Integrating assessments of toxicity, growth, survival, feeding behaviour, and key enzymatic activities revealed distinct molecular and physiological responses, which serve as “molecular fingerprints” of exposure to tobacco-derived contaminants. This comprehensive approach highlights the potential of the water flea as a sensitive model organism to assess ecological risks from tobacco pollutants, acting as an equivalent to a “canary in the coal mine” for freshwater ecosystems.



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sciforum-179013: Behavioral and reproductive consequences of *Caenorhabditis elegans*' embryos after exposure to low doses of bisphenol A and its substitutes

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Introduction

Endocrine disruptors, such as bisphenols (e.g. BPA and its analogues), interfere with hormonal homeostasis and physiological processes. The objective of this study was to investigate the detrimental effects of BPA and selected analogues (BPAF, BPF, BPS) on the model organism *Caenorhabditis elegans*.

Methods

The effects of embryonic exposure to BPA, BPAF, BPF, and BPS were studied in a reference strain *C. elegans* N2 and two mutant strains, namely *bli-1* and *dpy-13*. Embryos were exposed to 0,5; 1; and 5 μM of each compound for 4 hours. After exposure, hatching, oviposition, locomotor activity, and habituation to anterior touch were assessed to identify sensitive genotypes and evaluate their suitability for detecting subtle toxic effects.

Results

In WT, all tested bisphenols significantly reduced hatching already at 0,5 μM . *C. elegans dpy-13* was the most sensitive for hatching, with the strongest effect observed at 5 μM of BPF, where median hatching decreased to 12,5%. During oviposition, *dpy-13* showed relative resistance to BPA, but marked sensitivity to its analogues. BPAF significantly reduced egg laying from 0,5 μM , while BPF and BPS exhibited this effect at 1 μM . *C. elegans bli-1* was the most sensitive in habituation, showing a dose-dependent increase in the number of anterior touches required after all bisphenols tested. In particular, at concentration of 0,5 μM BPS, the median reached 37,5 touches compared to 27 observed in WT.

Conclusions

Comparative analysis revealed that the adverse physiological impacts of BPA analogues were not only comparable to BPA but, in several cases, more potent. Findings using *bli-1* and *dpy-13* mutants demonstrate that specific cuticle architecture plays a key role in modulating the biological impact of these bisphenols. This study improves the risk assessment of BPA substitutes and identifies specific *C. elegans* mutants as sensitive tools for screening endocrine disruptors at environmental concentrations.



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sciforum-146509: Bioassay study of released compounds to assess the safety of popular children's toys

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Various polymers are used to produce goods for people, in particular toys for children. To improve the properties of the material, such as plasticity, flame resistance or recyclability, different additives are included into the material composition. However, besides improving their characteristics these compounds can be significantly harmful to human health: for example, phthalates increase the flexibility of materials and can lead to the damage of internal organs (liver, kidney); polybrominated diphenyl ethers are used as flame retardants and can negatively affect the endocrine system. Thermoplastic rubber is a class of material that combines characteristics of rubber and plastic and is made from styrene and butadiene. It is characterized by its resistance to weathering and chemicals, flexibility and has a wide range of applications, including in gloves, electronics, toys, footwear, automotive industry etc. Thermoplastic rubber children's toys are popular anti-stress squash toys. However, when they are used, emission of substances is observed, and the toxicity of such toys and their safety for children's health are unknown. Therefore, the aim of this study was to study the toxicity of popular anti-stress squash toys by biotesting with *Lepidium sativum* L. to assess the risks to children's health. The study included a growth test with *L. sativum* with an assessment of germination energy, seed germination and biometric-morphometric indicators of seedlings. The results were processed using statistical methods. It was found that in all study variants, aqueous extracts from the studied toys or their extracts in a 1% dimethyl sulfoxide solution did not show phytotoxicity. The obtained data indicate the biosafety of water-soluble mixtures secreted by the studied children's toys.



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sciforum-165657: Biomimetic insights into toxicokinetics and health risks of organic environmental pollutants

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Insufficient monitoring of organic pollutants, including pharmaceuticals and pesticides, has led to their increasing presence in aquatic environments, raising concerns regarding long-term ecological and human health risks. Reliable tools for predicting the toxicokinetic behaviour and potential health outcomes of such contaminants are therefore needed. In this study, biomimetic human serum albumin (HSA) chromatography combined with in silico ADMET modeling was applied to evaluate the toxicokinetic and toxicological profiles of selected organic environmental pollutants. HSA chromatography was selected as a physiologically relevant model due to the key role of albumin in compound transport, distribution, and bioavailability in human plasma. Chromatographic experiments were performed under physiological conditions (pH 7.0) using an HSA column with varying acetonitrile contents (15–4.5%), enabling modulation of interaction strength between analytes and the protein. Obtained retention parameters were correlated with predicted ADMET and toxicity descriptors generated using the ADMETlab platform. A strong linear relationship ($r > 0.95$) between retention behaviour and mobile phase composition indicated that reversed-phase interactions dominate compound binding to HSA. At 6% acetonitrile, significant correlations ($r > 0.80$) were observed between HSA retention parameters and key toxicokinetic and toxicological endpoints, including lipophilicity, Caco-2 permeability, human intestinal absorption, volume of distribution, BBB and CNS permeability, clearance, LD₅₀, LOAEL, and aquatic toxicity. The investigated hydrophilic β -lactam antibiotics (penicillins and cephalosporins) exhibited high water solubility, low lipophilicity, high polarity, and poor membrane permeability, resulting in limited intestinal absorption, negligible BBB penetration, and restricted systemic exposure. In contrast, organophosphate pesticides showed high intestinal absorption, broader tissue distribution, and moderate to increased BBB permeability, indicating an elevated risk of systemic and neurotoxic effects, consistent with their acetylcholinesterase inhibition mechanism. The obtained results demonstrate that hydrophobicity-driven albumin interactions can effectively simulate biological behaviour, supporting biomimetic HSA chromatography as a robust screening tool for predicting toxicokinetic outcomes and human health risks associated with organic environmental pollutants.



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sciforum-165717: Clove Oil as a Xenobiotic: Assessment of Acute Oral Toxicity and Multi-Organ Damage in Rats

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Clove oil, a natural product widely used in food, cosmetics, and traditional medicine, contains eugenol as its principal bioactive compound. Despite its broad application, concerns remain regarding its safety when consumed at doses exceeding recommended limits. This study aimed to assess the acute oral toxicity of clove oil as a xenobiotic substance in Wistar rats following repeated exposure. Twenty-four adult rats were randomly allocated into four groups (n = 6 per group): a control group, a group receiving the World Health Organization (WHO)-recommended safe dose, a medium-dose group, and a high-dose group. Clove oil was administered orally once daily for seven consecutive days. Animals were closely monitored for clinical signs of toxicity, behavioral alterations, and changes in body weight throughout the study period.

Rats exposed to medium and high doses exhibited clear dose-dependent toxic manifestations, including lethargy, pruritus, coughing, respiratory distress with wheezing, delayed neurological responses, and significant body weight loss. No mortality was observed; however, pronounced pathological changes were detected during postmortem examination. These included extensive cardiac hemorrhage and rupture, along with severe bleeding and tissue damage in the liver and kidneys, indicating multi-organ toxicity. In contrast, animals in the control and safe-dose groups showed no notable adverse effects.

The findings demonstrate that excessive oral exposure to clove oil can induce significant acute toxic effects, particularly affecting vital organs involved in xenobiotic metabolism and clearance. This study highlights the importance of strict adherence to established safety guidelines and underscores the need for further toxicological investigations to better define the risks associated with prolonged or high-dose exposure to plant-derived xenobiotics such as clove oil.



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sciforum-179300: Cytotoxic, genotoxic, and mutagenic effects of the mixture of dyes used in the formulation of black hair dye

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Introduction

Hair dyes may pose risks to human health due to their complex chemical composition and reactivity, potentially affecting both users and professionals, with some evidence linking permanent dyes to an increased risk of bladder cancer. Black hair dye is a semi-permanent formulation containing multiple dyes, including azo compounds and anthraquinones; This study aimed to evaluate the cytotoxic, genotoxic and mutagenic potential of a mixture of hair dyes used in the formulation of black color (BHD), as well as its potential to alter the activities of apoptosis genes.

Methods

Human hepatoma cells (HepG2) were selected as the test organism due to their expression of phase I and II metabolizing enzymes, making them a well-established tool for evaluating mutagens and pro-mutagens. The tested concentrations were defined based on the commercial usage ratio indicated by the manufacturer (Arianor Cherry Red 0.002%, Arianor Sienna Brown 0.04% and Arianor Ebony 0.32%). In order to access DNA damage induced by BHD, comet assay, micronucleus test and gene expression analysis were performed with HepG2 cells, while Ames test was performed with *Salmonella typhimurium*

Results

Results showed cytotoxicity in HepG2 cells at concentrations allowed for human use; genotoxic effects were recorded by the comet assay for the lowest tested concentrations, as well as an expressive number of micronucleus were registered for all tested concentrations of BHD. Mutagenicity was confirmed in *Salmonella typhimurium* TA100 assays without S9, and altered expression was observed in two apoptosis-related genes (cytochrome c and caspase 9).

Conclusions

The findings support strategies to protect exposed populations from DNA-damaging chemicals and highlight their potential role in degenerative diseases, including cancer. Further investigation is needed on the adverse effects of hair dyes in humans and the environment.



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sciforum-179274: Does Nitrogen Type and Concentration Influence Microcystin Congener Profiles in Cyanobacterial Blooms? A Critical Meta-Analysis of L-Amino Acid Residue Variability

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Introduction

Cyanobacterial microcystins (MCs) are among the most widespread and structurally diverse cyanotoxins, posing serious risks to both aquatic ecosystems and human health. With over 250 identified structural variants, MCs are frequently linked to poisoning incidents. However, the influence of environmental factors on their chemical diversity remains poorly understood. Structural variations in MCs are most common at the two variable L-amino acids, X and Z, at positions 2 and 4, respectively, which can be N-poor (MC-OR), contain one arginine (MC-1R) in position 2 or 4, and two arginine residues (MC-2R).

Methods

This study examines how variations in the forms and concentrations of nitrogen (N-NO_3^- , N-NO_2^- , N-NH_4^+ , and total nitrogen (TN)) influence the relative abundance of microcystin (MC) congeners in cyanobacterial blooms. Through a meta-analysis of data from 102 global water bodies - each reporting nitrogen levels alongside the occurrence of different MC variants - we explore these relationships.

Results & Discussions

Several laboratory and field studies have shown that nitrogen enrichment increases MC concentrations and the expression of peptide synthesis genes involved in their production. Nitrogen availability and speciation can therefore modify the synthesis of specific MCs, leading to a shift from nitrogen-poor MCs (MC-OR) to nitrogen-rich MCs (MC-RR). Our analysis revealed significant positive correlations between specific MC variants and nitrogen forms: and MC-OR with total nitrogen (TN) ($p = 0.0024$), MC-1R with N-NH_4 ($p = 0.00$), N-NO_2 ($p=0.0013$), N-NO_3 ($p=0.017$) and MC-2R with N-NO_2 ($p = 0.00$) and N-NO_3 ($p=0.018$).

Conclusion

These findings reveal that variations in the number of nitrogen-rich arginine residues at the X and Z positions of the microcystin (MC) structure closely reflect changes in environmental nitrogen types and concentrations. By linking nitrogen availability to MC chemical diversity, this study enhances our understanding of how environmental factors shape toxin profiles in cyanobacterial blooms.



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sciforum-174517: Ecotoxicological assessment of valproic acid in aquatic organisms

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Introduction

Due to increased use of antiepileptic medications (AEDs) and lack of efficient wastewater treatment strategies, these drugs are frequently found in aquatic environments. Their presence in water endangers both fauna and flora, threatening the life of aquatic organisms. Valproic acid (VPA), a commonly prescribed AED, is a known human teratogenic drug, although, its effects on aquatic organisms are still poorly understood.

The aim of this study is to evaluate the effects of VPA on aquatic organisms commonly used in ecotoxicological studies, *Lemna minor*, *Daphnia magna* and *Chlorella vulgaris*.

Methods

The following tests used VPA concentrations ranging from 1 to 100 mg/L. Acute growth inhibition tests were realized on *Lemna minor* and *C.vulgaris*. *L.minor* was exposed to VPA for 7 days and the number of fronds, growth rate and root length were analysed. *C.vulgaris* was exposed to VPA during 48h and the growth rate and % of inhibition were analysed. A chronic toxicity study was performed to evaluate VPA effects on *D.magna*. These organisms were exposed to six concentrations of VPA for 21 days and several parameters related to *Daphnia's* reproduction and growth were analysed. All tests were performed according to OECD and standard endpoints were quantified, including EC₅₀, NOEC and % inhibition.

Results

VPA decreased the number of fronds, growth rate, root's length and pigmentation of *L.minor* and inhibited *C.vulgaris's* growth. This AED affected the reproduction of *D.magna*, delaying the age at the first posture and reducing the growth rate of the mothers, as well as affecting the number, viability and length of the offspring.

Conclusion

VPA has several harmful effects on the viability and reproduction of the organisms tested, which highlights the potential danger of VPA on aquatic environments. More research should be done to elucidate the environmental concentration of this drug and eventual removal techniques.



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sciforum-179412: Embryonic exposure to di(2-ethylhexyl) phthalate disturbs DNA methylation status of the ovaries in adult female zebrafish and the early development of F1 generation

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Di(2-ethylhexyl) phthalate (DEHP) is a widely used plasticizer commonly associated with flexible polyvinyl chloride (PVC) and numerous consumer products. Due to its extensive presence, concerns have been raised regarding its long-term biological effects, particularly during early developmental stages.

In this study, we investigated whether early-life exposure to DEHP induces persistent epigenetic alterations in adult zebrafish ovaries and affects early development of the F1 generation. Zebrafish embryos were exposed to DEHP (0, 10, 100, and 1000 nmol/L) from 5 hours post-fertilization (hpf) to 120 hpf, then reared under standard conditions until adulthood (6 months). Ovaries were collected to assess global and gene-specific DNA methylation, as well as expression of DNA methyltransferases (*dnmt*). Global DNA methylation was evaluated using immunohistochemistry with a 5-methylcytosine (5mC) antibody, while gene-specific methylation was analyzed by methylation-sensitive restriction enzyme qPCR (MSRE-qPCR). In parallel, developmental parameters of F1 embryos and larvae were assessed using morphometric analyses.

Global DNA methylation levels were significantly reduced in ovarian granulosa cells of DEHP-exposed groups, accompanied by downregulation of *dnmt1* and *dnmt3aa* expression. Gene-specific analysis revealed increased methylation in promoter regions of *lhr* and *esr1*, while no changes were observed in *fshr*.

Parental embryonic exposure to DEHP also impaired F1 development, resulting in reduced embryo size and a higher incidence of non-inflated swim bladders at 120 hpf, along with decreased swim bladder size.

Overall, these findings demonstrate that early-life DEHP exposure induces persistent epigenetic alterations in adult ovaries and adversely affects early developmental competence of the next generation.

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sciforum-168908: Emerging Chemical Exposure Risks in Afghanistan: The Role of INGOs in Health Protection and Environmental Education

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Introduction

Afghanistan faces increasing exposure to emerging chemical hazards due to uncontrolled industrial activities, excessive pesticide use, improper waste disposal, and weak environmental regulation. These risks disproportionately affect vulnerable populations. In the absence of effective national monitoring systems, International Non-Governmental Organizations (INGOs) play a critical role in health protection and environmental education.

Methods

This study uses a desk-based design combining qualitative review with descriptive quantitative analysis of secondary data from INGO reports, international organizations, and peer-reviewed literature. Documents (n = XX) were systematically analyzed to identify sources of chemical exposure and categorize intervention types. Frequencies and percentages were calculated to compare the contributions of INGOs and national regulatory authorities across key areas, including service delivery, environmental health education, and risk communication.

Results and Discussion

Findings indicate that INGOs lead the majority of interventions related to chemical risk mitigation, accounting for a higher proportion of health service delivery and community-based education activities than national authorities. INGOs were particularly active in awareness campaigns, pesticide safety training, and household exposure reduction. In contrast, national regulatory bodies demonstrated limited involvement across most categories. Overall, interventions were associated with improved community awareness and adoption of preventive practices; however, their impact is constrained by insecurity, limited resources, and restricted access to affected regions.

Conclusion

INGOs play a dominant role in addressing emerging chemical exposure risks in Afghanistan, while national institutional capacity remains limited. Strengthening government engagement, enhancing coordination, and integrating chemical risk management into national public health strategies are essential for sustainable and long-term health protection.



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sciforum-173559: From Algae to Fish: Unravelling the Toxic Effects of Metformin in Freshwater Ecosystems

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Background

The increasing occurrence of emerging contaminants, such as pharmaceuticals, in freshwater ecosystems has raised significant environmental concern. Metformin (MET) is a widely prescribed antidiabetic for type-II diabetes mellitus treatment, with growing off label uses. Its continuous use, combined with limited removal efficiency in conventional wastewater treatment plants, results in its persistent release into surface waters, posing potential risks to aquatic wildlife and ecosystem stability. This study evaluated the short-term ecotoxicological effects of MET on standard freshwater species, integrating physiological responses and biochemical biomarkers.

Methods

All bioassays followed OECD guidelines: growth inhibition assays for *Raphidocelis subcapitata* (3 days; 0 to 1000 mg MET/L) and *Lemna minor* (7 days; 0 to 200 mg MET/L), acute immobilization assays for *Daphnia magna* (2 days; 0 to 120 mg MET/L) and fish embryo acute toxicity test for *Danio rerio* (4 days; 0 to 3000 mg MET/L). In *L. minor*, biomarkers of oxidative stress, detoxification, lipid peroxidation, and photosynthetic pigments were quantified. For *D. magna* and *D. rerio*, endpoints related to oxidative stress, detoxification, lipid peroxidation, and neurotoxicity were assessed.

Results

MET exposure significantly inhibited growth in *R. subcapitata* (EC₅₀ = 222.4 mg/L) and *L. minor* (EC₅₀ = 50.8 mg/L) in a concentration-dependent pattern. In *D. magna*, MET induced acute toxicity (LC₅₀(48h) = 70.64 mg/L; EC₅₀(48h) = 53.67 mg/L). For *D. rerio*, MET did not seem to affect embryo mortality or hatching rates, and developmental abnormalities remained low (25%). In *L. minor*, increased antioxidant and detoxification responses seem to preserve photosynthetic function, although lipid peroxidation has been observed. Moreover, MET induced oxidative stress and neurotoxicity in *D. magna* and significantly affected antioxidant and detoxification enzymes in *D. rerio* embryos.

Conclusion

These findings emphasise metformin's potential to induce adverse effects across multiple trophic levels, with implications for food web dynamics, water quality, and ecosystem integrity.



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sciforum-177874: From Homes to Cells: Assessing Genome Damage Induced by Indoor PAH Mixtures

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Indoor air pollution is an important public health concern, with polycyclic aromatic hydrocarbons (PAHs) among the key hazardous contaminants. This study evaluated the genotoxic potential of environmentally relevant PAH mixtures using an integrated approach combining human biomonitoring, *in vitro*, and *in vivo* models. PAH mixtures were formulated based on concentrations measured in household indoor air and subsequently tested in mechanistic experimental systems. DNA damage was assessed using the comet and micronucleus assays in peripheral blood cells of human biomonitoring participants (children aged 5–18 years), divided into cases with diagnosed respiratory conditions and healthy controls), *in vitro* in human peripheral blood cells as well as lung (A549) and liver (HepG2) cell lines exposed to PAH mixtures, and *in vivo* in peripheral blood, lung, and liver cells of Wistar rats. Children with respiratory conditions exhibited significantly higher levels of genome damage compared with healthy controls. Experimental models further demonstrated concentration- and dose-dependent increases in DNA damage, with particularly pronounced effects in lymphocytes *in vitro* and liver cells *in vivo*. Overall, these findings provide new evidence linking indoor PAH exposure to genomic instability and highlight the value of integrated experimental and human biomonitoring approaches for improved indoor air risk assessment and protection of public health.

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sciforum-173885: From Mechanisms to Decisions: Adverse Outcome Pathways Reshaping the Future of Risk Assessment

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The ongoing transition toward Next Generation Risk Assessment (NGRA) is reshaping regulatory toxicology and the risk assessment of regulated products by promoting exposure-driven, human-relevant and mechanistically informed approaches to evaluate potential risks without relying on animal testing. In this context, Adverse Outcome Pathways (AOPs) serve as a transparent and structured framework to organize mechanistic evidence and support the integration of New Approach Methodologies (NAMs) into risk assessment processes. By linking molecular initiating events to key events across biological levels and ultimately to adverse outcomes, AOPs provide biologically plausible and regulatorily meaningful mechanistic information. This work critically examines how AOPs and AOP networks developed by the European Food Safety Authority (EFSA) are being integrated into pesticide risk assessment. Two regulatory-relevant case studies are analyzed: (i) pesticide-induced mitochondrial dysfunction leading to Parkinson's disease, and (ii) endocrine-disrupting mechanisms leading to uterine adenocarcinoma. For both cases, we reconstructed the AOP event flows and associated NAM batteries, assessing their scientific robustness, applicability domains, and regulatory readiness. The analysis shows that NAM-based evidence can comprehensively cover multiple key events—such as mitochondrial dysfunction, proteostasis impairment, ER α activation and epigenetic alterations—while also revealing persistent limitations, including gaps in toxicokinetic considerations, limited quantitative understanding of key event relationships, and challenges in characterizing uncertainties. Overall, our findings illustrate how AOPs can strengthen mechanistic integration, improve evidence transparency and support regulatory prioritization, while also highlighting the critical need for enhanced toxicokinetic data. In particular, further improvements—such as qAOPs and TK-TD integration—are essential to fully enable NGRA in pesticide risk assessment.



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sciforum-178108: Hepatorenal Disruption by Alkaloid Xenobiotics from *Nauclea diderrichii*: Biochemical, Histopathological, and In Silico ADMET Evidence

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Introduction

Despite its application in ethnomedicine and considered safe, limited data exist on the toxicity of *Nauclea diderrichii*-enriched alkaloid fractions. This study evaluated the hepatorenal effects of an alkaloid-rich fraction from the plant's stem bark extract using in vivo and in silico approaches.

Methods

Alkaloids were extracted by acid-base extraction procedure. The resulting fraction was analyzed by GC–MS, and the constituents were identified based on spectral matching as indole alkaloid-related compounds alongside pyridine-type alkaloids. Adult Wistar rats (n = 5 per group) were randomly divided into control and three treatment groups and orally administered the fraction at 100, 250, and 500 mg/kg body weight for 28 days. Dose levels were chosen on the basis of the reported LD₅₀. Biomarkers of hepatic and renal functions were measured, and the histopathological analysis of the tissues was carried out using the stain of hematoxylin-eosin. The identified alkaloids were subjected to in silico ADMET profiling.

Results

Treatment groups showed dose-related reductions in serum ALT, AST, urea, and creatinine levels (p 0.05 at higher doses). However, histopathological examination revealed mild to moderate hepatocellular degeneration, inflammatory infiltration, and renal tubular alterations. This discrepancy suggests that reductions in biochemical markers may reflect enzyme modulation or adaptive responses rather than tissue protection, indicating that serum biomarkers alone may underestimate early or subclinical organ injury. GC–MS profiling supported the presence of indole and pyridine alkaloid-like constituents, and in silico ADMET predictions of these compounds indicated moderate oral bioavailability with a potential risk of hepatotoxicity.

Conclusion

Although reductions in biochemical indices were observed, histopathological lesions indicate that the alkaloid-rich fraction of *Nauclea diderrichii* may induce subclinical hepatorenal toxicity upon repeated exposure. The findings highlight disconnect between serum biomarkers and tissue-level damage and underscore the importance of chemical characterization and safety evaluation of phytochemical fractions rather than crude extracts.



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sciforum-173931: Honey as an Indicator of Environmental PAH Contamination

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Environmental contamination is an increasing concern for food safety and public health, particularly regarding polycyclic aromatic hydrocarbons (PAHs), a group of persistent and potentially carcinogenic pollutants. PAHs accumulate in soil, water, and air and may enter the food chain through atmospheric deposition. Honey, produced by *Apis mellifera*, can serve as a valuable environmental indicator, reflecting contamination within the bees' foraging area. This issue is especially relevant in wildfire-prone regions such as Portugal, where recurrent fires contribute to elevated atmospheric PAH emissions.

A cross-sectional study was conducted on 20 honey samples collected across Portugal in 2024. Samples were prepared using QuEChERS extraction and clean-up procedures and analysed by GC-MS. Quantification was performed using a standard mixture of 16 priority PAHs.

Low-molecular-weight (LMW) PAHs exhibited the highest concentrations, with naphthalene reaching up to 18.625 µg/kg. Other LMW compounds ranged from 0.007 to 6.779 µg/kg. Phenanthrene also revealed elevated concentrations (up to 5.102 µg/kg) corroborating earlier findings. Among high-molecular-weight (HMW) PAHs, dibenzo[a,h]anthracene showed the highest concentration (4.337 µg/kg), while the remaining HMW compounds were close to the method detection limits.

ΣPAH4 concentrations ranged from 0.203 to 0.914 µg/kg, remaining below current indicative limits established by the European Food Safety Authority (EFSA). Variability among samples likely reflects geographic differences, local emission sources, wildfire exposure, and environmental conditions.

Overall, honey represents a valuable matrix for monitoring environmental PAH contamination, supporting its relevance in food safety assessment and environmental surveillance.



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sciforum-174025: How Climate-Driven Temperature Rise Modulates 4-Chloroaniline Toxicity in *Danio rerio*

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Introduction

4-chloroaniline (4-CA) is an aromatic amine widely used in the production of dyes, pharmaceuticals, agrochemicals, and polymers. It is considered a potential freshwater contaminant due to its ecological risk and uncertainty surrounding the predicted no-effect concentration [1–3]. In aquatic systems, 4-CA can disrupt physiological pathways in non-target species, causing sublethal stress and biodiversity loss [4]. Given that temperature can reshape toxicodynamic and toxicokinetic processes, 4-CA toxicity may be underestimated in a warming climate. This study assessed whether elevated temperature modulates the chronic sub-individual toxicity of 4-CA in zebrafish [5].

Methods

Juvenile *D. rerio* were chronically exposed (28 days) to environmentally relevant concentrations of 4-CA (≤ 100 $\mu\text{g/L}$), at two temperatures: standard and projected warming scenario (25 and 30 °C, respectively). Several biological responses were evaluated: antioxidant defence and detoxification, cellular energy allocation, neurotoxicity, and genotoxicity.

Results

Temperature significantly modulated 4-CA toxicity, with the combined factors disrupting antioxidant and detoxification capacity, enhancing oxidative stress, altering energy metabolism, and increasing neuro- and genotoxic damage. Temperature alone affected all biological responses, except lipid peroxidation. Significant effects were observed at 25 °C included oxidative stress (≥ 19.75 $\mu\text{g/L}$), energy imbalance (29.63 and 66.67 $\mu\text{g/L}$), neurotoxicity (44.44 $\mu\text{g/L}$), and genotoxicity (≥ 29.63 $\mu\text{g/L}$); and at 30 °C, oxidative stress (≥ 19.75 $\mu\text{g/L}$), detoxification disruption (100 $\mu\text{g/L}$), and neurotoxicity (29.63 $\mu\text{g/L}$).

Conclusions

Chronic exposure to 4-CA disrupted redox balance, antioxidant and detoxification capacity, and energy metabolism in zebrafish, with warming exacerbating oxidative stress, neuro-, and genotoxic damage. Although some compensatory antioxidant and metabolic responses were triggered, they were insufficient to prevent cellular damage, suggesting increased energetic costs under combined stressors. At the ecosystem level, enhanced contaminant toxicity under warming scenarios may alter species interactions and weaken the resilience of freshwater communities, suggesting that current ecological risk assessment may underestimate the future impacts of 4-CA.



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sciforum-179173: Hygienic Assessment of Alimentary Exposure to Stable Strontium in Russia: A Risk Analysis

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Introduction

Stable strontium (Sr) is a toxic trace element and a chemical analog of calcium. Its primary target is bone tissue, where it accumulates, disrupting mineralization and causing “strontium rickets”. Classified as a non-carcinogen with an oral reference dose (RfD) of 0.6 mg/kg bw/day. High variability of Sr levels in water and food across Russian regions necessitates a detailed risk assessment. This study evaluates alimentary Sr exposure by analyzing its content in drinking water and food products.

Methods

The analysis is based on a review of peer-reviewed literature and official Russian monitoring data on stable Sr concentrations in water. Non-carcinogenic risk was assessed using the Hazard Quotient (HQ) by comparing estimated daily intake with the RfD

Results

Sr content in Russian artesian water varies greatly, reaching 15.45 mg/L in the Smolensk region. The highest food levels were found in spices *Trachyspermum ammi* seeds (490 mg/kg) and fennel (183 mg/kg). According to published data, high concentrations are also known in nuts (almonds 15.7 mg/kg), dairy (hard cheese 12.0 mg/kg), mollusks (14.3 mg/kg), and fish liver (3.54 mg/kg). Legumes (3.34 mg/kg), chocolate (3.17 mg/kg), and spinach/cabbage (up to 2.65 mg/kg) also show significant levels. At average concentrations, total daily Sr intake yields an HQ within acceptable range (1.0). However, for some regions of Russia, high Sr in water together with consumption of products at maximum concentrations approaches threshold levels.

Conclusion

Alimentary exposure to Sr in Russia generally poses acceptable non-carcinogenic risk for average consumer. However, in certain biogeochemical provinces and among consumers on diets rich in Sr-accumulating foods, exposure may approach RfD. Such a scenario is also possible in other countries with similar hydrogeochemical conditions and dietary patterns. These findings highlight need for regional monitoring and targeted risk management.

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sciforum-177884: In Silico Assessment of Interactions Between Pharmaceutical Contaminants and Human Metabolic Enzymes Using Molecular Docking

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The increasing presence of pharmaceutical compounds in aquatic environments has raised concerns regarding their potential impacts on human health and ecosystems. Many of these substances are considered emerging contaminants due to their persistence, high solubility, and continuous introduction into the environment through industrial effluents and wastewater. Computational approaches have become valuable tools for evaluating the potential interactions between xenobiotics and biological targets, allowing the preliminary assessment of toxicological risks associated with environmental exposure.

This study aimed to investigate the interactions between selected pharmaceutical contaminants and human metabolic enzymes using molecular docking simulations. Protein structures were obtained from the Protein Data Bank and included Cytochrome P450 3A4 (CYP3A4), a key enzyme involved in xenobiotic metabolism, and N-acetyltransferase 2 (NAT2), responsible for acetylation reactions in drug metabolism. Ligand structures were retrieved from public chemical databases and prepared for docking using standard molecular modeling protocols. Docking simulations were performed using AutoDock Vina, and binding affinities and structural orientations were analyzed to evaluate potential interactions.

The results showed that amoxicillin presented a favorable binding affinity with CYP3A4 (approximately -8.7 kcal/mol). However, structural analysis indicated a relatively large distance (~ 6.5 Å) between the ligand and the heme iron atom, suggesting that although the molecule can occupy the active site, its orientation may not favor efficient catalytic biotransformation. For sulfamethoxazole, docking simulations revealed binding affinities around -7.8 kcal/mol with NAT2 and stable binding poses with RMSD values below 2 Å, suggesting a possible interaction near the catalytic region associated with acetylation.

Overall, the findings suggest that pharmaceutical contaminants may interact with human metabolic enzymes, highlighting the importance of evaluating their potential toxicological effects in scenarios of chronic environmental exposure. Computational approaches such as molecular docking represent useful tools for preliminary risk assessment of emerging contaminants.



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sciforum-179202: In silico evaluation of emerging pharmaceutical contaminants and their interactions with human proteins: implications for environmental toxicity

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The increasing presence of pharmaceutical compounds in the environment has raised concerns about their potential effects on human health. This study aimed to evaluate the interaction between selected drugs (amoxicillin, norfloxacin, and sulfamethoxazole) and human proteins using molecular docking approaches to assess potential toxicological implications.

Molecular docking simulations were performed using AutoDock Vina, with protein structures obtained from the Protein Data Bank. Cofactors such as heme groups and metal ions were carefully considered to ensure biologically relevant models. Binding affinities, root-mean-square deviation (RMSD), and ligand-cofactor distances were analyzed to evaluate interaction stability and catalytic relevance. Additionally, physicochemical and pharmacokinetic properties were considered to support the interpretation of potential environmental behavior.

Results showed that amoxicillin exhibited strong binding affinity to CYP3A4 (~ -8.7 kcal/mol), but with a ligand-iron distance (~ 6.5 Å) suggesting suboptimal orientation for catalytic metabolism. Sulfamethoxazole showed favorable binding to NAT2 (~ -7.8 kcal/mol) with low RMSD values (2 Å), indicating stable and potentially metabolizable interactions. These results reinforce that binding affinity alone does not necessarily indicate efficient biotransformation.

These findings suggest that such compounds may persist in human systems upon exposure, potentially affecting metabolic pathways and contributing to chronic toxicity. Overall, this study highlights the importance of computational approaches in evaluating the impact of emerging contaminants on human health.



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sciforum-174407: In silico workflow determining Metagenome-Assembled Genomes (MAGs) from a pediatric cohort exposed to obesogenic xenobiotics revealed different quality metrics

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A bioinformatic pipeline and tailored workflow were developed to reconstruct Metagenome-Assembled Genomes (MAGs) from metagenomic data obtained from a cohort of 12 children with obesity and 12 normal-weight children with differential bisphenol A (BPA) exposure levels. Preprocessing and sequence quality control included FastQC, Trimmomatic and host DNA removal with Bowtie2. Assembly was performed using MEGAHIT, with quality evaluated via QUAST. Reads were mapped back to the assembly using Bowtie2 and SamTools to determine coverage. For Binning and Contig Clustering, MetaBAT2 and MaxBin2 were used, followed by optimization through the MetaWRAP bin_refinement module and quality validation (completeness/contamination) through CheckM. Tools for downstream analysis and MAG annotation included Prokka for Gene Prediction and Functional Gene Annotation, enabling the identification of key metabolic pathways. Taxonomic classification was performed using GTDB-Tk to provide standardized phylogenetic assignments. All statistical analyses and data visualization were conducted in RStudio.

Benchmarking of the tested tools revealed differences in the quality of the reconstructed MAGs across varying thresholds—completeness ranging from >50% to >90% and contamination from 10% to 5%. A consolidated summary of tools and optimized parameters was compiled to evaluate pipeline performance based on completeness, contamination, N50, and taxonomic resolution. This comparative assessment enabled the identification of the most reliable assembly and binning strategies for downstream analyses.

The main results revealed distinct taxonomic signatures and quantitative differences between the two groups. MAG yield was lower in the obesity group compared to the normal-weight group. At the class level, obesity was associated with a distinct profile of Actinomycetes and Bacilli, whereas at the species level, a high prevalence of *Bifidobacterium adolescentis* was identified in children with obesity. Additionally, BPA exposure levels appeared to modulate microbial diversity and the relative abundance of specific taxa, suggesting a potential interaction between xenobiotic exposure and gut microbiome composition.



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sciforum-178129: In vivo effect of metals in clams *Ruditapes decussatus*: A multi-marker approach

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This study aimed to evaluate the differential biochemical responses of the clam *Ruditapes decussatus* exposed to cadmium (Cd) and copper (Cu), testing the hypothesis that these contaminants induce tissue-specific alterations in oxidative stress and energy metabolism.

Materials and methods

Specimens of *Ruditapes decussatus* were collected from the Hnaya region (western Annaba, Algeria), acclimated for 48 h, and then exposed for seven days in triplicate experimental conditions (three aquaria, six individuals per aquarium) to 200 µg/L Cd and 30 µg/L Cu. These concentrations were selected based on published data, representing polluted coastal environments, and are commonly used in laboratory ecotoxicological studies to induce measurable biochemical responses under short-term exposure. Experimental conditions were maintained constant (16 ± 2 °C; salinity: 37 psu; photoperiod: 12 h light/12 h dark), with regular renewal of seawater and metal solutions. Gills and digestive glands were analysed for reduced glutathione (GSH), lipid peroxidation (MDA), total lipids, and proteins. Data were analysed using two-way ANOVA followed by appropriate post hoc tests (p 0.05).

Results and discussion

Cadmium exposure induced a significant increase in MDA associated with a decrease in GSH, indicating marked oxidative stress, particularly in the digestive gland. This suggests enhanced utilization of GSH in detoxification processes. Copper exposure induced tissue-dependent responses, including an increase in GSH in some cases, suggesting the activation of antioxidant defence mechanisms potentially related to oxidative stress. Variations in lipid and protein contents indicate disturbances in energy metabolism under metal exposure. The digestive gland appeared more sensitive than gills, consistent with its role in detoxification and storage functions.

Conclusion

Overall, these results highlight the involvement of multiple antioxidant defence pathways and underline the complexity of the relationship between oxidative stress and energy metabolism in *Ruditapes decussatus* exposed to trace metals. The multi-biomarker approach provides valuable insights for ecotoxicological assessment of contaminated coastal environments.



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sciforum-179180: Individual and Combined Ecotoxicity of Albendazole, Metronidazole and Ibuprofen in Freshwater Algae and Agricultural Plants

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Introduction

The increasing global use and environmental persistence of pharmaceuticals have raised concerns about their ecotoxicological effects. Albendazole (ABZ), metronidazole (MTZ), and ibuprofen (IBU) are among the most frequently detected compounds in soil and aquatic environments, yet their impacts on non-target organisms, particularly in mixtures, remain poorly understood. This study assessed the ecotoxicological effects of ABZ, MTZ, and IBU, alone and in binary mixtures, on *Chlorella vulgaris*, *Lactuca sativa*, and *Triticum aestivum*, representing ecologically and agriculturally relevant species.

Methods

Ecotoxicity assays were performed using single compounds and binary mixtures. *Chlorella* was exposed to ABZ (1–500 µg/L) and MTZ and IBU (0.5–100 mg/L), as well as to ABZ+IBU and MTZ+IBU mixtures tested at 25:75, 50:50, 75:25 ratios. *Lactuca* and *Triticum* were exposed to single compounds (5–160 mg/L) and mixtures (160 + 160 mg/L). Algal assays followed OECD guideline 201, with growth rate and EC₅₀ values at 120 h, while plant assays followed OECD208, assessing germination, root and epicotyl growth.

Results

In single-compound tests, *C. vulgaris* was the most sensitive species (EC₅₀ values of 17.7 µg/L for ABZ, 6.3 mg/L for MTZ, and 78.5 mg/L for IBU). MTZ showed the highest toxicity, inhibiting growth in all organisms. In contrast, ABZ and especially IBU induced hormetic responses, stimulating plant growth at low concentrations and inhibiting it at higher levels. Binary mixtures exhibited complex, non-additive interactions, including reduced toxicity in the ABZ+IBU combination. *L. sativa* showed both inhibitory and stimulatory responses depending on mixture composition, while *T. aestivum* was more sensitive to mixtures, particularly at equal proportions.

Conclusions

These findings demonstrate that ABZ, MTZ, and IBU can significantly affect aquatic and terrestrial organisms and that mixture effects are not predictable from single-compound data, highlighting the importance of considering chemical interactions in environmental risk assessment.



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sciforum-171167: Interactive effects of temperature, pH, and antibiotics reshape zebrafish physiological stability

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Background

Freshwater organisms are increasingly exposed to multiple stressors, including climate-driven warming, pH shifts, and contamination by antibiotics, which may interact and amplify their effects. Sulfamethoxazole (SMX), trimethoprim (TRIM), and their mixture (MIX) frequently co-occur in aquatic environments, yet their toxicity under projected future environmental scenarios remains poorly understood. This study provides important data to help reduce current knowledge gaps in the combined effects of environmental stressors, particularly in the context of climate change, on *Danio rerio*. It highlights the need for integrated approaches in environmental research.

Methods

A chronic assay was conducted with *Danio rerio* testing the effects of environmentally relevant concentrations of SMX (150 µg/L), TRIM (30 µg/L), and MIX (150 µg SMX/L + 30 µg TRIM/L), under two environmental scenarios: standard conditions (26 °C + pH 7.5) and a climate-change scenario (28 °C + pH 9.0). A multi-biomarker approach was applied, integrating oxidative stress, lipid peroxidation, neurotransmission, energy metabolism, and DNA damage to evaluate *D. rerio* health status under different conditions.

Results

Antibiotic toxicities were consistently amplified under the climate-change scenario. Under the standard scenario, SMX and TRIM showed limited effects, mainly associated with antioxidant and detoxification responses, whereas MIX caused severe impairment of *D. rerio* health. Under a climate-change scenario, all antibiotics induced severe alterations in *D. rerio*, including lipid peroxidation, DNA damage, and disruption of energy metabolism, indicating a clear loss of physiological stability.

Conclusions

Overall, these results demonstrate that warming and alkalization enhanced antibiotic toxicity, both individually and in mixtures, resulting in more pronounced adverse effects on *D. rerio*. These findings highlight the need for integrative studies that simultaneously address chemical pollution and climate-related stressors to better predict long-term threats to aquatic biodiversity and ecosystem stability.



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sciforum-179494: Maternal Bisphenol S exposure impairs testicular function in adult *Wistar* rat offspring via thyroid axis disruption

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Bisphenol S (BPS), initially considered a safer alternative to BPA, is now increasingly recognized for its comparable or even more pronounced endocrine-disrupting effects. Recent studies suggest that bisphenols may interfere with endocrine function by disrupting thyroid signaling, which in turn can impair reproductive health. This study investigates the effects of maternal BPS exposure during gestation and lactation on testicular function in adult male offspring, with a particular focus on the involvement of thyroid hormone receptor (THR) inhibition. *Wistar* female rats were treated daily with BPS (200 µg/kg/day) or AT 1-850 (a THR antagonist, 10 nmol/day/rat), during gestation and lactation. The experimental work was carried out in accordance with Good Laboratory Practice (GLP). Testicular function was assessed in adult male offspring by evaluating sperm parameters, testicular histology, testosterone levels, and the expression of proteins involved in testicular development and blood-testis barrier (SOX9, CYP17A1 and CX43), along with their respective gene expression. BPS exposure led to reduced body weight, decreased relative seminal vesicle weight, testosterone levels, altered the seminiferous tubule dimension, and impairments in sperm motility, viability, daily sperm production, and their efficiency, accompanied by an increase in sperm abnormalities. Similarly, AT 1-850 exposure produced comparable negative effects. Protein expression analysis revealed a downregulation of SOX9, CYP17A1 and CX43 levels in both exposed groups. Gene expression analysis showed a reduction of *Sox9* in the BPS group, while AT 1-850 upregulated its expression. Both treatments significantly reduced *Cyp17a1* expression. These findings suggest that BPS disrupts testicular function in adult male offspring, potentially by interfering with nuclear THR signaling following maternal exposure during fetal and postnatal development.



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sciforum-180888: Methylimidazolium Ionic Liquids as Persistent Xenobiotics: Mitochondrial Injury and PDC-E2 Modification Relevant to Autoimmune Liver Disease

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Introduction

Methylimidazolium ionic liquids (MILs) are synthetic solvents increasingly used in industrial applications, including biofuel production. Although initially promoted as “green solvents” because of their low volatility and recyclability, growing evidence indicates that some MILs are environmentally persistent and may pose risks to human health. We investigated whether the 8-carbon MIL 1-octyl-3-methylimidazolium (M8OI), identified as an environmental contaminant with evidence of human exposure, may trigger mechanisms relevant to primary biliary cholangitis (PBC), an autoimmune liver disease directed against mitochondrial autoantigens.

Methods

The effects of M8OI were examined in rat liver progenitor B-13 cells and HepaRG human hepatic progenitor-like cells. Environmental persistence and biodegradation of MILs were assessed alongside cellular toxicity studies. Mitochondrial morphology, oxygen consumption rate by Seahorse extracellular flux analysis, reactive oxygen species generation, and cell death were evaluated to define the mechanism of toxicity. In HepaRG cells, PDC-E2 localisation, changes in the PDC-E2 immunoblotting pattern, and metabolism of M8OI were investigated.

Results

MILs demonstrated marked environmental resilience, supporting their classification as persistent xenobiotics. In B-13 cells and HepaRG cells, M8OI induced mitochondrial morphological changes and inhibited mitochondrial respiration, with evidence of complex I inhibition, leading to oxidative stress and cell death. In HepaRG cells, M8OI was metabolised, PDC-E2 translocated from mitochondria to the cell membrane, and a novel PDC-E2 band appeared, suggesting xenobiotic-induced modification. These findings support the possibility that an M8OI metabolite modifies PDC-E2, potentially replacing lipoic acid within its lipoyl-binding domain and thereby altering antigenicity. Such modified PDC-E2 may be expressed on the surface of apoptotic bodies, representing a possible mechanism linking xenobiotic exposure to loss of immune tolerance.

Conclusions

MILs may represent under-recognised persistent xenobiotics with potential relevance to mechanisms contributing to PBC and autoimmune liver injury.



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sciforum-178895: Monitoring and risk communications of Cyanobacteria Harmful Algal Blooms (CHAB) in Nova Scotia (NS), Canada

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Introduction

In Nova Scotia (NS), Canada, cyanobacterial harmful algal blooms (CHABs) are increasingly emerging during summer and fall, driven by complex ecological interactions within freshwater ecosystems. These blooms represent a dual threat to public health and aquatic ecosystems, contaminating drinking water supplies, disrupting recreational activities, and undermining biodiversity. Over a five-year period, systematic sampling across 17 lakes in NS identified four dominant and potentially toxic cyanobacteria species: *Dolichospermum flos-aquae*, *D. planctonicum*, *Microcystis aeruginosa*, and *Aphanizomenon* sp. These species are associated with the production of highly hazardous cyanotoxins, including *anatoxin-a* and *microcystins*, with congeners including MC-LR and MC-LY frequently detected. The proliferation of those raises urgent concerns for human health risks and ecological impacts such as fish kills, loss of biodiversity, and disrupted food webs.

Methodology

This study integrates five years of field observations, laboratory analyses (physical-chemical parameters and cyanotoxins), environmental parameters to identify key drivers of bloom formation. The mathematical modelling to investigate the CHAB dynamics is also used.

Results & Discussions

Results reveal that rising temperatures, nutrient enrichment (particularly from agricultural runoff), and prolonged thermal stratification are the primary triggers for CHABs in the region. Spatial analyses indicate shallow, nutrient-rich lakes are most vulnerable to persistent and intense blooms, while deeper, oligotrophic systems exhibit lower but increasing bloom frequencies. Model simulations demonstrate future temperature increases and extreme weather events are likely to exacerbate CHABs, intensifying toxin production and bloom duration.

Conclusion

The findings underscore the critical need for proactive monitoring and adaptive management strategies to mitigate the impacts of CHABs in NS. Real-time sensor networks and satellite remote sensing are essential tools for early bloom detection and public health protection. Future research should prioritize integrated approaches, combining field studies, laboratory experiments, and predictive modeling, to address the growing threat of CHABs in the context of a changing climate.



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sciforum-179197: Multi-tier Assessment of ecotoxicity of a PEG-Based Pharmaceutical on *Danio rerio* Embryos: Are Additives the Missing Piece?

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Water-soluble polymers (WSPs) are extensively used across industrial, medical, and consumer applications. However, the lack of specific regulatory frameworks raises concerns about their continuous and uncontrolled release, especially into aquatic ecosystems, and the potential risks to organisms and human health. Notably, commercially available WSP-based products rarely consist of WSPs alone, but commonly include additives that may significantly influence their environmental behaviour and toxicity. Increasing evidence suggests that such additives may represent main drivers of WSP-related (eco)toxicity. Among WSPs, polyethylene-glycol (PEG) is one of the most widely used, particularly in pharmaceutical formulations such as laxatives. These products typically contain high-molecular-weight PEG with eventual presence of other additives. This study aims to investigate the potential effects of two formulation of the same commercially available PEG based-laxative: (i) pure PEG-4000, and (ii) PEG-4000 (5 g in 10 mL) dissolved in purified water and combined with two additives (potassium sorbate and citric acid). *Danio rerio* embryos were exposed to both formulations at equivalent PEG concentration of 0.1 mg/L. A multitier approach was employed to assess effects across molecular, cellular, physiological, and organism levels, including proteomics analyses, oxidative stress and neurotoxicity biomarkers, cardiac activity, morphometric parameters, spontaneous coil-tailing activity, and swimming behaviour (distance moved, velocity, turn angle, thigmotaxis). At the cellular level, reactive oxygen species (ROS) production and ethoxyresorufin-O-deethylase (EROD) activity were significantly ($p < 0.05$) decreased only in embryos exposed to PEG+additives. Conversely, heart rate showed divergent trends, with a significant decrease in embryos exposed to PEG alone, but a significant increase in PEG+additives. Although the analysis of some endpoints is still ongoing, these findings suggest that additives in commercial PEG-based formulations may play a major role in modulating, and potentially driving, the overall toxicity of WSPs, highlighting the need to consider full product formulations in ecotoxicological risk assessment.



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sciforum-173906: Occurrence, Source Profiles, and Human Exposure to PBDEs and Alternative Brominated Flame Retardants in Vehicle Dust from a Hot-Climate Region

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Brominated flame retardants (BFRs) are widely used in automotive polymers and electronic components, yet vehicles remain an underexplored microenvironment for human exposure, particularly in hot climates. This study characterized the occurrence, profiles, sources, and health risks of polybrominated diphenyl ethers (PBDEs) and selected alternative BFRs in dust from 80 vehicles (domestic cars and taxis; model years 2015–2022) operating in Jeddah, Saudi Arabia. Dust samples were collected using a standardized vacuuming protocol, extracted and cleaned up by solvent extraction and silica SPE, and analyzed using GC–NCI–MS. We quantified selected PBDE congeners and several alternative BFRs, including DBDPE and TBB. BDE-209 and DBDPE dominated the BFR burden in vehicle dust, while lower-brominated PBDEs occurred at much lower levels, consistent with the global phase-out of Penta- and Octa-BDE. Taxis generally exhibited higher central tendency values for key congeners than domestic vehicles, reflecting longer in-vehicle time, higher occupancy, and more intensive use. Multivariate analysis (PCA and correlation) indicated two main source groupings: (i) legacy Penta-BDE-related congeners associated with polyurethane foams and textile furnishings, and (ii) Octa/Deca-BDE and DBDPE linked to hard plastics and electronic components. Human exposure assessment showed that dust ingestion overwhelmingly dominated BFR intake, with dermal and inhalation pathways contributing minimally. Non-carcinogenic hazard indices (HI) for all congeners were well below unity, and incremental lifetime cancer risk (ILCR) values for BDE-209 fell within or near commonly accepted risk ranges, although taxi drivers consistently showed higher exposure than domestic drivers. Overall, while risk estimates suggest low to moderate concern for adults under current conditions, the persistence, bio-accumulative potential, and mixture toxicity of BFRs, coupled with extreme thermal conditions inside vehicles, underscore the need for continued monitoring, material substitution, and targeted risk-reduction strategies in automotive interiors.



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sciforum-179489: Pathogen Detection and Functional Gene Analysis of Microbial Communities in Waste Impacted River System

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The discharge of untreated waste serves as a major source of environmental pollution, impacting both terrestrial and aquatic ecosystems. Although microbial diversity within these environments is remarkably high, scientific investigation into their ecological functions, metabolic capabilities, and pathogenic risks remains limited.

In this study, we employed Illumina sequencing of the V3–V4 hypervariable regions of the 16S rRNA gene to characterize microbial diversity and functional attributes across four distinct polluted sites involving soil (Site 1) and river (Sites 2–4). Across all locations, Proteobacteria and Bacteroidetes emerged as the dominant microbial phyla; however, the presence and abundance of specific phyla varied distinctly across sites. In the present study, identification of several potential pathogens were detected. Functional annotation analyses revealed that genes associated with amino acid and carbohydrate metabolism were highly abundant in these sites. Furthermore, genes conferring antibiotic resistance and xenobiotic degradation were also observed.

These findings indicate that polluted ecosystems are metabolically active and serve as reservoirs for potential pathogenic microorganisms; consequently, pose significant risks to both the environment and public health. This study provides critical insights into the dynamics of microbial communities in waste-contaminated environments and underscores the imperative of adopting integrated management strategies to curb the proliferation of pathogenic microorganisms.



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sciforum-178643: Perinatal and Direct Bisphenol A Exposure Shape Gut Microbiota and Behavior in a Sex-Specific Manner In mice

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Bisphenol A (BPA) is an endocrine-disrupting chemical widely used in consumer products and associated with obesity and chronic diseases. Early-life exposure to environmental contaminants is concerning because the perinatal period shapes gut microbiota and long-term host health. In previous work we showed that perinatal BPA exposure combined with a high-fat diet increased body fat in offspring.

To investigate whether a microbiota altered by perinatal BPA exposure could drive obesogenic effects, or whether direct BPA exposure is required, forty germ-free mice (20 males and 20 females) were colonized at postnatal day 49 with gut microbiota from perinatally BPA-exposed or control mice. Mice were divided into four groups: CTRL (control microbiota, vehicle), DIR (control microbiota, direct BPA exposure), PERI (perinatal BPA microbiota, vehicle), and DUAL (perinatal BPA microbiota, direct BPA exposure). BPA or vehicle administration began three days after colonization and continued for four months. Body composition (EchoMRI/NMR), behavior (Intelliscage), and gut microbiota composition (16S rRNA sequencing) were assessed.

Males in the DUAL group showed a higher fat percentage, although differences were not significant. Mice exposed to direct BPA (DIR and DUAL) displayed increased activity and anxiety-like behavior. Beta diversity revealed persistent microbiota differences associated with perinatal BPA exposure after one week and four months. In males, direct BPA exposure significantly altered microbiota composition after four months, and showed a synergistic effect with perinatal exposure. Specific ASVs were identified as potential microbial markers: *Bifidobacterium_animalis* and *Alistipes* were decreased in BPA-exposed groups, *Erysipelotrichaceae* and *Lachnospiraceae* increased in perinatal BPA groups, and *Parabacteroides_goldsteinii* and *Bacteroides* increased in direct BPA exposure groups.

In conclusion, perinatal BPA exposure has a lasting and stronger effect on gut microbiota composition than direct exposure, particularly in males. Altered microbiota alone did not trigger obesity but may contribute to sex-specific physiological and behavioral changes.



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sciforum-179488: Phenolic Compounds from Rapeseed Protein Side Stream as Potential Emerging Xenobiotics

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Introduction

The circular economy of biofuel industry leads to valorisation of side streams by separation of phenolic compounds that are able to act as emerging environmental contaminants. Phenolic acids are released to solution during alkaline extraction of rapeseed meal, first step of protein isolation. Reversible techniques were used for the recovery approach of polyphenols from rapeseed protein process streams. The optimization of polyphenolic separation is in progress. A lot of polyphenols are linked to xenobiotics and display antimicrobial and antioxidant activities.

Methods

Phenolic compounds were separated from aqueous solution using a polymeric resin under continuous stirring for adsorption with reversible interactions. Desorption was achieved with an aqueous and ethanolic washings to disrupt interactions between polyphenols and sorbent. The recovered phenolic compounds were collected in an ethanolic solution, which was concentrated using vacuum evaporation to obtain a phenolic concentrate.

Results

The separation of phenolic compounds from protein isolation side stream was achieved by adsorption, desorption and concentrating the solution. Based on literature, it is believed that the recovered polyphenolic compounds exhibit biological activity and may contribute to environmental and ecotoxicological effects.

Conclusions

This study shows the potential of reversible interaction techniques for the recovery of phenolic compounds from protein isolation side streams. The concentrated polyphenols are most likely to behave as emerging xenobiotics. The findings show the need for systematic evaluation of their, persistence, environmental fate and ecotoxicological effects with main focus on experimental validation of their biological activity and environmental impact.

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sciforum-179305: Polystyrene microplastics induce liver toxicity and cytoskeleton alterations in female rats

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Introduction

Microplastics (MPs) are emerging environmental pollutants that have attracted increasing scientific concern due to their widespread presence in ecosystems and potential risks to human and animal health. While their effects have been extensively studied in aquatic organisms, data regarding their impact on mammalian systems remain limited. In particular, the mechanisms underlying MP-induced toxicity at the cellular and molecular levels are still poorly understood.

Material and Methods

Adult female Wistar rats were exposed to polystyrene microplastics (PS-MPs) through oral gavage over four consecutive estrous cycles. Two types of particles were used: pristine polystyrene microplastics (PPS-MPs) and fluorescent polystyrene microplastics (FPS-MPs), both with a diameter of 5 μm . FPS-MPs were employed specifically to assess tissue distribution and translocation, while PPS-MPs were used for toxicological evaluation. At the end of the exposure period, liver tissues were collected for biochemical, histological, and molecular analyses.

Results

FPS-MPs were detected in hepatic tissue (133 ± 35 particles), confirming their translocation. Exposure to PPS-MPs increased superoxide dismutase (SOD) (2.58-fold) and catalase (CAT) activity (1.36-fold), while reducing protein sulfhydryl levels (PSH) (0.35-fold), indicating oxidative stress. Histological analysis and quantitative assessment revealed significant alterations, including significant decrease in glycogen content (2.4-fold). Immunofluorescence analysis showed a pronounced increase in α -tubulin and a decrease in DAAM-1 signals, a formin protein essential for actin filament assembly and cytoskeletal organization, suggesting impaired cytoskeletal dynamics. These observations were further supported by molecular analyses, which showed α -tubulin overexpression (3.35-fold) and reduced DAAM-1 expression (0.5-fold).

Conclusion

Our findings indicate that exposure to environmentally relevant concentrations of MPs induces early hepatocellular alterations, suggesting that oxidative stress and cytoskeletal remodeling may be central mechanisms underlying MP-induced hepatotoxicity.



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sciforum-179426: Predicting the Health Effects of AhR Ligands: Bioinformatic Risk Assessment of Environmental Pollutants and Dietary Compounds

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Introduction

The Aryl hydrocarbon Receptor (AhR) functions as a primary genomic defense mechanism against chemical exposure, balancing rapid detoxification with physiological homeostasis. However, persistent environmental ligands can shift the receptor from a protective sensor into a systemic disruptor, leading to severe toxicity. This study looks into the causes behind this transition by analyzing the structural and metabolic profiles of persistent dioxins, polycyclic aromatic hydrocarbons, and transient dietary indoles to see how chemical persistence impacts the environment and human health.

Methods

Physicochemical, pharmacokinetic, and comprehensive toxicological profiles, addressing both human and environmental ecotoxicity, were established using the ADMETlab 3.0, Deep-PK, and ProTox-3.0 platforms. Furthermore, blind molecular docking was executed via Pyrx against two high-resolution human AhR structures (8QMO and 7ZUB) to map binding affinities and core residue interactions within the PAS-B domain.

Results

The results revealed a significant difference in risks attributed to chemical persistence. Industrial contaminants demonstrated outstanding lipid solubility, blood-brain barrier permeability, and considerable bioaccumulation potential. TCDD exhibited severe acute toxicity, but benzo[a]pyrene had strong predictive markers for carcinogenesis and endocrine disruption. In contrast, Indole-3-Carbinol demonstrated quick elimination, low aquatic toxicity, and a favorable safety profile. Molecular docking confirmed that all compounds bind to the AhR PAS-B pocket. Persistent pollutants, such as 3-MC and Benzo[a]pyrene, demonstrated the highest binding affinities, up to -14.4 kcal/mol, forming persistent complexes with important core residues.

Conclusions

The metabolic stability of a ligand controls AhR-mediated biological effects. Because persistent pollutants resist metabolic breakdown, they bioaccumulate and maintain prolonged, high-affinity binding to the AhR. This sustained receptor activation, unlike the short-lived response of rapidly cleared dietary compounds, drives systemic toxicity. Overall, this research shows that integrating predictive ADME-Tox profiling with molecular docking technique delivers a concrete *in silico* framework to accurately predict the bioaccumulation, receptor affinity, and health hazards of emerging environmental contaminants.



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sciforum-179619: Prospective Surveillance of Emerging Chemical Poisoning and its impact on health in a South Indian Tertiary Hospital

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Introduction

Emerging chemicals including pharmaceuticals, pesticides, and household agents—are increasingly recognized as environmental contaminants with potential for adverse health effects. Human poisoning events serve as sentinel indicators of exposure. This prospective study aimed to evaluate the pattern, environmental sources, and acute health outcomes of poisoning by emerging chemicals in a tertiary care hospital in South India.

Methods

A prospective observational study was conducted from January 2020 to July 2023 at the Emergency Department of Sri Ramachandra Institute of Higher Education and Research (DU), Chennai, Tamil Nadu, India . Consecutive patients presenting with acute poisoning were enrolled. Data on demographic characteristics, poisoning agent, exposure route, time to presentation, clinical management, and outcomes were collected and analyzed.

Results

Among 81 prospectively enrolled patients, pharmaceutical overdose was the most frequent exposure (34.6%), followed by organophosphorus pesticides (18.5%) and rat killer (13.6%). Intentional ingestion accounted for 67.9% of cases. Most patients (76.5%) arrived within 4 hours of exposure. Activated charcoal was administered in 39.5% of cases; specific antidotes included N-acetylcysteine (18.5%) and atropine (8.6%). All patients recovered fully, with no mortality in the prospective cohort.

Conclusion

Prospective surveillance reveals that pharmaceuticals and pesticides are the predominant emerging chemicals causing acute poisoning. The high proportion of intentional ingestion highlights the intersection of environmental availability and mental health. Reducing the burden requires integrated strategies: stricter pesticide regulation, and community education.



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sciforum-179320: QSRR modeling for GC-MS retention prediction of emerging Xenobiotic contaminants: a robust in silico tool for environmental screening and risk assessment

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The occurrence of emerging xenobiotic contaminants in the environment poses significant risks to ecosystems and human health, necessitating rapid and reliable analytical methods for their monitoring. Quantitative structure–retention relationship (QSRR) analysis has emerged as a powerful in silico technique for linking molecular structure to chromatographic behavior, enabling the prediction of analytical parameters without reference standards. In this work, we developed a robust QSRR model for predicting the gas chromatography–mass spectrometry (GC-MS) retention times (RT) of a diverse set of xenobiotic compounds, including potential emerging contaminants. Molecular geometries were optimized using the PM7 semi-empirical method, from which a wide range of theoretical descriptors were computed. A Genetic Algorithm (GA) was employed for feature selection, yielding an optimal five-descriptor combination (DBI, R8i, TPSA_efficiency, Hy, and SM1B(p)). The model was rigorously validated using both internal and external validation strategies. Internal validation demonstrated excellent statistical performance ($R^2 = 0.88$, $Q^2_{\text{LOO}} = 0.877$, $s = 0.11$, $\text{RMSE}_{\text{tr}} = 0.11$). External validation confirmed the model's strong predictive power ($Q^2_{\text{F1}} = 0.812$, $Q^2_{\text{F2}} = 0.810$, $Q^2_{\text{F3}} = 0.837$, $\text{CCC}_{\text{ext}} = 0.89$, $\text{RMSE}_{\text{ext}} = 0.138$). These results underscore the robustness and practical utility of the developed QSRR model as a reliable tool for estimating the GC-MS retention times of emerging xenobiotics. This approach facilitates their rapid screening and identification in complex environmental matrices, thereby supporting exposure assessment and contributing to the broader understanding of their environmental risks and potential health effects.



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sciforum-175344: The Impact of Cigarette Filters on Aquatic Ecosystems Using Daphnids as Model Organisms

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Cigarettes are the most littered item in the world. 4.5 trillion are discarded annually, and their filters can introduce toxic chemicals and plastics into waterbodies. Therefore, the assessment of the ecotoxicological effects of smoked and non-smoked cigarette filters is necessary. With the freshwater organism, *Daphnia*, this study analyses the toxicity and sublethal effects caused by these two types of filters with New Approach Methodologies, such as effect-based bioassays and enzymatic biomarkers. Toxicity was assessed by measuring mortality following exposure to increasing concentrations of filters. The study also analysed the survival and growth rate, and quantified enzyme activities.

After 48 hours, only smoked cigarette filters were toxic from 100 ml extract/L with an EC₅₀ value of 397 ml/L. In contrast, exposure of 21 days reduced survival at lower concentrations, with smoked filters decreasing median survival to 4 days at 200 ml/L, corresponding to 4 filters per litre of water. Daphnids' growth rate was most affected after 7 days of exposure from concentrations of 5-70 ml/L. Size changes observed at 7 days, were reduced at 14 and 21 days of exposure, suggesting possible acclimation. Enzymatic activity was also altered after 21 days from concentrations of 15-45 ml/L, with significant increases in acid phosphatase and decreases in alkaline phosphatase, peptidase, and β -galactosidase.

Given the observed effects in *Daphnia*, cigarette filters may have the potential to impact other freshwater organisms. This is supported by evidence that some psychoactive substances can elicit comparable responses in daphnids, and vertebrate models. Furthermore, negative effects on these primary consumers may lead to cascading effects on higher trophic levels and loss of biodiversity. Lastly, the limited availability of data on environmentally relevant concentrations of filters also underscores the importance of this study, highlighting the need to consider this emerging contaminant in environmental risk assessment frameworks.



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sciforum-174432: Using the field lizard as a model to study the impact of glyphosate on soil-dwelling vertebrates

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Using the herbicide glyphosate on crops and green spaces leads to the secondary contamination of soil-dwelling animals. These animals are exposed not only through inhalation and contact with the substance, but also through ingestion via the food chain. Top predators, such as reptiles, birds and mammals, are particularly affected. This research summarizes the results of a study investigating the toxic effects of glyphosate on the wall lizard (*Podarcis siculus*), which, due to its lifestyle and habitat, is an ideal model organism.

For the study, *P. siculus* specimens collected from a pristine area were kept in a terrarium and orally exposed, every other day for three weeks, to two different concentrations of pure glyphosate. At the end of the treatment period, histological analyses, such as Mallory's trichrome, PAS and Picrosirius red staining, were performed on liver and gonads, to reveal their cellular and tissue morphology. Immunocytochemical analyses and real-time PCR on the same organs revealed changes in gene and protein expression.

All tissues from animals exposed to the herbicide show morphological alterations, such as tissue disorganization, likely due to a lack of proper cellular communication, and fibrosis. The liver and gonads exhibit typical endocrine-disrupting effects, including vitellogenin synthesis in male livers and changes in the localization and expression of estrogen receptors.

Consequently, reproductive function is severely impaired. In the testes, spermatogenesis slows, the walls of the seminiferous tubules thin and spermatozoa in the lumen decrease. Hyperstimulation occurs in the ovaries, resulting in an increase in the number of primary follicles that begin to differentiate.

In conclusion, exposure to glyphosate causes structural and functional damage, indicating potential harm to the health of soil-dwelling vertebrates. Overall, these data highlight the risks faced by vertebrates living in glyphosate-treated areas.



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sciforum-174467: What neurological evidence has been reported on the long-term effects of human exposure to mixtures of environmental neurotoxicants?

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Introduction

Environmental pollutants threaten global public health, rising incidence of morbidity and mortality. Three critical yet inadequately characterized outcomes of chemical pollution are neurodevelopmental toxicity, reproductive toxicity, and immunotoxicity [1]. Toxicological and epidemiological data reveal increasing prevalence of neurological disorders such as Alzheimer's and Parkinson's disease, amyotrophic lateral sclerosis, and Huntington's illness [2]. All of these conditions are characterized by structural and functional abnormalities in neurons of the brain and spinal cord [3,4].

Aim and Methods

A PRISMA compliant review was conducted using the PubMed, ScienceDirect, and Scopus databases. Keywords used included: “environmental contaminants,” “pollutants exposure,” “neurological diseases,” and “neurotoxicants”. Only scientific opinions from the European Food Safety Authority (EFSA) and peer-reviewed articles from 2020 and 2025 were included. The aim of this study is to assess current evidence correlating environmental neurotoxicants with cognitive dysfunction.

Results

Data reveal epidemiological evidence linking long-term exposure to environmental pollutants with nervous system dysfunction [2]. Prenatal exposure to outdoor air pollutants is linked to lower cognitive development scores and an increased risk of adverse neurodevelopmental and behavioral outcomes, such as autism spectrum disorder (ASD) and attention deficit hyperactivity disorder (ADHD) [5,6]. According to EFSA opinions, substances such as endocrine disruptors (e.g., dioxins and polychlorinated biphenyls) interfere with neurodevelopmental processes, especially if exposure occurs at critical stages of development (e.g., pregnancy, infancy, and puberty) [7]. Long-term exposure to air pollution, pesticides, and metals in adults may contribute to cognitive dysfunction [4].

Conclusion

The underlying etiology of the neurodegenerative process in patients is likely influenced by the interplay between predisposing genetic variants and environmental insults [8]. While the associations are strong, a causal relationship has not been fully proven due to methodological variability and confounding factors. A better understanding of the neurological impact of environmental pollutants is crucial for developing effective prevention and intervention strategies.



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sciforum-173868: Xenobiotic contaminants emitted from Landfill Fires and Associated Public Health Impacts: A Systematic Review

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Increase in volume of solid waste generation remains a global challenge. Driven by limited solid waste management infrastructure, poor regulation, and volume reduction strategies, open burning of these wastes at uncontrolled landfill sites is a common waste-management practice, particularly in many low- and middle-income countries. Such unsanitary landfill fires generate complex mixture of hazardous pollutants, notably polycyclic aromatic hydrocarbons (PAHs), heavy metals, radiation, particulate matters and polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), many of which are emerging contaminants of public health concern. These compounds are characterized by environmental persistence, bioaccumulation potential, long-range transport, and potent toxic, mutagenic, and carcinogenic properties. This systematic review synthesizes current evidence on xenobiotic contaminants emitted from landfill fires and evaluates their associated environmental and public health effects. A structured literature search is conducted in major scientific databases following PRISMA guidelines. Peer-reviewed studies reporting quantitative measurements of xenobiotic contaminants emitted from landfill fire, along with their toxicological outcomes in biota and environmental matrices, is screened against predefined inclusion criteria. Data is extracted and critically synthesized with attention to emission profiles, concentration ranges, exposure pathways, and biological endpoints. Reports of elevated concentrations of high-molecular-weight PAHs, toxic dioxin congeners, heavy metals and particulate matters in air, ash, soil, food and nearby aquatic systems is consistent following landfill fires. Documented ecotoxic effects include cancer risk, endocrine disruption, impaired growth and reproduction in invertebrates and vertebrates, and bioaccumulation across trophic levels. Overall, landfill fires represent a significant but underregulated source of hazardous inorganic and organic pollutants with measurable ecological risks. Strengthened waste management policies, routine environmental monitoring, and targeted risk assessments are urgently recommended to mitigate the environmental and public health burden associated with open landfill burning.



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sciforum-173918: Xenobiotic emission from indiscriminate solid waste management and risk of neurological disorders: an emerging public health concern

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Introduction

Exposure to xenobiotics from the environment and occupational settings, and the attendant associated expression of neurological disorders (NDs), is a major and fast growing emerging global health burden. Globally, an estimation of over 3.4 billion persons (43.1% of the global population), suffers at least an ND, and this is increasing annually. World Health Organization raised concern towards understanding the etiologies associated with NDs, as search for a lasting remedy. Xenobiotics (metals, organic pollutants particulate matters, microorganisms, and radiations), readily emitted from inappropriate solid waste (SW) management, are increasingly recognized as important risk factors in ND expression. This study aimed to determine the mechanisms linking exposure to mixture of contaminants from SWs to expressions of neurological disorders in human.

Methodology

This study utilized a qualitative and quantitative analyses of secondary data obtained using standard eligibility criterion in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) framework. Data were analyzed using inferential statistics, data visualization and meta-analysis of standardized mean difference (SMD) to measure the effect size.

Results and Discussion

Exposure to xenobiotics emitted from SW significantly increased multiple ND outcomes at varying frequencies: fetal and child neurodevelopment impairment, cognitive deficits, stroke, asthma, allergies, and attention-deficit/hyperactivity disorder. The mechanisms of ND expressions induced by SW emitted xenobiotics (metals, organic compounds and particulate matters) include disruption of neuronal integrity, alterations in neurotransmitter systems, induction of oxidative stress and enzyme dysregulation, neuroinflammation and epigenetic modifications (particularly DNA methylation of genes involved in brain development). Meta-analysis of ND biomarker assessments revealed significant positive effect sizes for neurological biomarkers ($p \leq 0.0001$). This indicates increased risk of ND expressions among environmentally and occupationally exposed populations, despite substantial heterogeneity ($I^2 = 94.88\%$). Conclusively, SW-derived xenobiotics are poorly studied source of NDs in humans, despite being an emerging area of environmental public health. Regulation of indiscriminate SW disposal and prevention of exposure to xenobiotic emission from SW may significantly reduce NDs in exposed populations.



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sciforum-174361: Xenobiotics from Water to the Gut: Monitoring Environmental BPA and Assessing Its Gut Bacterial Tolerance for Health Risk and Biotransformation

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Bisphenol A (BPA) is a ubiquitous endocrine-disrupting compound present in numerous environmental compartments due to its extensive industrial use in plastics. Its widespread distribution enables infiltration into the anthropogenic water cycle, food contamination, facilitating bioaccumulation through the food chain and raising concerns about chronic low-dose human exposure via drinking water and dietary sources. Since ingestion represents a major exposure route, the gut microbiota will constitute one of the first metabolic and biological barriers for this xenobiotic. Therefore, understanding gut bacterial bioreactions and responses to BPA is essential for a comprehensive risk assessment

This study bridges environmental monitoring with microbiological assessment by knowledge-transfer for analysing BPA concentrations in river and wastewater samples together with evaluating the interaction capacities of key bacterial isolates from human gut microbiota. Several microbiota species were cultured and exposed *in vitro* to concentrations of BPA simulating and encompassing environmental levels detected in water samples, as well as elevated experimental doses to establish tolerance thresholds. Microbial growth dynamics and degradation responses have been monitored to determine dose-dependent profiles and identify the strains with better BPA biodegradation capacity.

Our findings revealed that selected bacterial strains from different genera exhibited differential tolerance profiles and metabolising capacities for BPA, representing promising taxa candidates for BPA detoxification strategies. This approach integrates environmental risk assessment with toxicomicrobiomics, emphasising the importance of incorporating microbiome-related mechanisms within the One Health framework for xenobiotic risk assessment and the development of microbiome-based solutions.



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Session 4. (Micro)plastic Pollution in Environment and Human

sciforum-179492: Microplastic Bioaccumulation and its Trophic Implications in *Corbicula fluminea*

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Plastic pollution and non-native species have become major threats to freshwater ecosystems due to human activity. The Asian clam (*Corbicula fluminea*), a widespread invasive species in Europe, has been identified as a potential contributor in the bioaccumulation and trophic transfer of microplastics. This study examined the occurrence and accumulation of these pollutants in *C. fluminea*, correlating these pollutants with macroplastic contamination of the banks and sediments of five rivers in northern Portugal (Cávado, Homem, Lima, Minho, and Neiva), with varying degrees of pollution. Samples of macroplastics, sediment, and bivalves were collected and analyzed using Attenuated Total Reflectance Fourier Transform Infrared (ATR-FTIR) spectroscopy for particle characterization according to colour, size, and polymer type. Results indicated that polyethylene was the most prevalent polymer, transparent particles were the most abundant, with particles sized 0.3-1 mm being the most abundant. No significant relationships between the percentage of organic matter and microplastic abundance (in sediment or bivalves) were found by the statistical analysis. The findings underscore the role of *C. fluminea* as a significant bioaccumulator of microplastics and a potential vector for their transfer through the food web. This reinforces the importance of this bivalve in the dynamics of plastic contamination in freshwater ecosystems and highlights the urgent need for further research into the ecological consequences of this interaction.



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sciforum-142743: Occurrence and Effects of Microplastics in the Black Sea: Evidence from Mussels, Water and Sediments

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The Black Sea suffers from pollution originating mainly from land-based sources. The sea receives plastic waste from three major transboundary rivers – the Danube, Don, and Dnieper. The negative effects of MPs on aquatic organisms, resulting from plastic ingestion or entanglement, are already well documented globally. However, comprehensive studies on the ecological status of the Black Sea in Bulgaria are extremely scarce, especially those that include analysis of MP content in commercially important mussel species, surface waters, and sediments. The scientific hypothesis we have formulated is that the Black Sea and mussels are contaminated with MPs. Therefore, the main goal of this project is, for the first time in Bulgaria, to investigate and assess the quantity and composition of MPs in commercially important mussels, waters, and sediments from the Black Sea area, and their negative impact. The environmental samples from five locations along the southern Bulgarian Black Sea coast were sent to an accredited laboratory, and quantum cascade laser spectroscopy was used (the Agilent 8700 Laser Direct Infrared Chemical Imaging System). All samples showed high levels of different polymer MPs. Furthermore, the mussels will also be studied for a set of biomarkers and an assessment on the potential risk to human health associated with the consumption of Black Sea mussels contaminated with MPs will also be conducted.

Acknowledgements

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sciforum-179163: Thermodynamic Insights into (Micro)plastic Pollution in the Environment: Interfacial Processes, Chemical Synergism, and Ecological Implications

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Introduction

(Micro)plastic pollution has emerged as a critical environmental issue due to its persistence, widespread distribution, and complex interactions with natural systems. Beyond physical accumulation, microplastics act as active chemical interfaces that influence the transport, transformation, and bioavailability of contaminants, including heavy metals and organic xenobiotics.

Methods

This study applies a thermodynamic and physicochemical framework to analyze the role of microplastics as heterogeneous substrates in aquatic environments. Interfacial interactions were evaluated using adsorption equilibria, surface complexation modeling, and speciation analysis. Particular emphasis was placed on cooperative (synergistic) effects between microplastics, dissolved organic matter, and coexisting ionic species under varying pH and ionic strength conditions.

Results

The results demonstrate that microplastics significantly modify chemical speciation and pollutant distribution through surface-mediated processes. Synergistic interactions between polymer surfaces and ligands enhance the binding capacity for metal ions, shifting equilibrium boundaries and promoting localized accumulation. These effects are strongly dependent on environmental parameters, particularly pH and ionic composition, which govern both surface charge and ligand availability. Furthermore, microplastics facilitate the formation of multi-component complexes, leading to non-additive behavior in pollutant partitioning. This heterogeneous synergism amplifies the environmental persistence and potential toxicity of associated contaminants.

Conclusions

Microplastics should be considered not only as passive carriers but as active thermodynamic participants in environmental systems. Their ability to induce synergistic interfacial effects necessitates a revised framework for predicting contaminant fate and transport. Integrating thermodynamic modeling with environmental monitoring can improve risk assessment and support the development of targeted mitigation strategies for complex pollution scenarios involving microplastics and xenobiotics.

Acknowledgements

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sciforum-172982: Aged polyethylene microplastics as active modifiers of plant exposure to agrochemicals

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Microplastics are increasingly recognized as co-occurring xenobiotics in agricultural systems, yet their functional role in shaping plant exposure to other contaminants remains insufficiently resolved. This study investigates whether aged polyethylene microplastics (PE MPs) behave as inert background particles or as active components of plant exposure scenarios.

Using *Brassica napus* L. cultivated under controlled hydroponic conditions, we examined the independent and combined effects of aged PE MPs (~500 µm) with two chemically distinct agrochemicals: tetracycline and a glyphosate-based ionic liquid. Despite the absence of particle internalization, PE MPs adhered to root surfaces and induced significant reductions in chlorophyll and carotenoid levels, accompanied by pronounced alterations in antioxidant enzyme activities (CAT, APx, POx), demonstrating that physical root-particle contact alone is sufficient to disrupt redox balance.

Sorption experiments revealed compound-specific partitioning behavior. Tetracycline and the surfactant cation showed measurable affinity for aged PE, resulting in reduced freely dissolved concentrations and partial attenuation of selected biochemical stress markers. In contrast, the glyphosate anion displayed limited sorption and retained strong oxidative impact in co-exposure treatments.

The results demonstrate that microplastics simultaneously function as stress inducers and as modulators of xenobiotic availability. Importantly, reductions in dissolved concentrations did not consistently translate into proportional mitigation of plant stress responses. These findings emphasize that microplastics should be considered active participants in contaminant exposure pathways rather than passive environmental debris, particularly in agroecosystems where multiple xenobiotics co-occur.



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sciforum-172911: Beyond monitorization: ecological evaluation of the Douro estuary and it's microplastic distribution

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Background

Estuaries are highly productive ecosystems characterised by constant environmental variability, which makes frequent monitorization essential. Estuaries are among some of the most impacted ecosystems, often surrounded by densely urbanised areas and exposed to multiple pollution sources. Microplastics (MP) are an emerging pollutant that harm aquatic organisms and potentially pose risks to human health. However, MP are still not included in current European water quality guidelines. In this context, the present study assessed the ecological quality of the Douro estuary, in accordance with the Water Framework Directive (WFD), and evaluated the distribution of MPs within this ecosystem.

Methods

The ecological evaluation consisted of the analysis of physical and chemical parameters, phytoplankton biomass, macroinvertebrate community, sediment's organic matter, and granulometry. Along the low estuary 12 sites were assessed, and MP were sampled in 4 transects. Water samples were collected from the surface and sub-surface areas. In sediment MPs were also sampled along with ecological parameters. MPs were counted, and classified according to size, typology and colour.

Results

Physical and chemical results revealed a moderate ecological status, driven by $\text{NO}_2 + \text{NO}_3$ concentrations above reference values (1 mg N/L). Phytoplankton biomass showed a high ecological status across all sites. Regarding the macroinvertebrate community, the estuary was classified with a Moderate ecological status. Sediments exhibited low organic matter and a mixed granulometric profile. A total of 9.03 MP m^{-3} in water and 1650 MP Kg^{-1} in sediments were recorded, values above those described in Portuguese rivers. A Principal Coordinates Analysis with MP characteristics revealed differences among transects and samples areas consistent with a higher hydrodynamic effect.

Conclusion

The estuary holds a Moderate ecological status according to the WFD. MP contamination was also identified across the estuary, although further work is required to identify specific pollution sources.



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sciforum-179497: Contaminant Mixtures and Warming: Bioaccumulation and Organismal Stress in an Invaded Freshwater Trophic Chain

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The global increase in plastic production, driven by its affordability and resilience, has resulted in extensive environmental pollution, with microplastics (MPs) now permeating even the most isolated and pristine habitats. Within freshwater ecosystems, these particles, alongside other emerging pollutants such as toxic silver nanoparticles (AgNPs), are consumed by organisms, causing adverse health effects and potentially moving through food chains. This situation is exacerbated by climate change, which can modify contaminant behavior, and by biological invasions that disrupt ecosystem structure, potentially magnifying pollutant impacts. Critically, all these pressures may interact, and their possible combined effects represent a significant but largely unexplored risk to ecosystem health. This study employed a mesocosm-based multi-stressor design with four treatments (control, MPs, AgNPs, mixture), featuring an algal community, *Physa acuta* snails, and the signal crayfish (*Pacifastacus leniusculus*), to investigate the interactive effects of MPs and AgNPs under varying temperatures (18 and 24°C) and exposure durations (24 and 48 hours). To assess oxidative stress we analysed two antioxidant enzymes, catalase and glutathione S-transferases, and acetylcholinesterase to investigate neurotoxicity. Findings revealed contaminant accumulation across all trophic levels. Microplastic distribution showed no consistent tissue-specific patterns nor clear responses to temperature or exposure duration, whereas AgNPs exhibited structured tissue accumulation. Correlations between the two contaminants were weak and limited to specific groups, indicating that their simultaneous presence does not guarantee co-accumulation. Enzymatic biomarkers varied primarily by tissue, with limited treatment-related effects, suggesting that the experimental concentrations and durations may not have elicited classic stress responses. Future studies should incorporate more complex food webs and environmentally realistic contaminant levels to better mimic natural systems. Employing a broader suite of stress biomarkers would also help clarify immune responses across species and trophic positions. Additionally, implementing monitoring programs for these and other contaminants is essential for tracking their prevalence and detecting emerging trends.



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sciforum-173593: Differential Disruption of Morphogenesis and Biomineralization in Mussel Larvae Exposed to Environmental Microplastics and Diuron

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-

Early larval stages of marine bivalves are highly sensitive indicators of environmental contamination, yet the distinct impacts of microplastics and chemical pollutants on morphogenesis and biomineralization remain poorly characterized. This study evaluated the effects of environmental microplastics (EMPs), diuron, and their mixture on *Mytilus galloprovincialis* larvae at environmentally relevant concentrations. Using an integrative approach, we assessed embryotoxicity (larval abnormalities and growth), shell calcium deposition, tissue integrity (histology and polarized light microscopy (PLM)), and transcriptional responses of key genes involved in cytoskeletal stability (tubulin), shell formation (hrg), and calcium homeostasis (calreticulin). Exposure to diuron markedly increased larval abnormalities ($56.8 \pm 0.7\%$), particularly shell deformities and developmental arrest, whereas EMPs exhibited $42.7 \pm 0.9\%$ abnormal individuals, moderate growth inhibition, and mainly mantle anomalies. MIX exposure further exacerbated these effects, resulting in the highest embryotoxicity ($62.9 \pm 0.75\%$). Calcium deposition was significantly reduced under diuron (174.32 ± 1.26) and MIX (163.61 ± 5.23) treatments, whereas EMPs (180.45 ± 8.44) had a milder effect, confirming that biomineralization is differentially sensitive to chemical and particle stressors. Histological and PLM analyses revealed that diuron primarily impaired shell mineralization, EMPs disrupted mantle architecture, and MIX induced combined structural and mineralization defects. Gene expression patterns mirrored these observations, indicating stressor-specific modulation of biomineralization, cytoskeletal organization, and calcium regulation. Overall, our findings demonstrate that chemical and particle stressors differentially target critical cellular processes involved in morphogenesis and biomineralization, yet ultimately converge on impaired shell formation. This integrative framework provides mechanistic insight into early larval vulnerability and supports the use of multi-level biomarkers to predict sublethal effects on recruitment and population resilience in polluted coastal ecosystems.



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sciforum-179198: Flocculation as a Control Strategy for Plastic Removal in Wastewater Treatment Plants

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The continuous increase in the production and use of plastics and their consequent release into natural ecosystems represent a significant concern for both human and environmental health. Wastewater Treatment Plants (WWTPs) have been identified as one of the major pathways for plastics entering aquatic environments. Although several studies have demonstrated the effectiveness of coagulants/flocculants in plastic removal in laboratory tests, their practical application in WWTPs remains largely unexplored. This study evaluated the effectiveness of different commercial polymer-based flocculants, both synthetic and natural, in reducing plastic concentrations in wastewaters. Jar tests were performed using these wastewaters adding four commercial flocculants (2 bio-based and 2 polyacrylamide-based) at three concentrations close to the dosage recommended for suspended solids' removal (0.10 g/L), in combination with different plastic mixtures artificially created. Plastic removal efficiency was quantified by comparing the number of particles remaining in suspension after treatment with the initial amount. In addition, many chemical parameters were monitored to assess regulatory compliance (European Directive (EU) 2024/3019). The results demonstrated that the use of coagulants, chemical agents that promoting particles aggregation, was necessary to reach the chemical requirements of the Directive. Poly-aluminum chloride (PAC) administered at 0.08 g/L showed the best performance compared to other coagulants, while complying with the limits imposed by the EU Directive. The various flocculation tests, with the addition of this necessary PAC concentration, showed similar plastic removal efficiencies, with percentages of $96.25\% \pm 0.72$ for bio-based polymers and $99.58\% \pm 1.65$ for polyacrylamide-based polymers. These findings suggest the applicability of flocculation-based treatments for plastic mitigation in industrial WWTPs and suggest that natural flocculants may offer a sustainable alternative to synthetic polymers, improving environmental safety of wastewater treatment processes.



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sciforum-174172: FTIR-based insight into nickel binding mechanisms in soil containing polystyrene microplastics

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-

The interaction between microplastics (MPs) and heavy metals in soil is governed by complex surface processes that are still insufficiently characterized at the molecular level. This study investigated surface chemical transformations of polystyrene (PS) MPs in soil and their role in nickel (Ni) binding using Fourier-transform infrared spectroscopy (FTIR). Soil was spiked with 1% (w/w) PS and Ni at 50 and 500 mg kg⁻¹ under controlled conditions. Infrared spectra of PS recovered from soil revealed pronounced surface modifications compared to pristine PS. The appearance and intensification of bands associated with Al-O (914 cm⁻¹) and Fe-O/Mn-O vibrations (650 cm⁻¹), together with broadening of the 1026 cm⁻¹ band overlapping with Si-O-Si stretching vibrations, indicated the formation of PS-soil associations. These findings suggested that PS particles interact with mineral components, forming composite aggregates enriched in reactive oxygen-containing functional groups. With increasing Ni concentrations, additional spectral changes were observed. Enhanced intensity of mineral-associated bands indicated that Ni mainly interacts with oxygen-containing mineral sites (Si-O, Al-O, and Fe/Mn-O). Moreover, lower but consistent modifications in PS-specific aromatic vibrations (1601, 1492, 1451, and 695 cm⁻¹) demonstrated that Ni interacts not only with soil mineral phases but also partially with PS surfaces. Negatively charged PS surfaces may promote electrostatic attraction of positively charged Ni species, while π -metal interactions between Ni ions and aromatic rings further contribute to localized Ni accumulation. Therefore, partial Ni association with PS may induce competition for binding sites and facilitate subsequent desorption processes. Such interactions may contribute to enhanced Ni mobility in soil systems containing PS-MPs. Spectroscopic findings obtained in this study provide mechanistic evidence that MPs modify metal binding pathways in soil and should be considered active geochemical agents rather than inert particles in contaminated terrestrial environments.



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sciforum-173808: Fungal-Assisted Biodegradation of Bioplastics: A Comparative Analytical Study

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Abstract

The growing environmental concerns associated with conventional plastics have accelerated research on biodegradable alternatives. The accumulation of plastic waste in landfills and natural ecosystems has intensified issues such as soil contamination, marine pollution, and ecological imbalance. In response to these challenges, degradable plastics have emerged as potential alternatives due to their enhanced susceptibility to microbial degradation. The present study evaluates the fungal-mediated degradation of degradable polyethylene (PE) plastic, a modified polyolefin polymer designed to undergo accelerated environmental breakdown. Fungal strains, including *Fusarium* spp. and *Aspergillus niger*, were isolated and identified using conventional lactophenol cotton blue staining techniques. Qualitative biodegradation analysis was performed following the Modified ASTM G21-70 protocol. Quantitative degradation was assessed by determining percentage weight loss using three different methods: Modified ASTM, broth culture method, and soil burial test. The experiments were conducted under controlled laboratory conditions at $28 \pm 2^\circ\text{C}$ for an incubation period of 30 days. The highest degradation was observed in the Modified ASTM method, with *A. niger* showing 44% weight loss and *Fusarium* spp. 33%. In the broth culture method, degradation percentages were 31.5% for *A. niger* and 26.3% for *Fusarium* species, while the soil burial test exhibited comparatively lower degradation rates of 15.7% and 10.5%, respectively. Statistical analysis indicated significant differences in degradation efficiency among the tested methods ($p < 0.05$). Structural alterations in the degraded polyethylene samples were further characterized using Fourier Transform Infrared Spectroscopy (FTIR), which confirmed changes in functional groups indicative of polymer breakdown. These findings demonstrate the effective role of fungal cultures in enhancing the degradation of degradable polyethylene and suggest that such microbial approaches could be further explored as an eco-friendly strategy for reducing plastic waste accumulation and supporting sustainable plastic waste management.



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sciforum-174420: Gut plastizyme: Systematic Review for searching gut microbiota enzymes to be proposed as plastic-degradation resources

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Rapid industrialization and anthropogenic activities have led to the widespread occurrence of emerging contaminants, such as plasticizers and microplastics. These pollutants are a global concern due to their persistence and ability to interfere with endocrine systems, potentially causing adverse ecological and health effects. This systematic review identifies plastic degradation enzyme capacities within the gut microbiome taxa, previously described for environmental microorganisms. A search term was conducted using the following keywords: “Biodegradation”, “Microbial degradation”, “xenobiotic metabolism”, “microbial degradation pathways”, “enzymes”, “laccase”, “monooxygenase”, “dioxygenase”, “dehydrogenase”, “Bisphenol A” (BPA), “Xenobiotics” and “Endocrine disruptor”. Records were screened against inclusion criteria based on keywords detected in the titles and abstracts of original articles and experimental studies on the specific microbial degradation of BPA, in which specific enzymes, genes, or metabolic pathways were described. The analysis and presentation of the data obtained from the systematic review search were organized in accordance with the PRISMA 2020 flow diagram for new systematic review. A summary of the microorganisms with BPA-degrading enzymes identified in in vitro studies was compiled, highlighting genera such as *Lactobacillus*, *Enterococcus*, *Bacillus* and *Pseudomonas*. Their key enzymatic mechanisms primarily involve the action of laccases, peroxidases or cytochrome P450, which transform BPA into intermediates such as hydroquinone, 4-hydroxybenzoic acid or 4-hydroxyacetophenone. It has been also described the homology of the first environmental plastizyme with the specific enzymatic repertoire (laccases, dioxygenases and hydratases) of species taxonomically closest to the intestinal microbiota isolates, as determined by bioinformatic and molecular analyses of complete genomes (whole-genome sequencing, WGS). To extrapolate these results, a pilot complementary bioinformatic approach will be done with a reconstructed MAG (Metagenome-assembled Genome) from gut microbiota from a children cohort with known level of BPA exposure to validate and described the presence of “gut plastizyme” and specific “gut BPAzyme”.



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sciforum-176246: Impact of Prenatal Polystyrene Microplastic Exposure on Neurodevelopment and Hippocampal Neurogenesis

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The rapid increase in environmental microplastic contamination has raised growing concerns regarding their potential effects on human health, particularly during sensitive developmental periods. Polystyrene microplastics (PS-MPs), among the most prevalent forms, have been detected in food, drinking water, and biological tissues. However, their impact on brain development and long-term neurobiological outcomes remains poorly understood.

This study investigates the consequences of gestational exposure to PS-MPs on hippocampal neurogenesis and neuroinflammatory processes in rat offspring. Pregnant rats received daily, throughout gestation and lactation, 0.5 mL of a pristine polystyrene microplastic suspension containing 0.1 mg of 5 µm PS-MPs by gastric gavage. Offspring were evaluated at distinct developmental stages (G20, PND10, PND21, and PND90). Molecular and protein analyses were performed to assess the expression of key neurogenic markers, pro-inflammatory cytokines, and neurotrophic factors within the hippocampus.

Our findings demonstrate significant developmental stage-dependent alterations in gene and protein expression profiles. Prenatal PS-MP exposure induced a sustained increase in pro-inflammatory markers, particularly IL-6, alongside a marked reduction in DCX expression at adulthood (PND90), suggesting persistent impairment of the hippocampal neurogenic niche. Furthermore, sex-dependent differences were observed, indicating differential vulnerability between males and females.

Collectively, these results provide evidence that gestational exposure to polystyrene microplastics disrupts neurodevelopmental trajectories and promotes long-term neuroinflammatory alterations. This study highlights the potential developmental neurotoxicity of environmental microplastics and underscores the need for further investigation into their impact on brain health.



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sciforum-179092: Limited Uptake and Effects of End-of-life Tire particles in the gut of the Pavement Ant, *Tetramorium immigrans*: A First Assessment

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Tires and their wear-derived residues are increasingly recognized as significant environmental pollutants. While numerous studies have documented their adverse effects on aquatic organisms, their impacts on terrestrial ecosystems remain poorly understood. Ants represent a suitable model taxon for such investigations due to their abundance in urban environments and their demonstrated ability to transport other pollutants, including microplastics. In this study, we conducted a first assessment of the effects of End-of-Life Tire (ELT) particles on ants, examining both external and internal exposure pathways, using the pavement ant *Tetramorium immigrans* as a model species. Laboratory experiments were performed by exposing worker ants to different treatments (ELT powder, ELT-contaminated food, or a combination of both) and to varying doses of ELT particles. Overall, the observed effects were limited. Only 1–2 ELT particles were detected on the cuticle of ten ants, predominantly in individuals subjected to the ELT powder treatment. Ants consumed contaminated food, and the absence of ELT particles in the gut lumen suggests that particles transited through the digestive tract and were subsequently excreted. However, during gut passage, ELT particles appeared to induce mild histological alterations. Specifically, ants that ingested contaminated food exhibited a higher proportion of damage to the epitheliums' brush border (partially altered or entirely absent) compared to control individuals, along with a marginally significant increase in such damage at higher ELT doses. In contrast, epithelial vacuolization was not influenced by either treatment type or particle dose. These preliminary findings suggest that ants may be only weakly affected by ELT particle exposure. However, the limited sample size highlights the need for further investigations to robustly confirm this pattern.



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sciforum-174028: Linking Human Activities to Microplastic Pollution: Evidence from Marina da Afurada

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Estuaries are subject to intense anthropogenic pressures, particularly in areas with marinas and intensive nautical activities. These transitional ecosystems are increasingly affected by microplastic (MP) pollution, even though MPs are not yet included in the Water Framework Directive. This study aimed to evaluate the ecological status of the Douro Estuary and characterize the occurrence of MPs in the area adjacent to the Marina da Afurada. The ecological status was assessed using physico-chemical parameters, chlorophyll *a* concentrations and benthic community composition. Sediment grain size and organic matter (OM) content were also analysed. Additionally, MPs collected from the water column, subsurface, and sediments were quantified and characterized by morphology. Results revealed a gradient of improving water quality from upstream to downstream locations. Areas near the marina recorded the lowest dissolved oxygen value (82.7%), high concentrations of NO₃+NO₂ and NH₄ (1.247 mg/L and 0.40 mg/L, respectively), and high OM content (15.6%). These patterns reflect high residence times for the water masses and strong urban influence. Benthic community was dominated by tolerant species, with AMBI and BAT indices indicating ecological conditions between “moderate” and “good”. MPs abundance was higher in sediments, particularly in very fine-grained, organic-rich areas directly influenced by the marina, where fibres accounted for 82% of MPs. Fibres were also predominant in water column samples (75%), whereas paint particles were most abundant in subsurface samples (49%), suggesting a link to local nautical activities. Multivariate analyses revealed a significant correlation between OM, grain size, and MPs’ abundance, highlighting the influence of hydrodynamic conditions in MPs’ retention. Thus, this study demonstrates that although the Douro estuary functions as a generally balanced system, the Marina da Afurada acts as a local sink for MPs and nutrients derived from anthropogenic activities. These findings reinforce the need to incorporate MPs into future estuarine monitoring and management frameworks.



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sciforum-174031: Micro- and Nanoplastics in Food Products and Drinking Water: Risk Assessment, Analytical Methods, and Regulatory Framework Development

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Introduction

Assessing dietary intake of synthetic polymer particles is a critical issue. For the first time in Russia, an interdisciplinary study addressed the emerging problem of microplastics (MPs) and nanoplastics (NPs) in food hygiene and safety.

Methods

The research included global literature analysis, preparation of MPs/NPs reference materials, development and validation of analytical methods for detecting MPs/NPs in key food types and drinking water, and exposure and health risk assessment for the general population and occupational groups.

Results

MPs contamination levels in most of the 81 tested samples (salt, sugar, juices, cereals, etc.) were relatively low. However, certain bottled waters, nylon tea bags, and paperboard cups were identified as significant MPs/NPs sources with regular use. Athletes consuming bottled water and take-away food in plastic may face elevated exposure. Findings informed the development of methodological guidelines “Procedure for Detecting Micro- and Nanoplastic Particles in Food Products and Drinking Water”, outlining a structured protocol for sample preparation, separation, and analysis.

Conclusion

The protocol enables organizations to conduct large-scale MPs/NPs studies and generate representative data. A database on consumption of plastic-packaged foods and products with high MPs levels was created. Combined with representative MPs/NPs concentration data in Russian food products, this will support future assessments of dietary MPs exposure for the Russian population.

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sciforum-174084: Microplastics as Modulators of Xenobiotic Bioavailability and Phytotoxicity in Soil

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The co-occurrence of pharmaceuticals and microplastics (MPs) in agricultural soils raises questions about their interactive effects on contaminant mobility and plant exposure. This study evaluated how selected microplastics influence the bioavailability and phytotoxicity of sulfamethoxazole (SMX) in soil using sorghum as a model plant. Polyethylene (PE), polystyrene (PS), and acrylonitrile–butadiene–styrene (ABS) were tested in pristine and artificially aged forms (modified Fenton protocol). Dose-response analysis demonstrated a biphasic effect of SMX: low concentrations (1–5 mg/kg) slightly stimulated shoot and root growth, whereas ≥ 10 mg/kg significantly inhibited development, with nearly complete suppression of root elongation at 50 mg/kg. Microplastics alone (0.1–1%) did not negatively affect germination or early growth. However, when 1% aged MPs were introduced into SMX-contaminated soil (EC25 and EC50 levels), phytotoxic effects were mitigated. Plants grown in MP-amended systems exhibited significantly improved germination and biomass compared to SMX-only treatments. Analysis indicated that total SMX sorption in soil was not markedly altered by MPs, yet polymer type and ageing state influenced the water- and acid-extractable fractions. Primary PE and ABS increased SMX concentrations in eluates, while aged MPs generally showed enhanced retention capacity. Among the tested polymers, PS exerted the strongest effect on modifying SMX bioavailability and plant response. These findings demonstrate that MPs act as dynamic regulators of antibiotic mobility rather than passive soil contaminants. By modifying sorption–desorption equilibria and the plant-accessible fraction of SMX, MPs can attenuate or reshape phytotoxic outcomes. The results highlight the necessity of incorporating MP–pharmaceutical interactions into environmental risk assessment frameworks, particularly in intensively managed agricultural systems where both contaminant groups co-occur.



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sciforum-173869: Plastic contamination in different streams of Lake Orta (Northern Italy)

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Despite the growing evidence of plastic contamination in marine ecosystems, freshwater environments, particularly small tributaries, remain comparatively understudied. Inflowing streams may represent important pathways for plastic transport into lacustrine systems, acting as point sources that may influence contamination patterns at the basin scale. This study assessed the presence of plastics in the water of six tributaries of Lake Orta (Northern Italy) as Fiumetta, Pescone, Qualba, Plesina, Lagna, and Pellino. Sampling was conducted in November 2025 at the inlet of each tributary of the Lake Orta using 100 μm plankton nets equipped with a flowmeter. Collected particles were subsequently analysed and characterised in terms of shape, size, colour and polymer composition using micro-Fourier Transform Infrared spectroscopy ($\mu\text{FT-IR}$). A total of 91 suspected particles were analysed, of which 31 were confirmed as plastics. Microplastics (1mm) represented the dominant fraction of the detected debris, accounting for 94 % of the confirmed plastic. Fragments were the most frequent particle type (48%) and were mainly composed of polypropylene. Among the investigated tributaries, plastic concentrations were lowest in the Pescone stream (0.04 plastics m^{-3}), while the highest values were detected in the Lagna tributary (0.25 plastics m^{-3}). Polypropylene (58%) and polyethylene (26%) were the most frequently identified polymers. Variability in particle abundance and typology suggests the influence of site-specific factors, potentially related to urban settlements and industrial activities within the respective catchment. Further analyses are ongoing to monitor the seasonal fluctuation of plastic pollution in the selected streams.

Acknowledgments

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sciforum-174458: Polylactic acid bioplastics (PLA BPs): A threat to the reproductive health of the Mediterranean mussel *Mytilus galloprovincialis*

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Polylactic acid-based bioplastics (PLA-BPs) are considered the green-innovation of the 21st century because considered more environmentally friendly than conventional plastics. However, their growing production has led to their increased presence in environmental matrices at concentrations of mg/L (in liquid samples) and mg/g (in solid samples), a sign of the limited capacity of treatment plants to mitigate their release into the environment. Their slow degradation makes them a potential threat to biota health in marine environments. This study aims to evaluate the impact of environmental concentrations of PLA-BPs (0.5 µg/mL) on the reproductive health of the Mediterranean mussel *Mytilus galloprovincialis* during a 7-day exposure. Histomorphological analysis by Hematoxylin/Eosin (H/E) staining revealed that gonads of both sexes underwent a precocious spawning, intense haemocyte recruitment and adipogranular cell hypertrophy. Positive results for the diastase Periodic Acid-Schiff/PAS (dPAS/PAS) reaction indicated increase in the glycogen level, a key energy reserve during gametogenesis, which was more evident in females than in males. Metabolomic data based on Proton Nuclear Magnetic Resonance (¹H NMR) spectroscopy revealed augmentation of energy demands from both the aerobic and anaerobic pathways, as well as the occurrence of redox imbalance by alterations in the concentration of glutathione constituents. This finding was also confirmed by biochemical analysis showing, primarily in males, increase in the enzymatic activity of catalase and glutathione S-transferase. These results were validated by Partial Least Squares Discriminant Analysis (PLS-DA), which highlighted a greater variance in females between the treated and control groups. Overall, the study findings, besides highlighting some similarities with conventional plastics, suggest that PLA-BPs represent an emerging threat to the reproductive health of mussels. However, these ecological engineers of the intertidal zone are able to implement, at least for a period of 7-days, sex-dependent adaptive mechanisms to preserve their reproductive capacity and survival.



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sciforum-174431: Polystyrene microplastic beads and the mussel *Mytilus galloprovincialis*: an encounter that should never have happened

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Microplastic (MP) pollution is a major global environmental issue, especially in aquatic ecosystems. Despite its vastness and strong currents, the marine environment is highly vulnerable to MP contamination. Microplastics vary widely in chemical composition and size: larger fragments can be ingested by vertebrates that mistake them for food, while smaller particles, down to the micro- and nanoscale, can spread throughout aquatic food webs. Marine mussels, such as *Mytilus galloprovincialis*, are particularly susceptible because they are filter feeders and continuously process large volumes of water. This species is widely used in environmental biomonitoring due to its broad distribution and commercial importance. However, its role as a common food source also makes it a potential vehicle for transferring microplastics, along with associated chemicals and pathogens, to humans. This study investigated the cytotoxic effects of a 48-hour exposure to 5 μm polystyrene microplastics at two concentrations (0.5 and 1 $\mu\text{g/mL}$). Histological analyses confirmed the presence of MPs in mussel tissues and revealed significant structural alterations in the gills and mantle, the latter being particularly relevant as it contains the gonads and represents the main edible portion. Morphological observations showed dose-dependent damage to gills, ovaries, and testes. Exposure caused cellular disorganization, especially in spermatid cysts, and progressive oocyte degeneration. Hypertrophic mucous cells appeared in both male and female gonads, indicating a stress response. This condition was supported by redox imbalance and increased levels of stress-related proteins, including HSP70 and p53. Importantly, MP-induced stress altered sperm chromatin organization, making it more susceptible to DNase digestion. Overall, the findings demonstrate that microplastics disrupt tissue organization, impair reproductive processes, and compromise mussel health and quality, posing ecological risks and potential threats to human consumers.



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sciforum-174175: Redistribution of Ni in soil containing polystyrene microplastics: evidence from sequential extraction

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The co-occurrence of microplastics (MPs) and heavy metals in terrestrial ecosystems represents an emerging environmental concern, yet their combined influence on metal partitioning in soil remains less understood. This study investigated the effect of polystyrene (PS) MPs on nickel (Ni) redistribution and mobility using a controlled soil incubation experiment. Soil was amended with 1% (w/w) PS and spiked with Ni at 50 and 500 mg kg⁻¹, followed by sequential extraction according to the BCR protocol to assess Ni fractionation. In untreated soil, Ni was predominantly associated with oxidizable (F3) and residual (F4) fractions, with averages of 41.9% and 43.7% of the total content. The introduction of PS significantly altered Ni partitioning, promoting its transformation toward the reducible fraction (F2), which represents weakly bound, potentially mobile forms. In moderately contaminated soil (50 mg kg⁻¹ of Ni), PS addition increased the proportion of Ni in F2 by up to 84.6% compared to the corresponding treatment without PS. In highly contaminated soil (500 mg kg⁻¹ of Ni), the increase was less pronounced (31.4%), indicating a concentration-dependent response. The sum of acid-soluble and reducible fractions (F1+F2), considered phytoavailable Ni, increased significantly in PS-treated soils. Polystyrene enhanced Ni availability by up to 81.2% relative to treatments without MPs. Correspondingly, mobility factors (MF) were consistently higher under PS exposure, demonstrating reduced Ni stability in the soil matrix. These findings demonstrate that PS-MPs modify geochemical partitioning of Ni, promoting its migration from stable to more labile fractions. The effect was most pronounced under moderate contamination levels, suggesting that MPs may act as facilitators of metal redistribution in environmentally relevant scenarios. This mechanistic evidence highlights the importance of considering MP-metal interactions when assessing metal mobility in terrestrial systems.



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sciforum-178396: Synergistic Testicular Toxicity Induced by Arsenic and Microplastics and Its Attenuation by Imperatorin in Wistar Rats

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Environmental exposure to xenobiotics is increasingly implicated in the global decline of male reproductive health. Arsenic is a well-known environmental toxicant associated with impaired spermatogenesis and endocrine disruption. Microplastics have recently emerged as pervasive pollutants capable of interacting with co-existing contaminants and modifying their effects. However, the reproductive effect of combined arsenic and microplastic exposure remain unclear. This study investigated the effects of co-exposure to arsenic and microplastics on male reproductive parameters and evaluated the potential protective role of imperatorin.

Adult male Wistar rats were divided into five experimental groups (n = 6 per group): G1 – control, G2 – arsenic, G3 – microplastics, G4 – arsenic + microplastics, and G5 – arsenic + microplastics + imperatorin. Epididymal sperm samples were analysed for sperm concentration, motility, and morphological abnormalities. Testicular tissues were examined using haematoxylin and eosin staining, Perl's Prussian blue staining to evaluate iron deposition, and caspase-3 immunohistochemistry to assess apoptotic activity.

Individual exposure to arsenic or microplastics produced moderate alterations in sperm parameters and testicular histology compared with controls. Combined exposure resulted in the most pronounced reproductive toxicity. Sperm analysis showed reductions in sperm concentration and motility with increased morphological abnormalities such as coiled or fractured tails and head-tail separation. Histopathological examination revealed severe disruption of seminiferous tubule architecture, degeneration of the germinal epithelium, and reduced spermatogenic cell layers. Perl's Prussian blue staining demonstrated increased iron deposition within testicular tissue, indicating altered iron homeostasis and oxidative imbalance. Caspase-3 immunohistochemistry showed strong apoptotic signalling in the seminiferous epithelium of the co-exposed group. Treatment with imperatorin improved sperm parameters, preserved seminiferous tubule structure, reduced iron accumulation, and decreased caspase-3 immunoreactivity.

Microplastics intensify arsenic-induced reproductive toxicity, highlighting their role in mixture effects of environmental xenobiotics. Imperatorin mitigates these changes, indicating its potential as a protective agent against environmentally induced reproductive toxicity.



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sciforum-179011: Tire Road Wear Particles (TRWPs) from different asphalts: an ecotoxicological comparison on zebrafish larvae

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Rubberized materials, derived from End-of-Life Tires (ELTs), and synthetic polymers can be incorporated into asphalt mixtures to enhance durability and reduce traffic noise. However, the abrasion of tires on asphalt surfaces during traffic generates the so-called Tire Road Wear Particles (TRWPs), which represent contaminants in both terrestrial and aquatic environments. The aim of this study was to compare the toxicity of TRWPs collected from rubberized, polymer-modified, and conventional asphalts. These contaminants were collected in December 2024 using a vacuum system along the 73 Senese Aretina State Road (Central Italy), which features different contemporary types of rubberized, polymer-modified, and conventional asphalts. The collected particles were characterized in terms of ultrastructure, by Scanning Electron Microscopy (SEM/EDS), presence of microplastics, by μ Fourier Transform Infrared Spectroscopy (μ FT-IR), and occurrence of the additive Hexamethoxymethylmelamine (HMMM) to confirm the presence of tire-derived particles. Subsequently, TRWP suspensions (10 and 100 μ g/L) were prepared by 72 h of stirring followed by 48 h of settling. The suspensions were characterized by Dynamic Light Scattering and Single Particle Extinction and Scattering (SPES) to obtain both size and concentrations of particles. In addition, a *non*-target chemical analysis was performed to characterize the main chemicals released by TRWPs in water. Chronic toxicity was evaluated in *Danio rerio* (zebrafish) larvae exposed from 0 to 120 hours post fertilization (hpf). A wide battery of biomarkers of cellular stress, cellular damage, neuro-genotoxicity, as well as apical endpoints, such as heart rate and swimming behavior, was applied together with omics techniques, such as gel-free proteomics, metabolomics, and transcriptomics. This comprehensive approach, coupled with the result integration in the Biomarker Response Index (BRI), suggests that the use of rubberized and polymer-modified materials in asphalt mixtures does not affect TRWP toxicity, highlighting, albeit slightly, a greater toxicity of TRWPs derived from conventional asphalt.



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sciforum-173867: Unveil new insights into microplastic and benzo[a]pyrene toxicity in the seaworm *Hediste diversicolor* coelomic fluid: A transdisciplinary approach

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Microplastics (MPs) pollution presents a pressing concern for marine ecosystems, as their small size facilitates both ingestion and accumulation by organisms, as well as the transport of harmful pollutants. This dual threat complicates their ecological impact, especially concerning compartments like the coelomic fluid, crucial for marine invertebrate physiology. In this study, we investigated the toxicological effects of environmentally relevant concentrations of MPs (10 and 50 mg/kg sediment), both alone and in combination with benzo[a]pyrene (B[a]P, 1 µg/kg sediment), a carcinogenic polycyclic aromatic hydrocarbon known for its genotoxic and pro-apoptotic properties. The benthic polychaete *Hediste diversicolor* was exposed to these treatments for 7 days through spiked sediments, simulating realistic environmental conditions. The MPs used were particles smaller than 30 µm, composed of a mixture of polymers, including PE, PET, PP, LDPE, HDPE, and PEVA, with varied morphologies such as fragments, fibers, and films. Analyses revealed that both MPs and B[a]P were internalized by coelomocytes, with MPs enhancing B[a]P bioaccumulation. Combined exposures led to marked cytotoxic and genotoxic effects, evidenced by decreased lysosomal membrane stability (LMS), elevated micronuclei frequency (FMN), and increased DNA fragmentation, as assessed by terminal dUTP nick-end labeling (TUNEL) assay. Co-exposure also altered apoptotic and DNA repair pathways, as demonstrated by upregulation of P53, Bax, and Casp-3, alongside downregulation of the anti-apoptotic marker Bcl-2. These findings suggest that co exposure intensifies cellular damage and apoptotic signaling. Overall, this study underscores the risks of MPs in marine ecosystems, particularly their role in accumulating and transferring harmful substances affecting biota health.



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sciforum-178779: Xenobiotic Bisphenol A (C₁₅H₁₆O₂) from (Micro)plastic Pollution: Oxidative Stress and Genotoxic Effects in *Aristichthys nobilis*

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Background

(Micro)plastic pollution is a growing environmental and public health concern, especially in developing countries, where industrial discharge, unregulated plastic use, and improper waste management amplify the release of xenobiotics such as bisphenol A (BPA). BPA is widely used in consumer products like baby feeders, food containers, and plastic manufacturing industries. As an endocrine disruptor with potential carcinogenic properties, BPA leaches from macro- and microplastics into aquatic systems, threatening both aquatic organisms and humans through the food chain. Sustainable alternatives and improved waste management practices are urgently needed, particularly in developing regions.

Methods

Eighty freshwater bighead carp (*Aristichthys nobilis*) were randomly divided into four groups (A–D). Fish in groups B–D were exposed to different BPA concentrations for 60 days, while group A served as control. Post-exposure, gills, liver, kidneys, and brain tissues were analyzed for oxidative stress biomarkers, antioxidant enzyme activities, and genotoxic alterations.

Results

BPA exposure caused significant increases in oxidative stress markers (ROS, TBARS, GSH) and decreases in antioxidant enzymes (catalase, SOD, peroxidase) ($p < 0.05$). Morphological abnormalities, nuclear alterations in erythrocytes, and DNA damage were observed, indicating strong genotoxic potential.

Conclusion

The study demonstrates that BPA from (micro)plastics and industrial discharge induces oxidative stress, disrupts antioxidant defenses, and causes genetic damage in freshwater fish. In developing countries, uncontrolled plastic use and inadequate waste disposal exacerbate these risks. Adoption of **sustainable alternatives**—including bio-based plastics (PLA, PHA), natural polymers (cellulose, chitosan), and reusable materials like glass and stainless steel—along with stricter plastic waste management, is urgently needed to protect both aquatic ecosystems and human health.



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