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CHEMICAL EFFECTS

Toxicity assessment of hexafluoropropylene oxide-dimer acid on morphology, heart physiology, and gene expression during zebrafish (Danio rerio) development

2022-12-03

Hexafluoropropylene oxide-dimer acid (HFPO-DA) is one of the emerging replacements for the "forever" carcinogenic and toxic long-chain PFAS. HFPO-DA is a polymerization aid used for manufacturing fluoropolymers, whose global distribution and undetermined toxic properties are a concern regarding human and ecological health. To assess embryotoxic potential, zebrafish embryos were exposed to HFPO-DA at concentrations of 0.5-20,000 mg/L at 24-, 48-, and 72-h post-fertilization (hpf). Heart rate increased significantly in embryos exposed to 2 mg/L and 10 mg/L HFPO-DA across all time points. Spinal deformities and edema phenotypes were evident among embryos exposed to 1000-16,000 mg/L HFPO-DA at 72 hpf. A median lethal concentration (LC50) was derived as 7651 mg/L at 72 hpf. Shallow RNA sequencing analysis of 9465 transcripts identified 38 consistently differentially expressed genes at 0.5 mg/L, 1 mg/L, 2 mg/L, and 10 mg/L HFPO-DA exposures. Notably, seven downregulated genes were associated with visual response, and seven upregulated genes were expressed in or regulated the cardiovascular system. This study identifies biological targets and molecular pathways affected during animal development by an emerging, potentially problematic, and ubiquitous industrial chemical.

Authors: Sylvia Gong, Flannery McLamb, Damian Shea, Jeanne P Vu, Miguel F Vasquez, Zuying Feng, Kesten Bozinovic, Ken K Hirata, Richard M Gersberg, Goran Bozinovic

Full Source: Environmental science and pollution research international 2022 Dec 3. doi: 10.1007/s11356-022-24542-z.

Hexafluoropropylene oxide-dimer acid (HFPO-DA) is one of the emerging replacements for the "forever" carcinogenic and toxic long-chain PFAS.

Acute toxicity and risk assessment of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS) in tropical cladocerans Moina micrura

2022-11-26

Per- and polyfluoroalkyl substances (PFAS) are gaining worldwide attention because of their toxicity, bioaccumulative and resistance to biological degradation in the environment. PFAS can be categorised into endocrine disrupting chemicals (EDCs) and identified as possible carcinogenic agents for the aquatic ecosystem and humans. Despite

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this, only a few studies have been conducted on the aquatic toxicity of PFAS, particularly in invertebrate species such as zooplankton. This study evaluated the acute toxicity of two main PFAS, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS), by using freshwater cladocerans (Moina micrura) as bioindicators. This study aimed to assess the adverse effects at different levels of organisations such as organ (heart size and heart rate), individual (individual size and mortality) and population (lethal concentration, LC50). PFOA was shown to be more hazardous than PFOS, with the LC50 values (confidence interval) of 474.7 (350.4-644.5) µg L-1 and 549.6 (407.2-743.9) µg L-1, respectively. As the concentrations of PFOS and PFOA increased, there were declines in individual size and heart rate as compared to the control group. The values of PNECs acquired by using the AF method (PNECAF) for PFOA and PFOS were 0.4747 and 0.5496 µg L-1, respectively. Meanwhile, the PNEC values obtained using the SSD method (PNECSSD) were 1077.0 µg L-1 (PFOA) and 172.5 µg L-1 (PFOS). PNECAF is more protective and conservative compared to PNECSSD. The findings of this study have significant implications for PFOS and PFOA risk assessment in aquatic environments. Thus, it will aid freshwater sustainability and safeguard the human dependency on water resources.

Authors: Muhammad Raznisyafiq Razak, Ahmad Zaharin Aris, Azim Haziq Zainuddin, Fatimah Md Yusoff, Zetty Norhana Balia Yusof, Sang Don Kim, Kyoung Woong Kim

Full Source: Chemosphere 2022 Nov 26;313:137377. doi: 10.1016/j.chemosphere.2022.137377.

Pesticide contamination in agro-ecosystems: toxicity, impacts, and bio-based management strategies

2022-12-02

Continuous rise in application of pesticides in the agro-ecosystems in order to ensure food supply to the ever-growing population is of greater concern to the human health and the environment. Once entered into the agro-ecosystem, the fate and transport of pesticides is determined largely by the nature of pesticides and the soil attributes, in addition to the soil-inhabiting microbes, fauna, and flora. Changes in the soil microbiological actions, soil properties, and enzymatic activities resulting from pesticide applications are the important factors substantially affecting the soil productivity. Disturbances in the microbial community composition may lead to the considerable perturbations in cycling of major nutrients, metals, and subsequent uptake by plants. Indiscriminate applications are linked with the accumulation of pesticides in plant-based foods, feeds,

Continuous rise in application of pesticides in the agro-ecosystems in order to ensure food supply to the ever-growing population is of greater concern to the human health and the environment.

and animal products. Furthermore, rapid increase in the application of pesticides having long half-life has also been reported to contaminate the nearby aquatic environments and accumulation in the plants, animals, and microbes surviving there. To circumvent the negative consequences of pesticide application, multitude of techniques falling in physical, chemical, and biological categories are presented by different investigators.
In the present study, important findings pertaining to the pesticide contamination in cultivated agricultural soils; toxicity on soil microbes, plants, invertebrates, and vertebrates; effects on soil characteristics; and alleviation of toxicity by bio-based management approaches have been thoroughly reviewed. With the help of bibliometric analysis, thematic evolution and research trends on the bioremediation of pesticides in the agro-ecosystems have also been highlighted.
Authors: Umesh Pravin Dhuldhaj, Rishikesh Singh, Vipin Kumar Singh
Full Source: Environmental science and pollution research international 2022 Dec 2. doi: 10.1007/s11356-022-24381-y.

ENVIRONMENTAL RESEARCH

Occurrence, sources and risk of heavy metals in soil from a typical antimony mining area in Guizhou Province, China

2022-12-02
Antimony mining activities can result in serious contamination of soil by heavy metals, which represents a risk to human health. In this study, the contamination and sources of 14 heavy metals, and their risks to both ecosystem and public health from these metals at an antimony mining site in Guizhou Province in China were explored. The results showed that the mean concentrations of Hg, Cu, As, Se, Cd, Sn, Sb and Pb were 3.73, 2.49, 13.99, 38.32, 1.11, 1.61, 305.33, 1.59 times than their local background levels. Sb, Se, As and Hg presented the relatively heavy pollution, wherein Sb (EI = 2137.34 > 320), Hg (EI = 150.26 > 80) and As (EI = 139.92 > 80) also posed the strong ecological risk. The sources identification illustrated Hg, Pb, As, Bi, Cr, Sb, Cd and Zn were attributed to industrial activities, Ni, Co, Au and Cu ($p < 0.01$) were derived from a combination of a lithogeny origin and anthropogenic source, whereas Se was of natural origin. Health risk assessment demonstrated that Ni, Cr and As presented both the unacceptable noncarcinogenic and carcinogenic risk, and Sb (HI = 1.44E+03) and Cd (HI = 2.91E+00) posed unacceptable noncarcinogenic risk to the local resident. Furthermore, children in the 1-6 age group (HI = 7.83E+02) were more sensitive to noncarcinogenic risk, and the 6-18 age group (CRI = 2.39E-02) as more prone to carcinogenic risk. The dermal

Antimony mining activities can result in serious contamination of soil by heavy metals, which represents a risk to human health.

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contact was the predominant exposure pathway of noncarcinogenic and carcinogenic risks with a contribution rate of over 97% for all age groups. Overall, this research provided the comprehensive information on heavy metals in an antimony mining sites, and the related heavy metals should be paid attention for ensuring soil safety and protecting local people's health.
Authors: Yuting Guo, Rongshan Wu, Changsheng Guo, Jiapei Lv, Linlin Wu, Jian Xu
Full Source: Environmental geochemistry and health 2022 Dec 2. doi: 10.1007/s10653-022-01410-w.

Impact of textile dyes on health and ecosystem: a review of structure, causes, and potential solutions

2022-12-02
The rapid growth of population and industrialization have intensified the problem of water pollution globally. To meet the challenge of industrialization, the use of synthetic dyes in the textile industry, dyeing and printing industry, tannery and paint industry, paper and pulp industry, cosmetic and food industry, dye manufacturing industry, and pharmaceutical industry has increased exponentially. Among these industries, the textile industry is prominent for the water pollution due to the hefty consumption of water and discharge of coloring materials in the effluent. The discharge of this effluent into the aquatic reservoir affects its biochemical oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), and pH. The release of the effluents without any remedial treatment will generate a gigantic peril to the aquatic ecosystem and human health. The ecological-friendly treatment of the dye-containing wastewater to minimize the detrimental effect on human health and the environment is the need of the hour. The purpose of this review is to evaluate the catastrophic effects of textile dyes on human health and the environment. This review provides a comprehensive insight into the dyes and chemicals used in the textile industry, focusing on the typical treatment processes for their removal from industrial wastewaters, including chemical, biological, physical, and hybrid techniques.
Authors: Tarekul Islam, Md Reazuddin Repon, Tarikul Islam, Zahid Sarwar, Mohammed M Rahman
Full Source: Environmental science and pollution research international 2022 Dec 2. doi: 10.1007/s11356-022-24398-3.

The rapid growth of population and industrialization have intensified the problem of water pollution globally.

Characteristics and determinants of personal exposure to typical air pollutants: A pilot study in Beijing and Baoding, China

2022-11-29

Personal exposure to fine particulate matter (PM2.5), nitrogen oxides (NOx, NO2 and NO), ozone (O3) and sulfur dioxide (SO2) was repeatedly measured among fourteen office workers in Beijing and Baoding, China in summer, autumn and winter of 2019. Time-activity patterns were simultaneously recorded. Determinants of personal air pollution exposure were investigated for each pollutant via a linear mixed effect model. The personal concentrations of PM2.5, NO2, NO and O3 were higher in autumn and winter than those in summer. A decreasing trend was found in the personal PM2.5 level for a typical indoor population in Beijing, indicating that particulate pollution was effectively controlled in Beijing and its surrounding area. The personal levels of PM2.5, NO2, and O3 were weakly correlated with those monitored at ambient stations and were lower than the respective ambient levels except for PM2.5 in summer and NO2 in winter. This pilot study showed that the indoor air environment, ambient pollution, traffic-related variables and temperature were significant exposure sources for office workers. Our study highlighted the significance of controlling traffic emissions and improving the workplace air quality to protect the health of office workers. More importantly, we demonstrated the feasibility of model development for personal air pollution exposure prediction.

Authors: Xuan Zhang, Hao Zhang, Yan Wang, Pengchu Bai, Lulu Zhang, Yongjie Wei, Ning Tang

Full Source: Environmental research 2022 Nov 29;218:114976. doi: 10.1016/j.envres.2022.114976.

Personal exposure to fine particulate matter (PM2.5), nitrogen oxides (NOx, NO2 and NO), ozone (O3) and sulfur dioxide (SO2) was repeatedly measured among fourteen office workers in Beijing and Baoding, China in summer, autumn and winter of 2019.

PHARMACEUTICAL/TOXICOLOGY

Time and dose-dependent impairment of liver metabolism in Gasterosteus aculeatus following exposure to diclofenac (DCF) highlighted by LC-HRMS untargeted metabolomics

2023-02-01

Anthropogenic chemicals as emerging contaminants, such as pharmaceuticals, increased worldwide in the environment. This study aimed to apply metabolomics-based approaches on the fish model species three-spined stickleback (Gasterosteus aculeatus) exposed to diclofenac (DCF) to identify toxicity pathways and potential biomarkers.

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For this purpose, males and females were exposed to a continuous flow of diclofenac solution in laboratory for 21 days, followed by 3 days of depuration, to nominal concentrations of 1 (low) and 100 µg/L (high) of DCF. A methodology based on liquid chromatography coupled to high resolution mass spectrometry (LC-HRMS) was employed. Uni- and multivariate statistical analyses were combined to evaluate the modulations of the liver metabolome of G. aculeatus after exposure to DCF. The metabolomics data revealed variations both as a function of time and of the DCF concentration. We observed 2487 altered metabolites, with 1460 and 1027 specific to males and females, respectively. Some of them were significantly impaired by the experimental conditions. However, we showed that several metabolites were impacted by other factors as they were already modulated in the control individuals. The results indicated that the energy metabolism was up-modulated in females and down-modulated in males, with the presence of DCF. The antioxidant system was impacted in males, suggesting oxidative stress in the metabolism, while the immunity system was down-regulated in females following exposure. Moreover, our results revealed 1 and 4 metabolites as potential metabolic biomarkers in male and female sticklebacks, respectively. Among them, the glutaryl-carnitine and the adipoyl-carnitine were putatively identified in females, known to be implicated in the energy metabolism. These 5 metabolites showed to be promising biomarkers since they were early modulated during exposure to the stress and showed a notable trend through time.

Authors: Emmanuelle Lebeau-Roche, Gaëlle Daniele, Aurélie Fildier, Christelle Bonnefoy, Cyril Turiès, Anne Bado-Nilles, Jean-Marc Porcher, Odile Dedourge-Geffard, Emmanuelle Vulliet, Alain Geffard

Full Source: The Science of the total environment 2023 Feb 1;858(Pt 1):159801. doi: 10.1016/j.scitotenv.2022.159801.

Background: Chemical accidents have imposed casualties and high economic and social consequences to Iranian industries and society.

OCCUPATIONAL

Prediction of time in industrial chemical accidents: A survival analysis

2022-11-28

Background: Chemical accidents have imposed casualties and high economic and social consequences to Iranian industries and society. Objective: This study investigated the effect of risk factors involved in occurrences of the chemical accidents and predicted the time of occurrences in Iranian chemical factories.

Methods: A cross-sectional study was implemented in 574 chemical facilities with more than 25 employees from 2018 to 2020. Collecting data instruments were 2 checklists with 15 and 25 three-point Likert scale questions, respectively. Chi square and Monte Carlo tests assessed the relationships between independent risk factors and dependent hazardous chemical accidents. Cox semi-parametric and log-normal parametric models were used to predict the upcoming time of chemical accidents based on the impacts of risk factors understudy. Data analyses were performed using Stata and R software.
Results: The results showed that safety data sheets, labeling, fire extinguishing system, safe chemicals storage, separation, loading, transportation and training were statistically significant with occurrences of the chemical accidents (P-value < 0.05). Loading and transportation were mostly related to chemical incidents and reduced significantly the expected time of chemical events (P-value = 0.028).
Conclusion: Establishing a comprehensive chemical accidents dataset and strict governmental supervision on chemical safety regulations are suggested to decrease the chemical accidents at regional and local levels in chemical plants.
Authors: Fatemeh Sadeghi, Alireza Dehdashti, Neda Gilanic, Farin Fatemi, Seyed Shamseddin Alizadeh, Behnoush Khoshmanesh
Full Source: Work (Reading, Mass.) 2022 Nov 28. doi: 10.3233/WOR-211333.

Certified Registered Nurse Anesthetists' occupational exposure to inhalational anesthetic agents: a survey of anesthetic gas safety

2022-12-03

Background: Anesthetic gases have been known to cause damage when inhaled over long periods of time. Modern safety measures have been put in place to reduce the risk to anesthesia providers, however there is continued lack of information on providers experiencing short term effects (lethargy, fatigue, headache, slowed cognitive ability, nausea, and mucosal irritation) thereby leading to long-term sequalae (sister chromatid exchanges, micronuclei, chromosomal aberrations, and comet assays).
Method: A thirteen item, multiple choice survey was sent to 3,000 anesthesia providers, of which 463 completed the survey. A Chi-square test of independence was used to determine the association between gas exposure and participant self-reported symptoms. A Spearman's Correlation test was also utilized to interpret this data since both frequency of smelling gas and frequency of symptoms were ordinal

Background: Anesthetic gases have been known to cause damage when inhaled over long periods of time.

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variables for which Spearman's rho correlation was the appropriate measure of association.
Results: The major findings were that as the frequency of smelling anesthetic gas increased, so too did the frequency of self-reported headaches and fatigue. Spearman's rho = .148 and .092. P value = .002 and .049, respectively.
Conclusion: There have been many efforts to decrease the risk of exposure of anesthesia providers to anesthetic gases. While there is a decrease in reported exposures, indications of possible long-term effects remain a concern in anesthesia providers. Potential implications of exposure could lead to chromosomal aberrations, sister chromatid exchanges, comet assays, spontaneous abortions, and genotoxic effects.
Authors: Trent Masselink, Jan Hardinger, Carrie Bowman-Dalley, Crystal O'Guinn, Kumudhini Hendrix, Nancy Crowell, Ladan Eshkevari
Full Source: BMC anesthesiology 2022 Dec 3;22(1):375. doi: 10.1186/s12871-022-01896-y.

Identifying unusual human exposures to pesticides: Qilu Lake Basin as an overlooked source

2023-02-01

Although common exposure pathways of pesticides (e.g., crop consumption) have been intensively studied, we noticed that some unusual occupational exposures to pesticides were overlooked and could lead to unacceptable health risks. In this study, we presented information on the occurrence of 5 triazine pesticides (TRIs) and 3 neonicotine pesticides (NEOs) detected in water samples of Qilu Lake Basin in China. We identified the unusual occupational exposure scenarios as (i) adult females washing the harvested vegetables, and (ii) adult males catching fish in Qilu Lake; next, the health risk assessment was conducted using collected data. The results showed that the mean Σ5 TRI concentrations ranged from 505.87 ng/L in spring to 864.04 ng/L in summer, and the river water samples around Qilu Lake had the highest concentrations. The mean concentrations of Σ3 NEOs ranged from 885.86 ng/L in winter to 2593.04 ng/L in summer. Occupational exposed populations were bearing one to two orders of magnitude higher exposure doses than local adults. Although the carcinogenic risks caused by atrazine in water were at acceptable levels for local residents, all the occupational exposed males were at moderate risks, and 15.78 %-43.50 % of occupational exposed females in different seasons were even at high risks. The non-carcinogenic risks caused by pesticides in water were all at negligible levels, but the occupational exposed population were facing up to two orders of

Although common exposure pathways of pesticides (e.g., crop consumption) have been intensively studied, we noticed that some unusual occupational exposures to pesticides were overlooked and could lead to unacceptable health risks.

magnitude higher risks than local residents. This study established a sound basis for further decision-making to take necessary action on protection of sensitive population groups.

Authors: Chong Chen, Jiahong Luo, Chengcheng Bu, Weiwei Zhang, Limin Ma

Full Source: The Science of the total environment 2023 Feb 1;858(Pt 1):159864. doi: 10.1016/j.scitotenv.2022.159864.

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