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CHEMICAL EFFECTS

Evaluating the toxicity of sea-dumped conventional and chemical munition degradation products to fish and human cells using a combination of cell viability assays

2025-02-08

The disposal of munitions in marine coastal areas after World Wars I and II has raised significant concerns about environmental contamination and human health risks. This study investigates the acute cytotoxicity of munition-related chemicals commonly detected near marine dumpsites, focusing on degradation products of explosives and related compounds (E&RC) and degradation products of chemical warfare agents and related compounds (CWA&RC). The research examines three CWA&RC (1,4-oxathiane, 1,4-dithiane, thiodiglycol) and four E&RC (2,4,6-trinitrotoluene, tetryl, 1,3-dinitrobenzene, picric acid) using the RTgill-W1 cell line (rainbow trout gill cells) as a proxy for fish toxicity and human cell lines (Caco2 and HepG2) to model potential human exposure via contaminated seafood. The results indicate low acute cytotoxicity of CWA&RC, while E&RC exhibit significantly higher toxicity. Notably, the EC10 and EC50 values for tetryl and 1,3-DNB in RTgill-W1 align with concentrations detected near North American dumpsites, reflecting environmentally relevant conditions. The study also reveals inter-species and inter-organ variability in toxicity mechanisms, identifying potential adverse outcome pathways such as AOP 220. These findings highlight the need for further research into chronic exposure scenarios at environmentally realistic concentrations and contribute crucial data to understanding the risks posed by the degradation products of these chemicals to aquatic life and human health.

Authors: João Barbosa, Colin R Janssen, Marijke Neyts, Koen Parmentier, Frédéric Laduron, Kris Geukens, Philippe François, Jana Asselman

Full Source: Ecotoxicology and environmental safety 2025 Feb 8:291:117867. doi: 10.1016/j.ecoenv.2025.117867.

Tricresylphosphate isomers: A review of toxicity pathways

2025-02-05

Synthetic organophosphates are a large group of chemicals, annually produced by an industry with their further application as oil additives, flame retardants, plasticizers, warfare agents and insecticides for domestic use and in the control of vector-borne diseases. Consequently, organophosphates are often detected in the environment and human

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samples, which can have adverse effects on ecosystems and human health. This review aimed to summarize recent findings about different aspects of tricresyl phosphate mixture and separate isomers toxicity, including their impact on nervous, endocrine, and reproductive systems studied in animal models or in vitro. We also discuss the underlying molecular and cellular mechanisms involved in these processes, which comprise inhibition of neuropathy target esterase (NTE), overactivation of neuregulin1/ErbB and MAPK signaling pathways, impairment of glutamate signaling as well as interaction with nuclear hormone. Finally, we outline potential therapeutic targets and promising agents as important directions for future research.

Authors: Marta Tkachuk, Nataliya Matiytsiv

The effect of pH on chronic copper toxicity to Ceriodaphnia dubia within its natural pH niche

2025-02-01

The pH of freshwater ecosystems affects bioavailability of various metals to various organisms, including daphnids. Although it is well known that daphnid species show interclonal variation of metal sensitivity, knowledge about interclonal variation of bioavailability effects, such as the pH effect, is scarce. Here, we compared the effect of pH on chronic copper toxicity between two clones of Ceriodaphnia dubia, within its natural pH niche, which we determined to be approximately pH 6.5-8.5 based on existing experimental and biological monitoring data. Using a Bayesian modeling approach, we found that the effect of pH was not statistically significantly different between the two clones (with a credibility > 95%). Overall, we found an approximately threefold decrease in chronic Cu toxicity with increasing pH between pH 6.5 and 8.5, with 7-day 20% effect concentration (EC20) values ranging between 11.0 and 30.9 µg/L dissolved Cu. We then calibrated a preliminary generalized bioavailability model (gBAM) using these data and found a pH-effect slope parameter SpH = -0.247, which is within the range of previously reported values for Daphnia magna (-0.056 to -0.361) and similar to the SpH value of -0.220 used in the "invertebrate gBAM" for bioavailability-based Cu risk assessment under the Registration, Evaluation, Authorisation and Restriction of Chemicals. The preliminary C. dubia gBAM captured the magnitude of the observed pH effect well (mean of 1.3-fold EC20 prediction error, n = 9). It was also able to accurately predict chronic Cu toxicity in natural waters reported in an independent dataset (mean of 1.4-fold prediction error, n = 6). Also, two D. magna gBAMs (for two clones) and the invertebrate gBAM showed comparable predictive capabilities. Collectively, our work highlights the

importance of studying relations between pH and metal bioavailability within the species' natural niche. It also confirms earlier findings that biological variation of pH-bioavailability relations typically does not have a large impact on predictive capacity of bioavailability models, which is important for regulatory applications.
Authors: Karel A C De Schamphelaere, Stijn Baken, Allison Cardwell, Gijs Du Laing, Charlotte Nys, William Stubblefield, Karel Viaene, Kristi Weighman
Full Source: Environmental toxicology and chemistry 2025 Feb 1;44(2):484-496. doi: 10.1093/etojnl/vgae039. ~sFull Source: Neurotoxicology and teratology 2025 Feb 5:107432. doi: 10.1016/j.ntt.2025.107432.

Chemical characterization and phytotoxicity assay of Novolac phenolic foam resin from healthcare services: Challenging environmental liability

2025-02-07
Novolac phenolic foam resin (NPFR), a polymer of phenol and formaldehyde, is used in healthcare to ensure thermal stability of cold chain products. Post-use, NPFR is classified as non-hazardous solid waste and disposed of in landfills without prior treatment. However, it contains formaldehyde and phenol, two well-established toxicants, posing environmental and health risks. The full extent of these risks has not been evaluated, raising concerns about NPFR disposal. This study investigates the chemical and toxicological properties of NPFR to assess its environmental implication and the potential consequences of its disposal to support proper management strategies. The SEM-EDS revealed C, O, Ca, Na, Si, S, and K as the main elements. TGA-DSC curves showed mass losses related to dehydration (8.2 % - 180 °C) and organic matter degradation. According to the FTIR spectrum, traces of formaldehyde and phenol were found. GC-FID revealed formaldehyde levels: 660 mg L-1 [σ = 23.72] for solid fraction of NPFR and 441 mg L-1 [σ = 16.20] for a liquid fraction, while the content of phenol was 242 mg kg-1 [σ = 8.30] for a solid fraction of NPFR, and 210 mg L-1 [σ = 9.10] for a liquid fraction. These constituents confer toxicity to the residue. In the Lactuca sativa bioassay, the NPFR extract was considered as toxic at concentrations ranging from 31 to 125 g L-1, indicating a significant risk to plant life and, by extension, to the ecosystem. Based on these results, it may be concluded that the NPFR, classified as an environmental liability, requires a reevaluation of current management practices due to the risks associated with its conventional disposal methods. Furthermore, the current study provides relevant

Novolac phenolic foam resin (NPFR), a polymer of phenol and formaldehyde, is used in healthcare to ensure thermal stability of cold chain products.

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results and can contribute to public solid waste management policies, in accordance with the Sustainable Development Goals.
Authors: Sabrina Alves Dos Reis, Danilo Vitorino Dos Santos, Guilherme Sgobbi Zagui, Cristina Filomena Pereira Rosa Paschoalato, Cláudio Roberto Neri, Matheus Torelli Martin, Henrique Soares Novo, Dânia Elisa Christofoletti Mazzeo, Maria Aparecida Marin-Morales, Martí Nadal, Jordi Sierra, José L Domingo, Susana Inés Segura-Muñoz
Full Source: The Science of the total environment 2025 Feb 7:966:178717. doi: 10.1016/j.scitotenv.2025.178717.

ENVIRONMENTAL RESEARCH

The hidden risk in high-temperature urban environments: assessment of metal elements and human health risks of particulate matter at street

2025-02-02
With the exacerbated urban heat island effect, urban populations are exposing to high temperatures and increased exposure to particulate matter (PM) during daily commutes (especially vulnerable groups). Under high-temperature urban environments, the traffic emissions and the individual respiratory rate would rise simultaneously, causing an elevated risk of air particulate exposure. Most previous studies on PM at bus stations have focused on concentration levels, while neglecting chemical analyses of metal elements or increased human respiratory intake in high-temperature environments. This study conducted PM sampling and physiological parameter measurements of waiting passengers under high temperature conditions at six distinct bus stations in Nanjing. The health risks associated with exposure to metallic elements were evaluated alongside the impact of elevated temperatures on human health, employing chemical analyses to substantiate these assessments. The results indicated that the average PM concentration at bus stations exceeded the urban background by approximately 15 μg/m^3, while As, Cd, and Cr were identified as hazards posing significant health risks. Notably, under high-temperature conditions, the core body temperature of individuals reached 37.91 °C, with the health risk increasing by around 20-30 %. In view of the risk of human being exposed to high temperature environment, active and passive mitigation measures are proposed.
Authors: Zixuan Li, Lanfei Jiang, Hanhui Yu, Junqi Wang
Full Source: Journal of hazardous materials 2025 Feb 2:488:137475. doi: 10.1016/j.jhazmat.2025.137475.

The nexus of microplastics, food and antimicrobial resistance in the context of aquatic environment: Interdisciplinary linkages of pathways

2025-02-03

The exponential rise in plastic production since the mid-20th century has led to the widespread existence of microplastics in various ecosystems, posing significant environmental and health concerns. Microplastics, defined as plastic particles smaller than 5 mm, have infiltrated diverse environments, including oceans, freshwater bodies, and even remote Arctic ice. Their ability to absorb toxic chemicals and serve as vectors for microbial colonization raises concerns about their impacts on aquatic organisms and human health. This review examines the pathways by which microplastics infiltrate the food chain, highlighting their presence in various food items consumed by humans. Furthermore, it explores the nexus between microplastics and antimicrobial resistance (AMR), elucidating how microorganisms inhabiting plastic surfaces facilitate the transmission of antibiotic resistance genes (ARGs). The review underscores the urgent need for interdisciplinary research integrating environmental science, microbiology, public health, and policy to address the multifaceted challenges posed by microplastics. Standardized protocols for sampling and analysis are essential to enable meaningful comparisons across research and regions. By collectively addressing these challenges, we can strive towards a more sustainable and resilient future for ecosystems and human societies.

Authors: Shiwangi Dogra, Manish Kumar, Jian Zang

Full Source: Journal of contaminant hydrology 2025 Feb 3:269:104512. doi: 10.1016/j.jconhyd.2025.104512.

PHARMACEUTICAL/TOXICOLOGY

Lead seasonality: Affect children's blood lead levels and implication for lead exposure prevention

2025-01-27

Lead seasonality attributed to the patterns of Pb variation in the natural environment should be considered in the Pb risk analysis and related to the seasonality evident in humans. In this study, we integrate the Xi'an soil and dust lead seasonality data (554 surface soil samples and 554 road dust samples in three seasons) to evaluate the seasonal lead burden on children and propose the implications for children's lead exposure prevention strategies considering the lead seasonality and the influences

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from urban land use and children's living environment. The results showed that most seasonal variation patterns of soil and dust Pb are observed in winter (cold season), which coincided with the observation of higher children's blood lead levels in winter, although the strong correlation coefficients between children's blood lead levels (BLLs) and soil/dust Pb are observed in summer. The combinations of meteorological factors and anthropogenic pollutant emission strongly determine the metal seasonal variations. Those arrays of evidence suggest that lead seasonality is multifactorial within the environment and humans. Land uses and living environments such as old residential areas, heavy traffic, and fewer green parks, etc. have a significant impact on the increase of children's BLLs. Lead exposure prevention is proposed by BLLs warning and effective measure of reduction ≤ 50 μm soil/dust size fraction in winter.

Authors: Jie Dong, Xiaoping Li, Yu Zhang, Xueming Zheng, Shuang Zhang, Qishang Zhou, Feng He, Danqian Shi, Yueheng Jiang, He Shen, Xu Zhang, Ge Ma, Jiang Yun, Xiangyang Yan

Full Source: Journal of hazardous materials 2025 Jan 27:488:137349. doi: 10.1016/j.jhazmat.2025.137349.

OCCUPATIONAL

Impact of Pesticide Exposure on Auditory Health: Mechanisms, Efferent System Disruption, and Public Health Implications

2025-02-05

Pesticide exposure has been linked to adverse effects on auditory health, impacting both peripheral and central auditory systems. Studies suggest that organophosphate, carbamate, organochlorine, and pyrethroid pesticides disrupt auditory processing through oxidative stress, neuroinflammation, and interference with cholinergic signaling. These disruptions may compromise sensory hair cells, spiral ganglion neurons, and auditory pathways, impairing precise signal transmission. The auditory efferent system, responsible for cochlear protection and auditory signal modulation, appears particularly susceptible to pesticide-induced alterations. This system relies on cholinergic transmission to regulate cochlear amplification and selective attention, functions that may be disrupted by pesticide exposure. Evidence from epidemiological and experimental studies highlights the potential for long-term auditory dysfunction in populations exposed to pesticides, with agricultural workers and their families facing elevated risks due to prolonged contact

with agrochemicals. This review integrates findings on pesticide exposure and its implications for auditory health, discussing potential peripheral and central ototoxicity pathways. The cumulative effects of chronic exposure are emphasized, including the gradual degradation of auditory processing capabilities. Additionally, the need for targeted interventions, such as audiological monitoring and enhanced safety protocols, is addressed. Further research is critical to elucidate the mechanisms underlying pesticide-induced auditory damage and identify protective strategies. Such investigations can inform evidence-based policies to mitigate the public health impact of pesticide exposure while maintaining agricultural productivity. A multidisciplinary approach is essential to safeguard auditory health in vulnerable populations exposed to these environmental hazards.

Authors: Gonzalo Terreros, Claudio Cifuentes-Cabello, Amanda D'Espessailles, Felipe Munoz

Full Source: Toxicology 2025 Feb 5:154071. doi: 10.1016/j.tox.2025.154071.

Mesothelioma risks and cumulative exposure to elongate mineral particles of various sizes in Minnesota taconite mining industry

2025-02-08

Objectives: An excess of mesothelioma has been previously observed in iron ore miners in Northeastern Minnesota. This study explored the potential association between mesothelioma and elongate mineral particle (EMP) exposures in the Minnesota taconite mining industry, examining both regulated and non-regulated EMP dimensions.

Methods: A nested case-control study design within the Mineral Resources Health Assessment Programme cohort analysed 104 mesothelioma cases and 410 controls. Cumulative EMP exposures were assessed across various dimensional definitions, including regulated (National Institute for Occupational Safety and Health, NIOSH) and non-regulated EMPs. Conditional logistic regression models were applied to estimate mesothelioma risk linked to employment duration and cumulative EMP exposure while adjusting for potential confounding variables.

Results: Consistent with earlier assessments, mesothelioma was associated with the number of years employed in the taconite industry (rate ratio (RR) 1.02, 95% CI 1.00 to 1.05) and cumulative NIOSH EMP exposure ((EMP/cc)×years) in taconite mining and processing (RR 1.20, 95% CI 0.99 to 1.46). Positive associations were also observed with mesothelioma and cumulative exposure to non-regulated EMPs.

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Conclusions: This study supported the main conclusions in the previous study that the data were consistent with an association between mesothelioma and employment duration and with NIOSH EMP exposure in taconite mining and processing. However, the 95% CI indicates the data are also compatible with a null effect. Given the limitations we cite in the manuscript, additional study is needed to clarify the effect. Additionally, this study found possible evidence of a positive association between mesothelioma and cumulative exposure to Chatfield EMP, Suzuki EMP and Cleavage Fragments in the Minnesota taconite worker population.

Authors: Yuan Shao, Gurumurthy Ramachandran, Jeffrey H Mandel, Richard F MacLehose, Bruce H Alexander

Full Source: Occupational and environmental medicine 2025 Feb 8:oemed-2024-109647. doi: 10.1136/oemed-2024-109647.

The microbiome of Total Suspended Particles and its influence on the respiratory microbiome of healthy office workers

2025-02-08

Air particulate matter (PM) is widely recognized for its potential to negatively affect human health, including changes in the upper respiratory microbiome. However, research on PM-associated microbiota remains limited and mostly focused on PM (e.g., PM2.5 and PM10). This study aims to characterize for the first time the microbiome of Total Suspended Particles (TSP) and investigate the correlations of indoor TSP with the human upper respiratory microbiome. Biological and environmental samples were collected over three collection periods lasting three weeks each, between May and July 2022 at the University of Milan and the University of Insubria Como. TSP were sampled using a filter-based technique, while respiratory samples from both anterior nares (AN) and the nasopharynx (NP) were collected using swabs. Microbiome analysis of both human (N = 145) and TSP (N = 51) samples was conducted on metagenomic sequencing data. A comparison of indoor and outdoor TSP microbiomes revealed differences in microbial diversity and taxonomic composition. The indoor samples had higher relative abundance of environmental bacteria often associated with opportunistic infections like Paracoccus sp., as well as respiratory bacteria such as Staphylococcus aureus and Klebsiella pneumoniae. Additionally, both indoor and outdoor TSP samples contained broad spectrum antibiotic resistance genes. Indoor TSP exposure was negatively associated with commensal bacteria and positively associated with Staphylococcus aureus relative abundance. Finally, a correlation between the relative abundance

of respiratory bacteria identified in the indoor TSP and the upper respiratory microbiome was found, suggesting a potential interaction between TSP and the upper airways.

Authors: Giulia Solazzo, Sabrina Rovelli, Simona Iodice, Matthew Chung, Michael Frimpong, Valentina Bollati, Luca Ferrari, Elodie Ghedin

Full Source: Ecotoxicology and environmental safety 2025 Feb 8:291:117874. doi: 10.1016/j.ecoenv.2025.117874.