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CHEMICAL EFFECTS

Insights into the disinfection byproduct bromochloroacetamide-induced cardiotoxicity of zebrafish embryo-larvae: A multiomics approach and comparison of biomarker responsiveness

2025-08-07

Bromochloroacetamide (BCAcAm), an inevitable byproduct of the water treatment disinfection process, is widely detected in drinking water. Previous toxicological and in silico results suggested that developmental effects are associated with analogous chemical exposure; however, the key molecular events and underlying mechanisms remain unclear, especially in the early stages of aquatic organisms. In the present study, a zebrafish larval model was used to comprehensively assess the developmental toxicity of BCAcAm via transcriptional, metabolic, biochemical and morphological tests. Integration analyses of RNA sequencing and untargeted metabolomic data revealed crucial biological processes related to drug metabolism, cardiac muscle contraction and oxidative phosphorylation, which started from the initial stage, and ferroptosis progressed to the advanced stage in validated cardiac defects. Biochemical assays further verified ATP depletion, ROS and MDA accumulation, and hyperactivation of detoxification (increased GST activity) and the antioxidative system (increased GSH and GSSG levels). Transcriptionally, BCAcAm led to gpx4 downregulation, iron homeostasis perturbation (upregulated tfr and tf and downregulated fth) and lipid peroxidation (elevated alox12 and lpcat3), suggesting the involvement of ferroptosis. Moreover, the application of Fer-1 (a ferroptosis inhibitor) reversed BCAcAm-induced mitochondrial dysfunction and subsequent cardiotoxicity. In addition, the BMD and IBRv2 indices were derived from molecules across various biological levels. The general ranking of the different biomarkers in terms of better responsiveness and sensitivity performance is as follows: transcriptomics > metabolomics > biochemical assays. In the present study, an approach to detecting chemical-induced adverse outcomes and deciphering the underlying mechanisms through high-throughput data analysis is applied. This study provides valuable insights into the responsiveness and sensitivity of biomarkers, which may

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be instrumental for evaluating the ecological and health risks associated with newly emerged contaminants.

Authors: Jingying Zhu, Xinliang Ding, Qiaoqiao Xu, Yun Fan, Pengfei Zhu, Xiuzhu Li, Xuhui Zhang, Qi Zhang, Xianchao Du, Weijie Zhou, Jiandong Jiao, Bing Lu, Chuncheng Lu

Full Source: Ecotoxicology and environmental safety 2025 Aug 7:303:118805. doi: 10.1016/j.ecoenv.2025.118805.

The Trojan horse effect of nanoplastics exacerbates methylmercury-induced neurotoxicity during zebrafish development

2025-08-07

While the ability of plastic particles to transport heavy metals is well established, their Trojan horse effect on aquatic organisms remains debated, as they are suspected of facilitating the penetration of chemicals in tissues but also of reducing bioavailability and accelerating pollutant elimination. Here, we investigated the combined effects of 250 nm polystyrene nanoplastics (NPs) and methylmercury (MeHg) on zebrafish larvae over a 30-day exposure period. Larvae were exposed to 1000 µg/L NPs, 1 µg/L MeHg (MeHg1), 10 µg/L MeHg (MeHg10), or their respective combinations (Mix1 and Mix10). The presence of NPs enhanced MeHg accumulation and redirected its distribution toward the fish's head and eyes. On their own, NPs altered swimming activity, while MeHg10 induced mortality, reduced growth and diminished swimming activity. Proteomic analysis highlighted significant effects on lipid metabolism, oxidative stress, detoxification, myogenesis and catabolism. Although no light sensitivity deficits were detected through visual motor response testing, proteomic data suggested vision impairment in the mixture-exposed groups. High mortality rates were observed in Mix10-exposed fish, likely due to severe hypoactivity, which hindered feeding. This hypoactivity was linked to disrupted lipid metabolism, impaired neurotransmission, reduced ATP production, and neuroinflammation leading to neuronal degeneration. We concluded that the presence of NPs intensified MeHg neurotoxicity over a prolonged exposure, significantly increasing mortality.

Authors: Mathilde J L Oger, Benoît Bernay, Emmanuel Tessier, David Amouroux, Patrick Kestemont, Valérie Cornet

Full Source: Environmental pollution (Barking, Essex: 1987) 2025 Aug 7:126966. doi: 10.1016/j.envpol.2025.126966.

Unraveling profiles of organic ultraviolet filters in coastal waters of the East China Marginal Seas

2025-08-08

Ultraviolet filters (UVFs), which are applied in all aspects of life, constitute an emerging class of pollutants of great concern. Coastal areas facing intense anthropogenic pressure are negatively impacted by UVFs sourced from land- or sea-based activities. In this study, 107 coastal surface water samples collected from the East China Marginal Seas were analyzed for 22 organic UVFs (OUVFs) in four categories, namely, benzophenone (BP), triazine (TA), salicylate (SC), and benzotriazole derivative (i.e., drometrizole trisiloxane, DTS). The total concentration of BP-UVFs, TA-UVFs, and SC-UVFs were 0.40-7.16, 0.04-1.43, and 0.14-10.3 ng/L, respectively, while DTS ranged from nondetect to 0.31 ng/L. Cosmetic OUVFs presented relatively high detection frequencies and concentrations in national coastal waters, which is consistent with their increasing sales and extensive application in China. The OUVF profiles in the coastal waters of the investigated bays and estuaries were basically dominated by BP-UVFs, followed by SC-UVFs and TA-UVFs. Significant spatial variation was observed for the concentrations of BP-UVFs, SC-UVFs, and DTS, with higher-concentration sites located at the periphery of the Bohai Rime, the Yangtze River Delta, and the Pearl River Delta. Statistical analyses revealed spatial differences in site-specific OUVF composition, which may be due to multiple factors. The exposure risk of marine organisms to cosmetic OUVFs was low to medium, with higher risks observed in Hangzhou Bay. The environmentally relevant parameters of cosmetic OUVFs predicted by quantitative structure-property relationship models, the current production situation and interaction with particulate organic matter suggest the need for continuous monitoring of cosmetic OUVFs in light of their persistence and toxicity.

Authors: Zilan Wu, Xuan Jia, Xing Liu, Xiaodan Pei, Tian Lin, Jianzhong Li, Xi Liu, Yuan Gao, Ziwei Yao

Full Source: Environmental pollution (Barking, Essex: 1987) 2025 Aug 8:126968. doi: 10.1016/j.envpol.2025.126968.

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ENVIRONMENTAL RESEARCH

Development and application of an LC-MS/MS method for urinary DNA adduct profiling in residents of environmentally vulnerable areas

2025-08-09

DNA adducts, formed by the covalent binding of reactive electrophiles to DNA, serve as biomarkers of genotoxic exposure and early biological effects. However, non-invasive, high-throughput biomonitoring methods remain underdeveloped. This study developed and validated a robust LC-MS/MS method for simultaneous quantification of six urinary DNA adducts and applied it to assess environmental exposure among residents of polluted and control areas. A novel LC-MS/MS method was established to analyze six urinary DNA adducts. Method validation included assessments of linearity, sensitivity, accuracy, precision, matrix effects, and recovery. Urine samples from 953 environmentally exposed and 204 control residents were analyzed. DNA adduct levels were compared using multivariable regression models adjusted for potential confounders. The method demonstrated excellent performance ($R^2 \geq 0.994$, accuracy 98.5-100.6 %, and minimal matrix effects). Exposure area residents had significantly higher N3-methyladenine ($\beta = 0.548$, $p < 0.001$) and N6-methyl-2′-deoxyadenosine ($\beta = 0.207$, $p = 0.030$) levels than controls. N3-methyladenine and N6-methyl-2′-deoxyadenosine levels were significantly elevated among subjects residing near a coal-fired power plant, a crowded area of factories, and a high particulate matter exposure area compared to controls. However, N3-methyladenine levels were also significantly higher in an abandoned smelter or metal mine, and a cement factory, whereas N6-methyl-2′-deoxyadenosine levels were notably elevated in an operating smelter and waste incinerator, indicating distinct patterns by exposure source. The developed LC-MS/MS method enables sensitive, non-invasive detection of multiple urinary DNA adducts and supports their application as biomarkers for environmental exposure. The findings highlight the potential of urinary DNA adduct profiling for environmental exposure surveillance.

Authors: Bo-Ri Kim, Jeong-Kyu Ji, Jang-Hun Jeong, Kyung-Hwa Choi, Yong Min Cho, Woo Jin Kim, Yong-Dae Kim, Heon Kim, Young-Seoub Hong, Sang-Yong Eom

Full Source: Ecotoxicology and environmental safety 2025 Aug 9:303:118833. doi: 10.1016/j.ecoenv.2025.118833.

Environmental fibrotic hypersensitivity pneumonitis: A case report in a coal mine worker

2025-08-09

The aim of our study is to highlight the inadequacy of focusing solely on occupational exposure in the diagnosis of lung diseases in coal miners. Other factors, especially environmental exposures, should also be considered. A 74-year-old patient with a 20-year history of coal mining and a complaint of coughing was referred with a preliminary diagnosis of coal worker's pneumoconiosis due to abnormal findings on HRCT. Upon detailed questioning, it was learned that the patient had been keeping pet birds for 15 years. Physical examination, laboratory results, and pulmonary function tests were normal. A biopsy was performed due to the detection of an interstitial pattern in the lung imaging, and the diagnosis of fibrotic hypersensitivity pneumonia was made. Although coal worker's pneumoconiosis was initially considered due to the patient's history of long-term coal mining, careful evaluation of all exposures may enable early diagnosis and treatment of accompanying or underlying diseases.

Authors: Asuman Aslan Kara, Gülden Sarı, Adem Koyuncu, Cebrail Şimşek

Full Source: Archives of environmental & occupational health 2025 Aug 9:1-4. doi: 10.1080/19338244.2025.2545773.

PHARMACEUTICAL/TOXICOLOGY

PFOA exposure promotes prostate cancer progression by enhancing autophagy through m6A modification of MAPK15 mRNA

2025-08-09

Perfluorooctanoic acid (PFOA) is a globally pervasive environmental contaminant characterized by chemical stability and bioaccumulation through the food chain, posing serious health risks to both humans and animals. Accumulating evidence has linked PFOA exposure to the development of various cancers, including prostate cancer (PCa), renal cancer, breast cancer, and ovarian cancer. However, the molecular mechanisms by which PFOA promotes PCa progression remain unclear. In this study, we demonstrate that low-dose PFOA exposure enhances the expression of mitogen-activated protein kinase 15 (MAPK15), thereby promoting autophagy and facilitating tumor cell proliferation. Mechanistically, PFOA binds to the N6-methyladenosine (m6A) demethylase FTO (fat mass and obesity-associated protein), inhibiting its demethylase activity and resulting in elevated m6A modification levels on MAPK15 mRNA. This modification leads to increased MAPK15 protein expression, which in turn activates autophagy pathways and drives the proliferation, migration, and invasion of PCa cell lines. Collectively, our findings provide critical molecular evidence for the carcinogenic potential of PFAS compounds and offer new insights into environmental toxicology and ecological risk assessment.

Authors: Yongjing Qian, Zixuan Liu, Xinyi Lv, Xiaojing Cai, Jianfeng Wei, Ling Zhang, Xiannan Meng

Full Source: Ecotoxicology and environmental safety 2025 Aug 9:303:118839. doi: 10.1016/j.ecoenv.2025.118839.

Effect of combined high iodine-fluorine water exposure on the occurrence of dental fluorosis in school-age children: a cross-sectional study from rural Jiangsu, China

2025-08-10

The combined impact of high iodine and high fluoride exposure has garnered increased attention. To determine whether exposure to high levels of fluoride and iodine in water has adverse effects on children's teeth. In this study, 582 children aged 8 to 12 from rural Jiangsu, China, were divided into three groups based on the concentrations of iodine and fluoride in their drinking water: a high fluoride and high iodine group (HFHI), a high fluoride group (HF), and a control group (CONTROL). We employed the ion-selective electrode method to measure fluoride levels in urine samples and used inductively coupled plasma mass spectrometry to assess urinary iodine (UI) levels. The prevalence and severity of dental fluorosis (DF) were determined using Dean's Index in accordance with WHO criteria. A logistic regression model was used to analyze factors related to dental fluorosis. The urinary fluoride (UF) regression coefficients were compared using the Z-test to assess their influence. The results indicate that the prevalence of DF was 52.5, 33.5, and 4.1% in the HFHI, HF, and CONTROL groups, respectively. There were statistically significant differences in both the prevalence and severity of DF among the groups ($P < 0.001$ for both). The dental fluorosis indexes (DFI) were calculated as 1.2, 0.7, and 0.1 for the HFHI, HF, and CONTROL groups, respectively. UF levels were positively associated with DF in the HFHI and HF groups, with adjusted odds ratios (OR) of 5.30 and 3.12, respectively. The Z-test results showed statistically significant differences (HFHI vs. CONTROL, $P < 0.001$; HF vs. CONTROL, $P = 0.048$; HFHI vs. HF, $P < 0.001$). UF levels > 1.4 mg/L and UI > 300 µg/L demonstrated a significant interaction in the HFHI group (OR = 9.62, 95% CI 2.70-18.36, $P < 0.001$) and Overall (OR = 9.15, 95% CI 2.71-16.58, $P < 0.001$). Simultaneous exposure to high iodine and

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high fluoride in water adversely impacts the incidence of DF in school-age children. It is recommended that monitoring of UI levels in children from high fluoride regions be enhanced.
Authors: Yuting Xia, Yunjie Ye, Mao Liu, Yang Wang, Li Shang, Peihua Wang, Zhen Ding
Full Source: Environmental geochemistry and health 2025 Aug 10;47(9):369. doi: 10.1007/s10653-025-02685-5.

OCCUPATIONAL

Hexavalent Chromium Exposure Induces Immune Dysregulation and Lung Tissue Neutrophil Extracellular Traps Formation

2025-08-08
Hexavalent chromium [Cr(VI)] is a known human carcinogen that is associated with environmental pollution and health risks. However, the relationship between its immunotoxicity and inflammation is still poorly understood. In this study, researchers used a mouse dynamic inhalation exposure system to simulate Cr(VI) occupational environments and conducted multi-organ immunological assessment along with lung tissue inflammatory profiling. It was observed that Cr(VI) inhalation exposure induced selective, time-dependent variations in lymphocyte subsets across specific organs, accompanied by significant upregulation of immune-related cytokines. The exposure triggered neutrophil extracellular traps (NETs) formation in lung tissue with concurrent elevation in NETs-associated gene expression and inflammasome-related gene activation. Immune dysregulation demonstrated close correlation with inflammation characterized by NETs formation and inflammasome activation. Furthermore, a two-week recovery period resulted in significant amelioration of these Cr(VI)-induced immunological disturbances and inflammatory manifestations. These findings provide critical insights into the crosstalk between immune dysfunction and inflammatory activation in occupational Cr(VI) exposure.
Authors: Zhiqiang Ji, Zekang Su, Changmao Long, Shiyi Hong, Yali Zhang, Xiaoli Wang, Guiping Hu, Guang Jia
Full Source: Food and chemical toxicology: an international journal published for the British Industrial Biological Research Association 2025 Aug 8:115692. doi: 10.1016/j.fct.2025.115692.

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Gestational exposure to micro and nanoplastics differentially impactscardiac development and function in male and female rats throughout the lifespan

2025-08-08
Micro- and nanoplastics (MNPs) are a ubiquitous contaminant. Identification of MNPs in the human placenta suggests this toxicant poses a danger to developing offspring. Previously, we demonstrated that maternal pulmonary MNP exposure restricts fetal growth and disrupts fetoplacental cardiovascular function in rats. Herein, we investigated how repeated maternal inhalation of polyamide-12 MNP from gestational day 4-19 during pregnancy (10 mg/m3, geometric mean 175.8 ± 1.9 nm, mode particle size 19 nm, size range 6 nm-8 µm) in Sprague Dawley rats influences cardiovascular development and function in male and female offspring at gestational day 20, 2 weeks, 1 month and 3 months of age. Exposed neonates demonstrated decreased relative left ventricle wall thickness while dilation of the left ventricle was identified in MNP-exposed adolescents and adults. Analyses of offspring myocardial mRNA suggest that maternal MNP exposure disrupted mitochondrial function, calcium handling, and defense against oxidative species. MNP exposure increased blood flow velocity within the left ventricle, decreased fractional shortening, and increased relative cardiac output at the fetal, adolescent and adult stages, respectively. Although variable, select experimental outcomes were changed in a sexually dimorphic manner after gestational MNP.
Authors: Chelsea M Cary, Samantha Adams, Gina Moreno, Talia N Seymore, Marianne Polunas, Michael Goedken, Xiang Wang, Edward Yurkow, Phoebe A Stapleton
Full Source: Toxicology and applied pharmacology 2025 Aug 8:117507. doi: 10.1016/j.taap.2025.117507.

Ex vivo exposure to p,p′-DDE decreases human macrophage polarization to the M1 phenotype

2025-08-07
Evidence from cellular and animal model studies has shown that p,p-dichloro-diphenyl-trichloroethane (p,p′-DDT) and p,p-dichloro-diphenyl-dichloroethylene (p,p′-DDE) negatively affect the macrophage's inflammatory response and resistance to pathogen infections. Still, no evidence is available on the p,p′-DDE effects on human macrophages, even though there is a translational value to human public health. This study aimed to determine p,p′-DDE serum concentrations in human

volunteers with non-occupational exposure and to investigate the effect of ex vivo exposure to p,p'-DDE on the polarization of human monocyte-derived macrophages (hMDM) toward the M1 phenotype. p,p'-DDE from thirty healthy male volunteers was quantified by gas chromatography with a micro-electron capture detector. The hMDM were differentiated using GM-CSF. hMDM were exposed to 25-2500 ng/ml p,p'-DDE for 48 h, and after 24 h of exposure, they were activated with LPS+IFN-γ to the M1 phenotype for 24 h. p,p ´ -DDT was detected in 4/30 individuals (mean= 0.54 ± 0.35 ng/ml), and 30/30 had p,p ´ -DDE (mean=0.57 ± 0.34 ng/ml). Ex vivo, p,p ´ -DDE did not affect cell viability but decreased the expression of M1-polarization markers (HLA-DR and CD68). Bivariate and multivariate analyses revealed that in the M1 macrophage phenotype, 25-2500 ng/ml p,p'-DDE, in a concentration-dependent manner, decreased NO•--production, IL-1β, TNF-α, and IL-12 secretion, while increasing ROS. Our study showed that humans are still exposed to p,p'-DDE. Experimental results suggest that p,p'-DDE negatively interferes with the polarization of hMDMs toward the M1 phenotype at environmentally relevant concentrations, influencing key inflammatory mediators critical to innate immunity against pathogens and inducing oxidative stress. This study is the first to evaluate the effect of the p,p'-DDE on polarization of hMDMs to the M1-phenotype. It may contribute to addressing studies to determine whether the incidence of pathologies associated with inflammatory macrophage dysfunction is higher in human populations exposed to DDT and its metabolites. These data will be valuable for implementing policy and health intervention strategies in individuals still exposed to this pesticide.

Authors: José R Palacios-Valladares, Christian D Ortiz-Robles, Lea A Cupul-Uicab, Omar B Rivera-Maya, Luisa C Hernández-Kelly, Rosa M García-Hernández, Rocio Gómez, Mariano E Cebrián, Emma S Calderon-Aranda
Full Source: Toxicology 2025 Aug 7:518:154259. doi: 10.1016/j.tox.2025.154259.