CHEMWATCH

Bulletin Board

Contents

SEP. 05, 2025

(click on page numbers for links)

CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

CHEMICAL EFFECTS

Counteracting effects of Ethanolic extract of allium Sativum on Perfluorooctanoic acid-induced cardiotoxicity: insights into Keap1-Nrf2/PPARα pathways

2025-08-27

Perfluorooctanoic acid (PFOA) is a synthetic chemical belonging to per and poly-fluoroalkyl substances. It persists in the environment and accumulates in human bodies, leading to significant health concerns. Allium sativum (garlic) is acknowledged for its nutritional and anti-oxidative properties. Current research investigated the efficacy of A. sativum ethanolic extract against PFOA-induced cardiotoxicity. Fifty adult albino rats were grouped equally into five groups: control, vehicle, A. sativum (300 mg/kg), PFOA (25 mg/kg), and PFOA and A. sativum. Rats were daily gavaged with treatments for 8 weeks. Serum samples were used for measuring lactate dehydrogenase (LDH), total cholesterol, and triglycerides (TG) levels. Cardiac tissues were used for assessing oxidative stress biomarkers (heme oxygenase1 (HO1), catalase (CAT), superoxide dismutase (SOD), and malondialdehyde (MDA)), and nuclear Factor kappa-light-chain-enhancer of activated B cells (NF-κB). Also, the gene expression for nuclear factor erythroid-derived 2-like 2 (Nrf2), Kelch-like ECH-associated protein1 (Keap1), and peroxisome proliferator-activated receptor α (PPAR α) was determined. Cardiac tissues had undergone histopathological and immunohistochemical examination for caspase-3. Results revealed that PFOA exposure decreased the anti-oxidant enzymes (HO1, CAT, SOD), and markedly elevated levels of both MDA and NF-κB. PFOA inhibited the Nrf2 pathway as presented by the downregulated Nrf2 and upregulated Keap1 genes. Additionally, PFOA disturbed lipid metabolism via PPAR α downregulation. These changes were supported by histopathological changes and increased caspase-3 immunoexpression. A combination of A. sativum extract with PFOA provided significant protection against the aforementioned changes. Results suggested that A. sativum is an effective natural product that can attenuate PFOA-induced cardiotoxicity.

Authors: Eman El-Sayed Khayal, Hend S Eisa, Marwa Ahmed Abass, Shaimaa A Abdelrhman, Samar Sakr

Full Source: Toxicology research 2025 Aug 27;14(4):tfaf129. doi: 10.1093/toxres/tfaf129.

CHEMWATCH
Bulletin Board
Technical
SEP. 05, 2025

From contamination to remediation: Understanding the toxicity, risk assessment, and degradation pathways of triphenyl phosphate and related organophosphate flame retardants in water and soil

2025-08-29

Triphenyl Phosphate (TPhP), a widely used organophosphate flame retardant (OPFR), has been increasingly detected in the environment via soil and water matrices, due to its persistence and potential toxicity. While numerous studies have investigated its behavior and remediation in aquatic environments, limited attention has been paid to study the TPhP occurrence and treatment in soil. This disparity is attributed to the inherent complexity and heterogeneity of soil, a dynamic matrix composed of diverse mineral particles, organic matter, and microbial populations. Unlike water, soil conditions are difficult to replicate in controlled environments, and factors such as adsorption to organic matter and restricted oxygen diffusion can significantly impede degradation processes. These limitations result in prolonged persistence and delayed remediation in terrestrial settings. This review aims to bridge the knowledge gap in OPFR remediation and promote sustainable solutions for mitigating TPhP and other OPFR-related contaminants from the environment. Remediation strategies, including biological, chemical, and substance-based natural approaches, are discussed, with an emphasis on their degradation mechanisms and removal efficiencies. Despite the limited research on TPhP degradation in aquatic environments, remediation strategies for soil and sediments remain largely unexplored, underscoring the need for further research in this area. In addition, this review explores the toxicity, global distribution, and bioaccumulation risks of TPhP and related OPFRs in both water and soil environments. The paper concludes by addressing key challenges and outlining strategic approaches and potential solutions for the effective remediation and risk management of TPhP and related OPFRs in environmental systems.

Authors: A Vasinthiya Tej, M Pranika, S Adhithya, K Nithya, Asha Sathish, Vinod Kumar

Full Source: The Science of the total environment 2025 Aug 29:999:180356. doi: 10.1016/j.scitotenv.2025.180356.

Effects of glyphosate-based herbicide on oxidative stress and neurotoxicity parameters in newt (Triturus ivanbureschi) larvae under temperature changes predicted by future climate scenarios

2025-08-29

The alarming decline of amphibian populations can largely be attributed to extent use of pesticide and global warming process. Special concerns were raised over the glyphosate-based formulations, one of the most commonly applied herbicides worldwide, due to their potentially detrimental effects on different animal groups. However, researches on the effects of glyphosate in newt species are still scarce. The present study assessed the effects of environmentally realistic concentrations of commercial herbicide product (22,5 µg/L glyphosate) on antioxidative defense system, oxidative damage to lipids and proteins and the activity of acetylcholinesterase (AChE) in larvae of the Balkan crested newt (T. ivanbureschi) under optimal (19 °C) and increased (23 °C) temperatures after 14 days of treatment. The results showed that even though larvae exposed to glyphosate at 19 °C did not exhibit any differences in the antioxidative defense system, they suffered from increase in protein carbonylation compared to ones from control group. On the other hand, increased temperature in combination with glyphosate led to the significant induction of CAT, GST, and GR activities and an increase in GSH concentration. This response of the antioxidative defence system seems to be sufficient to prevent oxidative damage to lipids and proteins. Glyphosate at elevated temperature also inhibited AChE activity suggesting significant neurotoxic effect. Different response of crested newts emphasize the need to assess the potentially harmful effects of glyphosate in various ecological contexts, particularly in light of the predicted increase in average temperatures by several degrees in the coming decades.

Authors: Svetlana G Despotović, Branka R Gavrilović, Tijana B Radovanović, Tamara G Petrović, Maja Ajduković, Tijana Vučić, Milena Cvijanović, Pavle Z Mašković, Jelena M Mašković, Marko D Prokić, Jelena P Gavrić-Čampar

Full Source: Ecotoxicology and environmental safety 2025 Aug 29:303:118969. doi: 10.1016/j.ecoenv.2025.118969.

CHEMWATCH
Bulletin Board
Technical
SEP. 05, 2025

ENVIRONMENTAL RESEARCH

Using Environmental Mixture Exposure-Triggered Biological Knowledge-Driven Machine Learning to Predict Early Pregnancy Loss

2025-08-29

The assessment of how environmental mixture exposures affect reproductive health faces difficulties. While knowledge graph networks offer valuable advantages in biological interpretation and prediction, their application in epidemiological studies, particularly in a small sample size setting, remains scarce. We recruited 116 women undergoing in vitro fertilization and embryo transfer (IVF-ET) treatment in Beijing and Yantai City, China. Among them, 55 women were diagnosed with early pregnancy loss (EPL), while 61 achieved clinical pregnancy. Clinical records, and paired hair, serum, and follicular samples were collected, with 16 per- and polyfluoroalkyl substances (PFAS) and 41 metal(loid)s measured. We developed a framework coupled with biological knowledge graph-based networks (BKGNs) and machine learning (ML) to predict EPL. Our BKGNs integrate chemical-specific biological pathways, i.e., Gene Ontology (GO) and protein, with individual-level mixture exposure data. The GO-integrated model, with an area under the curve (AUC) of 0.876, outperformed others (AUC = 0.819), even when the sample size decreased to 60% of the total. Additionally, this framework deciphered critical exposures (e.g., serum selenium and chromium) and biological perturbations (e.g., cell population proliferation and apoptotic nuclear changes), linking mixture exposure to EPL. Our proposed novel framework is both robust and cost-effective, offering a mechanistic lens for predicting exposure-associated health outcomes.

Authors: Mengyuan Ren, Tianxiang Wu, Han Zhang, Shuo Yang, Lu Zhao, Lili Zhuang, Qun Lu, Xikun Han, Bo Pan, Tiantian Li, Jingchuan Xue, Yuanchen Chen, Michael S Bloom, Mingliang Fang, Bin Wang

Full Source: Environmental science & technology 2025 Aug 29. doi: 10.1021/acs.est.5c05389.

Pollution characteristics, pollution sources and driving factors of hexavalent chromium in groundwater: A case study in Xianyang region, China

2025-08-29

Hexavalent chromium (Cr(VI)) is a recognized carcinogen that poses significant risks to public health. The Xianyang area in China is

characterized by groundwater Cr(VI) pollution. In this study, a coupled framework was developed by incorporating hydrochemical method, geo-statistical analysis, correlation analysis, principal component analysis (PCA), positive matrix factorization (PMF) and the geo-detector model to identify pollution characteristics, pollution sources and associated driving factor of Cr(VI) in groundwater. The results indicate that groundwater is primarily characterized by HCO3-Ca·Mg and HCO3-Na types, while high Cr(VI) samples are mainly associated with SO4·Cl-Na and HCO3-Na types. Cr(VI) concentrations are higher in unconfined groundwater (average: 48.7 μg/L) than in confined groundwater (average: 40.9 μg/L). Multivariate statistical analysis indicates that Cr(VI) primarily originates from rock weathering and anthropogenic inputs. The geo-detector analysis further suggests that natural factors contribute 83.2% to the high Cr(VI) in unconfined groundwater, with pH (26%) and mean annual precipitation (22.7%) being the key environmental variables influencing the spatial variability of Cr(VI). The Cr(VI) pollution is influenced by dual-factor combinations, with the combinations between mean annual precipitation and pH (0.378), as well as Eh and pH (0.373), being the most significant factors affecting Cr(VI) distribution. The geo-detector analysis also reveals the contribution of traffic-related factors and industrial activities to Cr(VI) contamination. The study results improve the understanding of Cr(VI) pollution characteristics in the region and provide a reliable framework for identifying the sources and drivers of high-risk pollutants.

Authors: Zhiwen Zheng, Peiyue Li, Jing Ning, Han Lu
Full Source: Environmental geochemistry and health 2025 Aug 29;47(10):419. doi: 10.1007/s10653-025-02731-2.

PHARMACEUTICAL/TOXICOLOGY

Effects of Per- and polyfluoroalkyl substances on atherosclerosis: an evidence-based risk assessment in the context of the TRAEC strategy

2025-08-27

Per- and polyfluoroalkyl substances (PFASs) are closely associated with the occurrence and progression of cardiovascular diseases (CVD). However, research on the impact of PFASs on atherosclerosis (AS) remains limited. Therefore, we assessed the risk effects of PFASs on AS using a novel Targeted Risk Assessment of Environmental Chemicals (TRAEC) strategy. Following targeted data collection, 39 pieces of research evidence related to PFASs exposure and AS were incorporated. After rigorous screening, they were included in the final scoring system. Through the integration of five key aspects, including reliability score, concentration weight, risk intensity, correlation score, and completeness score, health risk evaluation was carried out for the top five PFASs in terms of detection rates in the research. The findings of this study demonstrate that PFOA exposure accelerates AS in ApoE-/- mice and induces the foam cell formation of RAW264.7 cells. Based on published evidence and our own findings, the final TRAEC case study score for PFASs exposure was 5.18, suggesting a moderate risk of AS. Collectively, the TRAEC strategy provides a scientific and structured approach for assessing the risk effects of PFASs exposure on AS, thereby enhancing the consistency and effectiveness of risk assessment.

Authors: Yiming Zhu, Zhenzhen Tan, Ziwen An, Longfei Li, Mingmei Guo, Wenjing Duan, Zhixia Yu, Ziang Chen, Yi Liu, Ang Li, Huicai Guo
Full Source: Environmental research 2025 Aug 27:122698. doi: 10.1016/j.envres.2025.122698.

Comparative neurotoxic effects and mechanism of cadmium chloride and cadmium sulfate in neuronal cells

2025-08-23

Cadmium (Cd), a known food pollutant, has been demonstrated in numerous studies to induce neurological damage. The pathogenic mechanisms of cadmium chloride (CdCl2) and cadmium sulfate (CdSO4) are generally attributed to the induction of oxidative stress and apoptosis. Nevertheless, the extent to which these two cadmium compounds exhibit differential concentration-dependent neurotoxic effects, as well as the specific underlying mechanisms involved, remain to be elucidated. In this study, the differential neurotoxic effects and underlying mechanisms were explored in PC12 cells which were treated with 0, 0.5, 1 and 2 μmol/L of CdCl2 and CdSO4 for 24 h, and C57BL/6J mice which were exposed to 0, 50, 100, and 200 mg/L CdSO4 in drinking water for 18 weeks. Our present data indicate that both CdCl2 and CdSO4 elicit oxidative damage, genetic material damage, and apoptosis in PC12 cells, in which CdCl2 exhibits higher toxicity than CdSO4 at lower concentrations but lower toxicity at higher concentrations. Further mechanism analysis was conducted with the help of Non-labelled quantitative proteomics techniques and bioinformatics. The results indicated that the events related to oxidative stress as well as DNA damage and repair, such as Base excision repair, DNA replication, nucleotide excision repair, and chemical carcinogenesis-reactive oxygen species, are involved in the cadmium-induced neurotoxicity. Validation results basing on PC12 cells and mouse model

Copyright Chemwatch 2025 ©

indicated that the expressions of oxidative stress-related proteins Nrf2, Hmox1, Gsta3, and the DNA repair protein Nqo1 are upregulated, while the expressions of Pole, which involved in regulation DNA replication and repair, are downregulated. These results together revealed that oxidative damage occurs in PC12 cells under cadmium treatment, leading to genetic material damage and a decrease in DNA repair protein expression, which fails to repair damage promptly and induces cell death. Consequently, this study represents the first comprehensive comparison of the differential neurotoxic effects of CdCl2 and CdSO4 in neuronal cells across a range of concentrations. Furthermore, our findings also first reveal that cadmium may mediate its neurotoxic effects through the Nrf2/Hmox1/Gsta3/Nqo1/Pole signaling pathway. These results provide novel insights into the molecular underpinnings of cadmium-induced neurotoxicity.

Authors: Zongqin Mei, Jie Yang, Yuan Zhao, Wenhong Li, Rongxian Li, De Liu, Han Lu, Zuoshun He, Shiyan Gu

Full Source: Environment international 2025 Aug 23:203:109749. doi: 10.1016/j.envint.2025.109749.~rOCCUPATIONAL

Effects of antidepressant exposures on a stream detrital food chain: Microbial decomposers and invertebrate detritivores

2025-08-29

Antidepressants are often found in freshwater ecosystems, yet their potential impacts on ecological processes and species interactions remain poorly understood. This study assessed the ecological influence of fluoxetine and amitriptyline at environmentally realistic levels (1-100 ng L-1) on a detritus-based food chain that encompasses microbial decomposers and freshwater snails. In the experiment, we monitored the responses of microbial decomposers (biomass and enzyme activity), and Cipangopaludina cathayensis (consumption rates and antioxidant capacity), as well as leaf litter traits (decomposition rate and nutrient content). After 30 days of exposure, fluoxetine at concentrations of 1 and 10 ng L-1 significantly inhibited the activities of leucine aminopeptidase, glycine aminopeptidase and N-acetylglucosaminidase, thereby reducing the river snail's ability to extract nitrogen from leaves. The activities of β-glucosidase and polyphenol oxidase were significantly inhibited by amitriptyline at concentrations of 10 and 100 ng L-1, which may reduce leaf palatability and subsequently decrease the consumption rate of the river snail. Furthermore, fluoxetine at 1 ng L-1 and amitriptyline at 10 ng L-1 affected the river snail by triggering an antioxidant stress response, leading to a significant increase in the activities of glutathione peroxidase and superoxide dismutase. Thus, fluoxetine and amitriptyline exhibited different bottom-up effects on the detrital food chain by acting on distinct microbial enzymes. Consequently, this study demonstrates that antidepressants disrupt key ecosystem processes, impacting nutrient cycling and freshwater ecosystem health.

Authors: Jingjing Du, Maosen Wang, Xinhan Gao, Xilin Wang, Junjie Zhang, Hongxuan Fan, Jianxiang Lv, Xuezheng Huang

Full Source: Ecotoxicology and environmental safety 2025 Aug 29:303:118974. doi: 10.1016/j.ecoenv.2025.118974.

Prenatal exposure to metals and metal mixtures influences birth weight in affected populations in the Republic of Suriname, South America

2025-08-27

This study examined the relationship between infant birth weight and exposure during pregnancy to three non-essential trace metals, cadmium, lead, and mercury, and one essential trace metal, manganese. Small-scale gold mining has contaminated freshwater fish with mercury, a primary food resource, in interior regions of Suriname, South America. Whole blood samples from pregnant women collected in early pregnancy (late first trimester or early second trimester) were used to determine trace metal concentrations. Inductively-coupled plasma mass spectrometry was used to measure trace metal concentrations. Bayesian kernel machine regression was used to evaluate the association of trace metal exposures on infant birth weight and possible interactions among trace elements. Lead was negatively associated with birth weight. Mercury appeared to affect birth weight in a non-linear fashion. Low birth weight was observed at low concentrations of blood mercury. Birth weight increased with increasing concentrations of mercury up to the higher concentrations of mercury where birth weight appeared to trend downward. Lead and mercury interacted such that high concentrations of lead and low concentrations of mercury were associated with low birth weight. Cadmium and manganese were not associated with birth weight in this study. Lead has been observed in previous studies to negatively influence birth weight as this study found. The association of mercury with birth weight in this study might reflect diet quality. With fish being a principal dietary source of mercury in this population and knowing that consumption of nutrient packed fish is beneficial for children's physical and neurological development, low concentrations of mercury may reflect the absence or low level of fish consumption in the maternal diet. The

mechanistic and clinical health implications of these associations with birth weight require further investigation.
Authors: Jeffrey K Wickliffe, Ihsan E Buker, Cassandra Newsom, Hannah H Covert, Wilco Zijlmans, Firoz Abdoel Wahid, Maureen Y Lichtveld, Ashna D Hindori-Mohangoo, Anisma Gokoel, Gaitree Baldewsingh, Martin Shafer, Christa Zaborske, Patrick J Parsons, Christopher D Palmer, Melissa J Smith
Full Source: Environmental research 2025 Aug 27;285(Pt 5):122708. doi: 10.1016/j.envres.2025.122708.

~tMonte Carlo evaluation of occupational exposures in equine radiology procedures

2025-08-21
Portable X-ray equipments are commonly used in diagnostic radiology of equine patients. Despite its benefits, the exposure to ionizing radiation can pose a health risk to workers as physical restraint of patients is typically required. In this context, the aim of this study was to apply Monte Carlo simulation to investigate occupational exposure in the diagnosis of horses. The simulations were carried out by the Monte Carlo N-Particle 6.2 (MCNP6.2) code. The workers were represented by a FASH3 (female) and MASH3 (male) virtual anthropomorphic phantoms. To simulate the horse, a realistic virtual anthropomorphic phantom was created by voxelizing a commercially available 3D model. The spectra were calculated using the SpekCalc program with parameters: 90 and 100 kV, anode angle of 20°, filtration of 2.7 mmAl and field of view of 43×35cm2. In the first simulated scenario, workers do not utilize personal protective equipment (PPE). In the second scenario, workers use PPE (lead apron, thyroid protector and lead glasses) and accessories to increase the distance from the patient/X-ray. The results are presented as conversion coefficients for Equivalent Dose (CC[HT]) and Effective dose (CC[E]) normalized by the Air Kerma. Without protection, the most exposed organs/tissues of the assistants were: thyroid, for the woman, and breasts, for the man. In the most critical scenario, the assistant CC[E] values are higher than tube operators by a factor of 28. The combination of PPE use and increased distance reduced these CC[HT] by at least 99% for the assistants and 97% for tube operators.
Authors: Lucas Wilian Gonçalves de Souza, Evely Alves Oliveira, José Wilson Vieira, Whoody Alem Wanderley Araripe Farias, William de Souza Santos, Lucio Pereira Neves, Ana Paula Perini
Full Source: Applied radiation and isotopes : including data, instrumentation and methods for use in agriculture, industry and medicine 2025 Aug 21:226:112116. doi: 10.1016/j.apradiso.2025.112116.