CHEMWATCH

Bulletin Board

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CHEMICAL EFFECTS

Comparative toxicity of beach mesoplastics from South Spain: An in vitro approach

2024-02-16

Plastics, particularly mesoplastics, dominate beach debris and act as carriers of hazardous chemicals, either initially present in plastics or absorbed from the surrounding environment. In this study, mesoplastics were collected from five beaches in the southern region of Spain to investigate their potential impact on marine life. In vitro assays employing fish liver cells (PLHC-1) were conducted to evaluate the toxicity of methanolic extracts derived from intact mesoplastics and after simulated photodegradation. LC-MS analysis of the methanolic extracts revealed the presence of organophosphate esters, phthalates, and phthalate alternatives. The extracts from photodegraded plastics generally showed higher cytotoxicity, ability to generate reactive oxygen species (ROS), and genotoxicity (micronuclei formation) than those from intact mesoplastics. All the extracts induced EROD activity in PLHC-1 cells, indicating the presence of significant amounts of CYP1A inducers in beach mesoplastics. Thus, mesoplastics contain chemicals able to induce cytotoxicity and genotoxicity in PLHC-1 cells, and further photodegradation of mesoplastics facilitates the release of additional chemicals, increasing the overall toxicity. This work also highlights the usefulness of cell-based assays to better define the risks of plastic pollution.

Authors: Mahboubeh Hosseinzadeh, Tiantian Wang, Carmen Morales-Caselles, Sandra Callejas, Ethel Eljarrat, Cinta Porte

Full Source: Chemosphere 2024 Feb 16:141494. doi: 10.1016/j.chemosphere.2024.141494.

Plastics, particularly mesoplastics, dominate beach debris and act as carriers of hazardous chemicals, either initially present in plastics or absorbed from the surrounding environment.

An integrative data-centric approach to derivation and characterization of an adverse outcome pathway network for cadmium-induced toxicity

2024-02-16

Cadmium is a prominent toxic heavy metal that contaminates both terrestrial and aquatic environments. Owing to its high biological half-life and low excretion rates, cadmium causes a variety of adverse biological outcomes. Adverse outcome pathway (AOP) networks were envisioned to systematically capture toxicological information to enable risk assessment and chemical regulation. Here, we leveraged AOP-Wiki and integrated heterogeneous data from four other exposome-relevant resources to build the first AOP network relevant for inorganic cadmium-induced toxicity. From AOP-Wiki, we filtered 309 high confidence AOPs, identified 312 key events (KEs) associated with inorganic cadmium from five exposome-relevant databases using a data-centric approach, and thereafter, curated 30 cadmium relevant AOPs (cadmium-AOPs). By constructing the undirected AOP network, we identified a large connected component of 18 cadmium-AOPs. Further, we analyzed the directed network of 59 KEs and 82 key event relationships (KERs) in the largest component using graph-theoretic approaches. Subsequently, we mined published literature using artificial intelligence-based tools to provide auxiliary evidence of cadmium association for all KEs in the largest component. Finally, we performed case studies to verify the rationality of cadmium-induced toxicity in humans and aquatic species. Overall, cadmium-AOP network constructed in this study will aid ongoing research in systems toxicology and chemical exposome.

Authors: Ajaya Kumar Sahoo, Nikhil Chivukula, Kundhanathan Ramesh, Jasmine Singha, Shambanagouda Rudragouda Marigoudar, Krishna Venkatarama Sharma, Areejit Samal

Full Source: The Science of the total environment 2024 Feb 16:920:170968. doi: 10.1016/j.scitotenv.2024.170968.

ENVIRONMENTAL RESEARCH

MOF-Based Membranes for Remediated Application of Water Pollution

2024-02-18

Membrane separation play a crucial role in current increasingly complex energy environment. Membranes prepared by metal-organic framework (MOF) materials usually possess unique advantages in common, such as uniform pore size, ultra-high porosity, enhanced selectivity and throughput, and excellent adsorption property, which have been contributed to the separation fields. In this comprehensive review, we summarize various design and synthesized strategies of free-standing MOF and composite MOF-based membranes for water treatment. Special emphases are given not only on the effects of MOF on membrane performance, removal efficiencies, and elimination mechanisms, but also on the importance of MOF-based membranes for the applications of oily and micro-pollutant removal, adsorption, separation, and

Membrane separation play a crucial role in current increasingly complex energy environment.

catalysis. The challenges and opportunities in the future for the industrial implementation of MOF-based membranes are also discussed.
Authors: Huan Xu, Shuyuan Chen, Ye-Fan Zhao, Fangfang Wang, Fan Guo
Full Source: ChemPlusChem 2024 Feb 18:e202400027. doi: 10.1002/cplu.202400027.

Microplastic pollution in high-altitude Nainital lake, Uttarakhand, India

2024-02-16
Microplastics (MPs) contamination has been reported in all environmental compartments, but very limited information is available at higher-altitude lakes. Nainital Lake, located at a high altitude in the Indian Himalayas, has various ecosystem services and is the major source of water for Nainital town, but the MP abundance is still unknown. This study presents the first evidence of the abundance and distribution of MP in Nainital Lake. Surface water and sediment samples were analysed from 16 different sites in and around the catchment area of Nainital Lake. The MP were observed in all the samples, and their abundance in surface water was 8.6-56.0 particles L-1 in the lake and 2.4-88.0 particles L-1 in hotspot sites. In the surface sediment, MP abundance ranged from 0.4 to 10.6 particles g-1, while in the hotspot sediment, the mean abundance was 0.6 ± 0.5 particles g-1. Fibers were the dominant MP, while 0.02-1 mm were the predominant size of MP particles. The results of chemical characterization showed the presence of six polymers, among which high-density polyethylene was the most abundant. The Polymer Hazard Index assessment classified the identified polymers as low-to high-risk categories, with a higher abundance of low- (polypropylene) and medium- (polyethylene)-risk polymers. Tourist activities and run-off catchments can be considered the major sources of MP, which can affect the ecosystem. Minimal concentrations of MP were observed in the tube well and drinking water, which depicts the direct risks to humans and, thus, the need for remedial measures to prevent MP contamination in drinking water. This study improves the knowledge of MP contamination in the higher-altitude freshwater lake, which can be the major pathway for the transport of MP to the rivers, and also emphasizes the need for waste management in Nainital town.
Authors: Yashi Jain, Hariharan Govindasamy, Gurjeet Kaur, Nithin Ajith, Karthik Ramasamy, Robin R S, Purvaja Ramachandran
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Feb 16:123598. doi: 10.1016/j.envpol.2024.123598.

Microplastics (MPs) contamination has been reported in all environmental compartments, but very limited information is available at higher-altitude lakes.

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Pollution and mobility of heavy metals in the soils of a typical agricultural zone in eastern China

2024-02-17
The pollution of heavy metals (HMs) in agricultural soils profoundly threatens national food safety, and the mobility and environmental behaviors of HMs are closely implicated in crop safety. Here, we assessed the pollution level and mobility of ten HMs and explored their environmental behaviors in the soils of three different land uses from a main crop production zone in eastern China. The concentrations of HMs in the soils were higher in the farmland than the woodland and wasteland, and Cd showed a relatively higher pollution and ecological risk levels compared to other metals. Cadmium was dominated by the reducible (41%) and exchangeable (23%) fractions, and the rest of HMs were mainly in the residual fraction (> 60%). The significant correlation between the exchangeable and DGT-labile Cd indicates relatively higher mobility of Cd in the soils. Soil pH, organic matters and mineral elements had significant correlation with the exchangeable and reducible fractions of most of the HMs (e.g., Cd, Co, Mn, Ni, Pb and V; $p < 0.05$), indicating their good predictors of the HMs mobility. However, this was not the case for the DGT-labile fraction, which suggests a marked difference in the controlling mechanisms of the mobility versus potential bioavailability of HMs in the soils. The results of this study indicate that both the chemically extracted fractions and the bioavailable fractions of HMs need be considered when effectively assessing the safety of agricultural soils.
Authors: Jie Zhang, Liyuan Yang, Ye Liu, Menghan Xing, Yanhong Wu, Haijian Bing
Full Source: Environmental geochemistry and health 2024 Feb 17;46(3):91. doi: 10.1007/s10653-024-01887-7.

The pollution of heavy metals (HMs) in agricultural soils profoundly threatens national food safety, and the mobility and environmental behaviors of HMs are closely implicated in crop safety.

PHARMACEUTICAL/TOXICOLOGY

Subpopulations of children with multiple chronic health outcomes in relation to chemical exposures in the ECHO-PATHWAYS consortium

2024-02-08
A multimorbidity-focused approach may reflect common etiologic mechanisms and lead to better targeting of etiologic agents for broadly impactful public health interventions. Our aim was to identify clusters of chronic obesity-related, neurodevelopmental, and respiratory outcomes in children, and to examine associations between cluster membership and

widely prevalent chemical exposures to demonstrate our epidemiologic approach. Early to middle childhood outcome data collected 2011-2022 for 1092 children were harmonized across the ECHO-PATHWAYS consortium of 3 prospective pregnancy cohorts in six U.S. cities. 15 outcomes included age 4-9 BMI, cognitive and behavioral assessment scores, speech problems, and learning disabilities, asthma, wheeze, and rhinitis. To form generalizable clusters across study sites, we performed k-means clustering on scaled residuals of each variable regressed on study site. Outcomes and demographic variables were summarized between resulting clusters. Logistic weighted quantile sum regressions with permutation test p-values associated odds of cluster membership with a mixture of 15 prenatal urinary phthalate metabolites in full-sample and sex-stratified models. Three clusters emerged, including a healthier Cluster 1 (n = 734) with low morbidity across outcomes; Cluster 2 (n = 192) with low IQ and higher levels of all outcomes, especially 0.4-1.8-standard deviation higher mean neurobehavioral outcomes; and Cluster 3 (n = 179) with the highest asthma (92 %), wheeze (53 %), and rhinitis (57 %) frequencies. We observed a significant positive, male-specific stratified association (odds ratio = 1.6; p = 0.01) between a phthalate mixture with high weights for MEP and MHPP and odds of membership in Cluster 3 versus Cluster 1. These results identified subpopulations of children with co-occurring elevated levels of BMI, neurodevelopmental, and respiratory outcomes that may reflect shared etiologic pathways. The observed association between phthalates and respiratory outcome cluster membership could inform policy efforts towards children with respiratory disease. Similar cluster-based epidemiology may identify environmental factors that impact multi-outcome prevalence and efficiently direct public policy efforts.

Authors: Drew B Day, Kaja Z LeWinn, Catherine J Karr, Christine T Loftus, Kecia N Carroll, Nicole R Bush, Qi Zhao, Emily S Barrett, Shanna H Swan, Ruby H N Nguyen, Leonardo Trasande, Paul E Moore, Ako Adams Ako, Nan Ji, Chang Liu, Adam A Szpiro, Sheela Sathyanarayana, program collaborators for Environmental influences on Child Health Outcomes

Full Source: Environment international 2024 Feb 8:185:108486. doi: 10.1016/j.envint.2024.108486.

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Occupational exposure to organic solvents and risk of bladder cancer

2024-02-16

Background: Bladder cancer has been linked to several occupations that involve the use of solvents, including those used in the dry-cleaning industry.

Objectives: We evaluated exposure to solvents and risk of bladder cancer in 1182 incident cases and 1408 controls from a population-based study.

Methods: Exposure to solvents was quantitatively assessed using a job-exposure matrix (CANJEM). Exposure to benzene, toluene and xylene often co-occur. Therefore, we created two additional sets of metrics for combined benzene, toluene and xylene (BTX) exposure: (1) CANJEM-based BTX metrics and (2) hybrid BTX metrics, using an approach that integrates the CANJEM-based BTX metrics together with lifetime occupational histories and exposure-oriented modules that captured within-job, respondent-specific details about tasks and chemicals. Adjusted odds ratios (ORs) and 95% confidence intervals (95% CI) were estimated using logistic regression.

Results: Bladder cancer risks were increased among those ever exposed to benzene (OR = 1.63, 95% CI: 1.14-2.32), toluene (OR = 1.60, 95% CI: 1.06-2.43), and xylene (OR = 1.67, 95% CI: 1.13-2.48) individually. We further observed a statistically significant exposure-response relationship for cumulative BTX exposure, with a stronger association using the hybrid BTX metrics (ORQ1vsUnexposed = 1.26, 95% CI: 0.83-1.90; ORQ2vsUnexposed = 1.52, 95% CI: 1.00-2.31; ORQ3vsUnexposed = 1.88, 95% CI: 1.24-2.85; and ORQ4vsUnexposed = 2.23, 95% CI: 1.35-3.69) (p-trend=0.001) than using CANJEM-based metrics (p-trend=0.02).

Impact: There is limited evidence about the role of exposure to specific organic solvents, alone or in combination on the risk of developing bladder cancer. In this study, workers with increasing exposure to benzene, toluene, and xylene as a group (BTX) had a statistically significant exposure-response relationship with bladder cancer. Future evaluation of the carcinogenicity of BTX and other organic solvents, particularly concurrent exposure, on bladder cancer development is needed.

Authors: Shuai Xie, Melissa C Friesen, Dalsu Baris, Molly Schwenn, Nathaniel Rothman, Alison Johnson, Margaret R Karagas, Debra T Silverman, Stella Koutros

Full Source: Journal of exposure science & environmental epidemiology 2024 Feb 16. doi: 10.1038/s41370-024-00651-4.

Background: Bladder cancer has been linked to several occupations that involve the use of solvents, including those used in the dry-cleaning industry.
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OCCUPATIONAL

Survey to assess the feasibility of establishing an international network for evidence synthesis in occupational safety and health

2024-02-19

Background: Evidence synthesis in the field of occupational safety and health (OSH) has been continuously growing over the last two decades. With over 100 systematic reviews now published, the Cochrane Work Review group has played an important role in this development and the Cochrane Thematic Group 'Work & Health & Social Security' was established recently to combine evidence from both the OSH and insurance medicine fields. Worldwide, many organizations produce and synthesize evidence in OSH that can complement and support each other. We believe that a global network including Cochrane and others can collaborate on methods development and in the production, synthesis, use and dissemination of different types of evidence even more effectively.
Aims: To determine if establishing a global network for evidence synthesis in OSH is feasible.
Methods: We conducted a survey of international and national institutions between November 2022 and January 2023 using LimeSurvey. Participants included representatives of affiliated and sustaining members of the International Commission on Occupational Health, national institutes for OSH, academia and other international organizations.
Results: From 151 invitations, we received responses from 57 representatives of 54 organizations. Representatives reported that their organization will contribute financially on an annual basis (n = 1) or provide in-kind support (n = 10) and will probably be able to provide financial or in-kind support (n = 25).
Conclusions: The feasibility criterion was met and an international network is being established.

Authors: D M McElvenny, J Verbeek, D Gagliardi, C Tikka, J L Hoving
Full Source: Occupational medicine (Oxford, England) 2024 Feb 19:kqad148. doi: 10.1093/occmed/kqad148.

Background: Evidence synthesis in the field of occupational safety and health (OSH) has been continuously growing over the last two decades.

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Elemental carbon - An efficient method to measure occupational exposure from materials in the graphene family

2024-02-16

Graphene is a 2D-material with many useful properties such as flexibility, elasticity, and conductivity among others. Graphene could therefore become a material used in many occupational fields in the future, which can give rise to occupational exposure. Today, exposure is unknown, due to the lack of efficient measuring techniques for occupational exposure to graphene. Readily available screening techniques for air sampling and -analysis are either nonspecific or nonquantitative. Quantifying materials from the broad graphene family by an easy-to-use method is important for the large-scale industrial application of graphene, especially when for the safety of working environment. Graphene consists primarily of elemental carbon, and the present study evaluates the organic carbon/elemental carbon (OC/EC)-technique for exposure assessment. The purpose of this work is to evaluate the OC/EC analysis technique as an efficient and easy-to-use method for quantification of occupational exposure to graphene. Methods that can identify graphene would be preferable for screening, but they are time consuming and semi-quantitative and therefore not suited for quantitative work environment assessments. The OC/EC-technique is a thermal optical analysis (TOA), that quantitively determines the amount of and distinguishes between two different types of carbon, organic and elemental. The technique is standardised, well-established and among other things used for diesel exposure measurements (ref standard). OC/EC could therefore be a feasible measuring technique to quantitively determine occupational exposure to graphene. The present evaluation of the technique provides an analytical method that works quantitatively for graphene, graphene oxide and reduced graphene oxide. Interestingly, the TOA technique makes it possible to distinguish between the three graphene forms used in this study. The technique was tested in an industrial setting and the outcome suggests that the technique is an efficient monitoring technique to be used in combination with characterisation techniques like for example Raman spectroscopy, scanning electron microscopy and atomic force microscopy.

Authors: Tobias Storsjö, Håkan Tinnerberg, Jinhua Sun, Chen Ruiqi, Anne Farbrot
Full Source: NanoImpact 2024 Feb 16:100499. doi: 10.1016/j.impact.2024.100499.

Graphene is a 2D-material with many useful properties such as flexibility, elasticity, and conductivity among others.

The moderating effect of work-related musculoskeletal disorders in relation to occupational stress and health-related quality of life of construction workers: a cross-sectional research

2024-02-16

Background: This study aimed to investigate work-related musculoskeletal disorders (WMSDs), occupational stress, and health-related quality of life (HRQoL); identify the factors that affect HRQoL; and investigate the moderating effects of WMSDs on occupational stress and HRQoL.
Methods: The participants were construction workers who had worked in the construction industry for over three months. A total of 178 construction workers voluntarily participated and anonymously completed the musculoskeletal symptoms questionnaire, the Korean Occupational Stress Scale, short-form 36. The moderation effect of WMSDs on occupational stress and HRQoL were analyzed by Haye's Process Macro Model.
Results: The results of the study showed that 96 subjects (53.9%) had WMSDs, and the most common pain site was the lower back (33.3%). The group with WMSDs had higher occupational stress than did the group without WMSDs ($p < 0.01$). Compared with the group without WMSDs, the group with WMSDs displayed significant differences in HRQoL ($p < 0.001$). Furthermore, the factor affecting HRQoL was WMSDs ($p < 0.001$). In the impact of occupational stress on HRQoL, WMSDs had a significant moderating effect ($p < 0.001$).
Conclusion: The results of this study indicate that construction workers' WMSDs significantly impact occupational stress and HRQoL, and WMSDs have a significant moderating effect on the relationship between occupational stress and HRQoL. Therefore, to improve the HRQoL of workers in the construction industry, it is necessary to develop methods to reduce occupational stress and prevent and treat WMSDs.

Authors: Soo Jeong, Byoung-Hee Lee

Full Source: BMC musculoskeletal disorders 2024 Feb 16;25(1):147. doi: 10.1186/s12891-024-07216-4.

Background: This study aimed to investigate work-related musculoskeletal disorders (WMSDs), occupational stress, and health-related quality of life (HRQoL); identify the factors that affect HRQoL; and investigate the moderating effects of WMSDs on occupational stress and HRQoL.
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