Bulletin Board

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CHEMICAL EFFECTS

Environmental impact of endocrine-disrupting chemicals and heavy metals in biological samples of petrochemical industry workers with perspective management

2023-05-11

Exposure to endocrine disrupting chemicals (EDCs) or heavy metals are synthetic compounds that can lead to negative effect on health, including immune and endocrine system disruption, respiratory problems, metabolic issues, diabetes, obesity, cardiovascular problems, growth impairment, neurological and learning disabilities, and cancer. Petrochemical industry drilling wastes, which contain varying levels of EDCs, are known to pose a significant risk to human health. This study aimed to investigate the levels of toxic elements in biological samples of individuals working in the petrochemical drilling sites. Biological samples, including scalp hair and whole blood, were collected from petrochemical drilling workers, individuals residing in the same residential area, and control age-matched persons from nonindustrial areas. The samples were oxidized by an acid mixture before analysis using atomic absorption spectrophotometry. The accuracy and validity of the methodology were verified through certified reference materials from scalp hair and whole blood. The results showed that the concentrations of toxic elements, such as cadmium and lead, were higher in biological samples of petrochemical drilling employees, while lower essential element levels (iron and zinc) were detected in their samples. This study highlights the significance of adopting better practices to reduce exposure to harmful substances and protect the health of petrochemical drilling workers and the environment. It also suggests that perspective management including policymakers and industry leaders should take measures to minimize exposure to EDCs and heavy metals to promote worker safety and public health. These measures could include the implementation of strict regulations and better occupational health practices to reduce toxic exposure and promote a safer work environment.

Authors: Yuanji Li, Geovanny Genaro Reivan Ortiz, Pham Thi Minh Uyen, Phan The Cong, Sarah I Othman, Allam Ahmed A, Ahsanullah Umar, Hassan Imran Afridi

Full Source: Environmental research 2023 May 11;115913. doi: 10.1016/j.envres.2023.115913.

Exposure to endocrine disrupting chemicals (EDCs) or heavy metals are synthetic compounds that can lead to negative effect on health, including immune and endocrine system disruption, respiratory problems, metabolic issues, diabetes, obesity, cardiovascular problems, growth impairment, neurological and learning disabilities, and cancer.

Application of Inorganic Nanomaterials in Cultural Heritage Conservation, Risk of Toxicity, and Preventive Measures

2023-04-24

Nanotechnology has allowed for significant progress in architectural, artistic, archaeological, or museum heritage conservation for repairing and preventing damages produced by deterioration agents (weathering, contaminants, or biological actions). This review analyzes the current treatments using nanomaterials, including consolidants, biocides, hydrophobic protectives, mechanical resistance improvers, flame-retardants, and multifunctional nanocomposites. Unfortunately, nanomaterials can affect human and animal health, altering the environment. Right now, it is a priority to stop to analyze its advantages and disadvantages. Therefore, the aims are to raise awareness about the nanotoxicity risks during handling and the subsequent environmental exposure to all those directly or indirectly involved in conservation processes. It reports the human-body interaction mechanisms and provides guidelines for preventing or controlling its toxicity, mentioning the current toxicity research of main compounds and emphasizing the need to provide more information about morphological, structural, and specific features that ultimately contribute to understanding their toxicity. It provides information about the current documents of international organizations (European Commission, NIOSH, OECD, Countries Normative) about worker protection, isolation, laboratory ventilation control, and debris management. Furthermore, it reports the qualitative risk assessment methods, management strategies, dose control, and focus/receptor relationship, besides the latest trends of using nanomaterials in masks and gas emissions control devices, discussing their risk of toxicity.

Authors: Luz Stella Gomez-Villalba, Ciro Salcines, Rafael Fort

Full Source: Nanomaterials (Basel, Switzerland) 2023 Apr 24;13(9):1454. doi: 10.3390/nano13091454.

Nanotechnology has allowed for significant progress in architectural, artistic, archaeological, or museum heritage conservation for repairing and preventing damages produced by deterioration agents (weathering, contaminants, or biological actions).

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ENVIRONMENTAL RESEARCH

Pollution Characteristics and Risk Assessment of PAHs in the Soil of Wild Forsythia Suspensa in Shanxi

2023-05-08

Shanxi is one of the main producing areas of Forsythia suspensa in China. In order to explore the safety of the soil in the areas where Forsythia suspensa grows,70 surface (0-25 cm) soil samples were collected from the main growing areas of F. suspensa in the eastsouth of Shanxi Province in July 2017. The concentration and composition characteristics of 16 polycyclic aromatic hydrocarbons (PAHs) in the sample soils were analyzed using chemical extraction and gas chromatography-mass spectrometry (GC-MS). The diagnostic ratio method was used to determine the source of PAHs in the areas. The potential ecological risk was assessed by using the method of calculating the equivalent carcinogenic concentration of benzo[a]pyrene. The results showed that the average concentration of total PAHs (Σ16PAHs) in all of the soil samples was 1.85 µg·g-1, which was dominated by three ring number PAHs, accounting for 76.7% of the total PAHs. The detection rates of phenanthrene (Phe) and anthracene (Ant) were both 100% of all the sample sites. The soil PAHs in the wild F. suspensa growing areas mainly originated from coal, biomass burning, and motor vehicle exhaust emissions, which resulted from air transport and sedimentation pathways. In all of the sample sites, the concentration of Σ16PAHs the limit standard level (0.2 µg·g-1) of Maliszewska-Kordybach for agricultural soil pollution and exceeded the soil heavy pollution level limit value (1.0 µg·g-1) in 41.4% of the sample sites. The concentration of BaP was above the risk control standard for soil contamination of agricultural land (0.55 µg·g-1) in 10% of all the soil samples. A total of 11.4% of the sample soil ΣBaPeq16PAHs and ΣBaPeq8BPAHs exceeded the agricultural soil screening value (0.55 µg·g-1). These results indicate that the contamination of PAHs was at a detectable level in the soil of wild F. suspensa growing in Shanxi, and thus their potential ecological risks should not be ignored. It is necessary to enhance the research regarding these areas to ensure the safe production of medicinal plants.

Authors: Jia-Jia Guo, Qi Wang, Min-Jie Kang, Hai-Hua Jiao, Wen-Ming Ru, Zhi-Hui Bai
Full Source: Huan jing ke xue= Huanjing kexue 2023 May 8;44(5):2879-2888. doi: 10.13227/j.hjkx.202205356.

Background: Exposure to perfluoroalkyl substances (PFAS) has been shown to be neurotoxic in experimental studies, but epidemiological evidence linking prenatal PFAS exposure to child neurodevelopment is equivocal and scarce.
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PHARMACEUTICAL/TOXICOLOGY

Prenatal exposure to legacy PFAS and neurodevelopment in preschool-aged Canadian children: The MIREC cohort

2023-05-11

Background: Exposure to perfluoroalkyl substances (PFAS) has been shown to be neurotoxic in experimental studies, but epidemiological evidence linking prenatal PFAS exposure to child neurodevelopment is equivocal and scarce.
Objective: To quantify associations between prenatal exposure to legacy PFAS and children's intelligence (IQ) and executive functioning (EF) in a Canadian pregnancy and birth cohort and to determine if these associations differ by child sex.
Methods: We measured first-trimester plasma concentrations of perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS), and perfluorohexanesulfonic acid (PFHxS) in the Maternal-Infant Research on Environmental Chemicals (MIREC) study and assessed children's full-scale (n = 522), performance (n = 517), and verbal (n = 519) IQ using the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III). Children's working memory (n = 513) and ability to plan and organize (n = 514) were assessed using a parent-reported questionnaire, the Behavior Rating Inventory of Executive Function - Preschool Version (BRIEF-P). We quantified associations between individual log2-transformed PFAS exposure and children's IQ and EF using multiple linear regression analyses and evaluated effect modification by child sex. We also used Repeated Holdout Weighted Quantile Sum (WQS) regression models with effect modification by child sex to quantify the effect of combined exposure to all three PFAS chemicals on IQ and EF. All models were adjusted for key sociodemographic characteristics.
Results: Geometric mean plasma concentrations (IQR) for PFOA, PFOS and PFHxS were 1.68 (1.10-2.50), 4.97 (3.20-6.20) and 1.09 (0.67-1.60) µg/L respectively. We found evidence of effect modification by child sex in all models examining performance IQ (p < .01). Specifically, every doubling of PFOA, PFOS, and or PFHxS was inversely associated with performance IQ, but only in males (PFOA: B = -2.80, 95% CI: -4.92, -0.68; PFOS: B = -2.64, 95% CI: -4.77, -0.52; PFHxS: B = -2.92, 95% CI: -4.72, -1.12). Similarly, every quartile increase in the WQS index was associated with poorer performance IQ in males (B = -3.16, 95% CI: -4.90, -1.43), with PFHxS contributing the largest weight to the index. In contrast, no significant association was found for females (B = 0.63, 95% CI: -0.99, 2.26). No significant associations were found for EF in either males or females.

Conclusions: Higher prenatal PFAS exposure was associated with lower performance IQ in males, suggesting that this association may be sex- and domain-specific.
Authors: Carly V Goodman, Christine Till, Rivka Green, Jana El-Sabbagh, Tye E Arbuckle, Richard Hornung, Bruce Lanphear, Jean Seguin, Linda Booij, Mandy Fisher, Gina Muckle, Maryse F Bouchard, Jillian Ashley-Martin
Full Source: Neurotoxicology and teratology 2023 May 11;107181. doi: 10.1016/j.ntt.2023.107181.

Novel Biodegradable Nanoparticulate Chain-End Functionalized Polyhydroxybutyrate-Caffeic Acid with Multifunctionalities for Active Food Coatings

2023-04-27
The bioactivities of polyhydroxyalkanoates have been curtailed owing to the lack of bioactive functional groups in their backbones. In this regard, polyhydroxybutyrate (PHB) produced from new locally isolated Bacillus nealsonii ICRI16 was chemically modified for enhancing its functionality, stability as well as solubility. First, PHB was transformed to PHB-diethanolamine (PHB-DEA) by transamination. Subsequently, for the first time, the chain ends of the polymer were substituted by caffeic acid molecules (CafA), generating novel PHB-DEA-CafA. The chemical structure of such a polymer was confirmed by Fourier-transform infrared (FTIR) spectroscopy and proton nuclear magnetic resonance (1H NMR). The modified polyester demonstrated improved thermal behavior compared to PHB-DEA as was shown by thermogravimetric analysis, derivative thermogravimetry, and differential scanning calorimetry analyses. Interestingly, 65% of PHB-DEA-CafA was biodegraded in a clay soil environment after 60 days at 25 °C, while 50% of PHB was degraded within the same period. On another avenue, PHB-DEA-CafA nanoparticles (NPs) were successfully prepared with an impressive mean particle size of 223 ± 0.12 nm and high colloidal stability. The nanoparticulate polyester had powerful antioxidant capacity with an IC50 of 32.2 mg/mL, which was the result of CafA loading in the polymer chain. More importantly, the NPs had a considerable effect on the bacterial behavior of four food pathogens, inhibiting 98 ± 0.12% of Listeria monocytogenes DSM 19094 after 48 h of exposure. Finally, the raw polish sausage coated with NPs had a significantly lower bacterial count of 2.11 ± 0.21 log cfu/g in comparison to other groups. When all these positive features are recognized, the

> The bioactivities of polyhydroxyalkanoates have been curtailed owing to the lack of bioactive functional groups in their backbones.

polyester described herein could be considered as a good candidate for commercial active food coatings.
Authors: Fady Abdelmalek, Marian Rofeal, Joanna Pietrasik, Alexander Steinbüchel
Full Source: ACS sustainable chemistry & engineering 2023 Apr 27;11(18):7123-7135. doi: 10.1021/acssuschemeng.3c00389.

Copper in airborne fine particulate matter (PM2.5) from urban sites causes the upregulation of pro-inflammatory cytokine IL-8 in human lung epithelial A549 cells

2023-05-14
Fine atmospheric particles, such as PM2.5, are strongly related to the onset and exacerbation of inflammatory responses leading to the development of respiratory and cardiovascular diseases. PM2.5 is a complex mixture of tiny particles with different properties (i.e., size, morphology, and chemical components). Moreover, the mechanism by which PM2.5 induces inflammatory responses has not been fully elucidated. Therefore, it is necessary to determine the composition of PM2.5 to identify the main factors causing PM2.5-associated inflammation and diseases. In the present study, we investigated PM2.5 from two sites (Fukue, a remote monitoring site, and Kawasaki, an urban monitoring site) with greatly different environments and PM2.5 compositions. The results of ICP-MS and EDX-SEM indicated that PM2.5 from Kawasaki contained more metals and significantly induced the expression of the pro-inflammatory cytokine gene IL-8 compared to the PM2.5 from Fukue. We also verified the increased secretion of IL-8 protein from exposure to PM2.5 from Kawasaki. We further investigated their effects on inflammatory response and cytotoxicity using metal nanoparticles (Cu, Zn, and Ni) and ions and found that the Cu nanoparticles caused a dose-dependent increase in IL-8 expression together with significant cell death. We also found that Cu nanoparticles enhanced the secretion of IL-8 protein. These results suggest that Cu in PM2.5 is involved in lung inflammation.
Authors: Chisato Amma, Yayoi Inomata, Risa Kohno, Minami Satake, Atsushi Furukawa, Yuka Nagata, Hironori Sugiyama, Takafumi Seto, Ryo Suzuki
Full Source: Environmental geochemistry and health 2023 May 14. doi: 10.1007/s10653-023-01599-4.

> Fine atmospheric particles, such as PM2.5, are strongly related to the onset and exacerbation of inflammatory responses leading to the development of respiratory and cardiovascular diseases.

Hydrogen Peroxide Induces α-Tubulin Detyrosination and Acetylation and Impacts Breast Cancer Metastatic Phenotypes

2023-04-27

Levels of hydrogen peroxide are highly elevated in the breast tumor microenvironment compared to normal tissue. Production of hydrogen peroxide is implicated in the mechanism of action of many anticancer therapies. Several lines of evidence suggest hydrogen peroxide mediates breast carcinogenesis and metastasis, though the molecular mechanism remains poorly understood. This study elucidates the effects of exposure to elevated hydrogen peroxide on non-tumorigenic MCF10A mammary epithelial cells, tumorigenic MCF7 cells, and metastatic MDA-MB-231 breast cancer cells. Hydrogen peroxide treatment resulted in a dose- and time-dependent induction of two α-tubulin post-translational modifications-de-tyrosination and acetylation-both of which are markers of poor patient prognosis in breast cancer. Hydrogen peroxide induced the formation of tubulin-based microtentacles in MCF10A and MDA-MB-231 cells, which were enriched in detyrosinated and acetylated α-tubulin. However, the hydrogen peroxide-induced microtentacles did not functionally promote metastatic phenotypes of cellular reattachment and homotypic cell clustering. These data establish for the first time that microtentacle formation can be separated from the functions to promote reattachment and clustering, which indicates that there are functional steps that remain to be identified. Moreover, signals in the primary tumor microenvironment may modulate α-tubulin post-translational modifications and induce microtentacles; however, the functional consequences appear to be context-dependent.

Authors: Megan B Stemberger, Julia A Ju, Keyata N Thompson, Trevor J Mathias, Alexandra E Jerrett, Katarina T Chang, Eleanor C Ory, David A Annis, Makenzy L Mull, Darin E Gilchrist, Michele I Vitolo, Stuart S Martin
Full Source: Cells 2023 Apr 27;12(9):1266. doi: 10.3390/cells12091266.

Purpose: To assess occupational eye lens dose based on clinical monitoring of interventional radiologists and to assess personal protective eyewear (PPE) efficacy through measurements with anthropomorphic phantom.

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OCCUPATIONAL

Evaluation of operator eye exposure and eye protective devices in interventional radiology: Results on clinical staff and phantom

2023-05-11

Purpose: To assess occupational eye lens dose based on clinical monitoring of interventional radiologists and to assess personal protective eyewear (PPE) efficacy through measurements with anthropomorphic phantom. Methods: Two positions of the operator with respect to X-ray beam were simulated with phantom. Dose reduction factor (DRF) of four PPE was assessed, as well as correlation between eye lens and whole-body doses. Brain dose was also assessed. Five radiologists were monitored for one-year clinical procedures. All subjects were equipped with whole-body dosimeter placed over lead apron at the chest level and eye lens dosimeter placed over the left side of the PPE. Kerma-Area Product (KAP) of procedures performed during the monitoring period was recorded. The correlation of eye lens dose with whole-body dose and KAP was assessed. Results: DRF was 4.3/2.4 for wraparound glasses, 4.8/1.9 for fitover glasses, 9.1/6.8 for full-face visor in radial/femoral geometries. DRF of half-face visor depended on how it is worn (range 1.0-4.9). Statistically significant correlation between dose value over the PPE and chest dose was observed, while there was no correlation between eye lens dose and chest dose. The results on clinical staff showed statistically significant correlation between dose values over the PPE and KAP.
Conclusions:All PPE showed significant DRF in all configurations, provided they were worn correctly. Single DRF value is not applicable to all clinical situations. KAP is a valuable tool for determining appropriate radiation protection measures.

Authors: Andrea D'Alessio, Roberta Matheoud, Barbara Cannillo, Giuseppe Guzzardi, Francesca Galbani, Andrea Galbiati, Marco Spinetta, Carmelo Stanca, Serena Maria Tettoni, Alessandro Carriero, Marco Brambilla
Full Source: Physica medica : PM : an international journal devoted to the applications of physics to medicine and biology : official journal of the Italian Association of Biomedical Physics (AIFB) 2023 May 11;110:102603. doi: 10.1016/j.ejmp.2023.102603.

High blood levels of lead have been shown to relate to its toxicity, and its early detection in occupational workers is important to take necessary measures.

Identification of critical genes associated with lead exposure based on in silico analysis

2023-05-13

High blood levels of lead have been shown to relate to its toxicity, and its early detection in occupational workers is important to take necessary measures. The genes associated with lead toxicity were identified by in silico analysis of expression profile (GEO-GSE37567) based on lead exposure of peripheral blood mononuclear cells maintained in culture. The GEO2R tool was used to identify differentially expressed genes (DEGs) among three groups: control versus day-1 treatment, control versus day-2 treatment, and control versus day-1 treatment versus day-2 treatment, and their enrichment analysis was performed to categorize them for molecular function, biological process, cellular component, and KEGG pathways. The protein-protein interaction (PPI) network of DEGs was constructed using a STRING tool and hub genes were identified by using the CytoHubba plugin of Cytoscape. Top 250 DEGs were screened in the first and second groups and 211 DEGs were in the third group. Fifteen critical genes viz. MT1G, ASPH, MT1F, TMEM158, CDK5RAP2, BRCA2, MT1E, EDNRB, MT1H, KITLG, MT1X, MT2A, ARRDC4, MT1M, and MT1HL1 were selected for functional enrichment and pathway analysis. The DEGs were primarily enriched in metal ion binding, metal absorption, and cellular response to metal ions. The significantly enriched KEGG pathways included mineral absorption, melanogenesis, and cancer signaling pathways. PPI network analysis revealed that seven genes of the MT family exhibited good connectedness and served as a marker of lead induced toxicity. Our study suggests that MT1E, MT1H, MT1G, MT1X, MT1F, MT1M, and MT2A of the metallothioneins gene family may act as potential biomarkers to monitor lead exposure.

Authors: Swati Sharma, Vijay L Kumar, Anuradha Bhardwaj
Full Source: Toxicology and industrial health 2023 May 13;7482337231175970. doi: 10.1177/07482337231175970.

In pediatric patients with neurogenic bladder (NGB), urinary tract evaluation, early diagnosis, and individualized management are important.

Diagnosis and Treatment of Japanese Children with Neurogenic Bladder: Analysis of Data from a National Health Insurance Database

2023-04-28

In pediatric patients with neurogenic bladder (NGB), urinary tract evaluation, early diagnosis, and individualized management are important. We aimed to clarify the current status of diagnosis and treatment of NGB in Japanese children. This descriptive, observational,