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CHEMICAL EFFECTS

Analysis of serum lead, copper, iron, and zinc and hematological parameters in battery smelting workers: assessing lead toxicity

2024-08-23

The present study is conducted to know the serum lead, copper, iron, and zinc levels, in parallel to hematological parameters, in battery smelting workers to assess lead toxicity. Battery smelting is known to expose workers to high levels of lead, which can have significant negative health effects. Blood samples from 150 participants, including 75 battery smelting workers and 75 controls, were analyzed for metal concentrations and hematological indices. The results revealed significantly elevated levels of lead in the serum of battery smelting workers as compared to control group. Elevated lead levels were also correlated with significantly decreased hemoglobin levels and hematocrit values, manifesting potential anemia in these workers. In addition, disarrangements in serum copper, iron, and zinc levels were also observed, proposing a possible interaction between lead exposure and the metabolism of these essential metals. These findings highlight the need for regular monitoring of battery smelting facilities and environment and to take improved protective measures to prevent lead toxicity and its associated hematological disturbances. This study aims to analyze the effect of occupational lead exposure on blood levels of lead, zinc, iron, and copper in battery workers compared to normal subjects and evaluate their blood counts.

Authors: Maleeha Sikandar Memon, Ikram Udiin Ujjan, Marvi Shaikh, Sadia Qamar Arain, Arshi Naz, Huma Abbasi

Full Source: Biometals: an international journal on the role of metal ions in biology, biochemistry, and medicine 2024 Aug 23. doi: 10.1007/s10534-024-00623-z.

The present study is conducted to know the serum lead, copper, iron, and zinc levels, in parallel to hematological parameters, in battery smelting workers to assess lead toxicity.

A bioinspired pseudopeptide-based intracellular delivery platform enhances the cytotoxicity of a ribosome-inactivating protein through multiple death pathways

2024-08-23

Saporin is a 28 621 Da protein and plant toxin possessing rRNA N-glycosidase activity. Due to its potent ribosome-inactivating ability, saporin is commonly studied as an anticancer agent. However, its enzymatic activity is greatly hindered by its poor plasma membrane permeability. To overcome this barrier, we used a bioinspired intracellular

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delivery platform based on the pH-responsive pseudopeptide, poly(L-lysine isophthalamide) grafted with L-phenylalanine at a stoichiometric molar percentage of 50% (PP50). PP50 was co-incubated with saporin (PP50/saporin) in a mildly acidic pH environment to aid intracellular delivery and increase saporin's therapeutic potential. We demonstrated that PP50 greatly enhanced the cytotoxicity of saporin in the 2D monolayer of A549 cells and 3D A549 multicellular spheroids whilst remaining non-toxic when administered alone. To elucidate the mechanism of cell death, we assessed the activation of caspases, the inhibition of protein synthesis, the onset of apoptosis and the mechanism of PP50/saporin entry. Inhibition of protein synthesis and activation of caspases 3/7, 8 and 9 were found to occur before the onset of apoptosis and cell death. PP50/saporin was also shown to rely on micropinocytosis and caveolae-mediated endocytosis for cell entry. In addition, fluorescein isothiocyanate-labelled saporin (FITC-saporin) was localized within the cytoplasm and nuclei when delivered with Cyanine5-labelled PP50 (Cy5-PP50). Taken together, this suggests that multiple pathways are triggered to initiate apoptosis and cell death in cells treated with PP50/saporin. Therefore, these results make PP50 a potential intracellular delivery platform for the internalization of protein therapeutics.

Authors: Gabriella Morrison, Nicole Henry, Michal Kopytynski, Rongjun Chen

Full Source: Biomaterials science 2024 Aug 23. doi: 10.1039/d4bm00600c.

Polystyrene nanoplastics alter intestinal toxicity of 2,4-DTBP in a sex-dependent manner in zebrafish (Danio rerio)

2024-08-22

Nanoplastics (NPs) and 2,4-di-tert-butylphenol (2,4-DTBP) are ubiquitous emerging environmental contaminants detected in aquatic environment. While the intestinal toxicity of 2,4-DTBP alone has been studied, its combined effects with NPs remain unclear. Herein, adult zebrafish were exposed to 80 nm polystyrene nanoplastics (PS-NPs) or/ and 2,4-DTBP for 28 days. With co-exposure of PS-NPs, impact of 2,4-DTBP on feeding capacity and intestinal histopathology was enhanced in males while attenuated in females. Addition of PS-NPs significantly decreased the uptake of 2,4-DTBP in females, while the intestinal concentrations of 2,4-DTBP were not different between the sexes in co-exposure groups. Furthermore, lower intestinal pH and higher contents of digestive enzymes were detected in male fish, while bile acid was significantly increased in co-exposed females. In addition, co-exposure of PS-NPs stimulated female fish to remodel microbial composition to potentially

Nanoplastics (NPs) and 2,4-di-tert-butylphenol (2,4-DTBP) are ubiquitous emerging environmental contaminants detected in aquatic environment.

enhance xenobiotics degradation, while negative Aeromonas aggravated inflammation in males. These results indicated that in the presence of PS-NPs, the gut microenvironment in females can facilitate the detoxification of 2,4-DTBP, while exaggerating toxiciy in males. Overall, this study demonstrates that toxicological outcomes of NPs-chemical mixtures may be modified by sex-specific physiology and microbiota composition, furthering understanding for environmental risk assessment and management of aquatic environments.
Authors: Ruimin Liu, Huina Gao, Xuefang Liang, Jiye Zhang, Qingjian Meng, Yuchen Wang, Wei Guo, Christopher J Martyniuk, Jinmiao Zha
Full Source: Journal of hazardous materials 2024 Aug 22:478:135585. doi: 10.1016/j.jhazmat.2024.135585.

ENVIRONMENTAL RESEARCH

Unseen riverine risk: Spatio-temporal shifts of microplastic pollution and its bioavailability in freshwater fish within the Ikopa River urban system

2024-08-24
Growing concern over microplastic pollution, driven by their widespread accumulation in the environment, stresses the need for comprehensive assessments. This study investigates the spatial and temporal distribution of microplastics in the Ikopa River (Antananarivo - Madagascar), which flows through a densely populated area, and examines their correlation with contamination levels in local fish species. By analyzing upstream and downstream stations across wet and dry seasons, only a notable increase in microplastic concentration downstream during the wet season was observed, ranging from 138.6 ± 9.0 to 222.0 ± 24.5 particles m-3, with polyethylene-co-vinyl acetate being the predominant polymer at 62.3 ± 5.13% of the total sampled polymers. This distribution underlines the impact of urban activities on pollution levels. Fish species, gambusia and Nile tilapia, were assessed for microplastic occurrence in gills and gastrointestinal tracts. Higher contamination rates were found in gambusia, enlightening the influence of feeding behaviour and fish habitat on microplastics contamination. Ingestion of microplastics directly from the water column was evident in both species, with the detection of high-density plastics such as polytetrafluoroethylene and polyvinyl chloride suggesting likely sediment contamination. This research highlights the widespread contamination of aquatic environments and its

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direct impact on local wildlife, pointing to a clear requirement for effective pollution management strategies.
Authors: Andry Ny Aina Rabezanahary, Patrick Kestemont, Valérie Cornet, Samira Benali, Patrick Laby, Ranjàna Hanitra Randrianarivo, Yves Jean Michel Mong, Jean-Marie Raquez, Omayma Missawi
Full Source: Environmental monitoring and assessment 2024 Aug 24;196(9):837. doi: 10.1007/s10661-024-13010-5.

Spatial-temporal distribution characteristics of surface water pollutants and their potential sources in Ngari, China

2024-08-24
The Ngari region has many important rivers and is critical to water resource security and water resource continuity in China and even in adjoining Asian countries. However, the spatial distribution and monthly variation in local water quality have been poorly understood until recently. In this study, the spatial-temporal variations of 12 water quality parameters, including pH, dissolved oxygen (DO), permanganate index (IMn), chemical oxygen demand (COD), five-day biochemical oxygen demand (BOD5), ammonia nitrogen (NNH3), total nitrogen (Ntotal), total phosphorus (Ptotal), copper (Cu), fluoride (F), arsenic (As) and cadmium (Cd), were determined from samples collected monthly at 22 water cross-sectional sites in the Ngari region in 2020. The surface water pollution in the southern Ngari region was the most serious, and the water pollution level in winter was higher than that in the other seasons. As (0.0781 ~ 0.6154 mg/L) and F (1.05 ~ 4.64 mg/L) were the main exceedance factors derived from the recharge of high arsenic and fluoride geothermal water and weathering of As and F-bearing minerals. The hazard quotient and carcinogenic risk for As and F at the five contaminated sampling sites indicated potential health risks and even carcinogenicity to local populations. The hydrochemistry types of the lakes and rivers in the Ngari region were mainly chloride water and carbonate water. The results from this study can provide a scientific basis for the prevention and control of surface water pollution in the Ngari region and contribute to subsequent research on the ecology of water bodies.
Authors: Yubing Zhu, Xiao Sun, Lin Shi, Di Zhang, Meizhen Wu, Liming Chai, Jinfeng Zhao
Full Source: Environmental geochemistry and health 2024 Aug 24;46(10):393. doi: 10.1007/s10653-024-02176-z.

The Ngari region has many important rivers and is critical to water resource security and water resource continuity in China and even in adjoining Asian countries.

PHARMACEUTICAL/TOXICOLOGY

Elucidating the mechanism of plasticizers inducing breast cancer through network toxicology and molecular docking analysis

2024-08-22

Objective: The objective of this study was to elucidate the molecular mechanisms underlying the potential contribution of commonly utilized plasticizers, including Diethyl phthalate (DEP), Dimethyl phthalate (DMP), and Dioctyl phthalate (DOP), to the pathogenesis of breast cancer.
This study aimed to highlight the complex interactions between these environmental chemicals and key molecular pathways implicated in tumorigenesis.
Methods: We employed network toxicology and molecular docking techniques to analyze the interactions between plasticizers and key proteins implicated in breast cancer. Utilizing databases such as the TCGA, we performed an expression analysis of selected key genes in breast cancer tissue compared to normal controls. Enrichment analysis was conducted to identify the biological pathways associated with these genes.
Results: Enrichment analysis highlighted the association of these plasticizer-targeted genes with pathways integral to adenocarcinoma development, suggesting a broad impact of plasticizers on hormone-dependent and other forms of cancers. Subsequent expression analysis using data from the TCGA breast cancer database indicated significant upregulation or downregulation of these genes in breast cancer tissues compared to normal controls, confirming their pivotal roles in tumor biology. Furthermore, the molecular docking analysis revealed that plasticizers, including DEP, DMP, and DOP, exhibit specific binding interactions with key proteins such as MAPK1, AKT1, SRC, ESR1, and ALB, which are crucial in the regulation of breast cancer pathogenesis.
Conclusion: The study provides evidence that exposure to plasticizers may influence breast cancer pathogenesis through interactions with critical proteins and signaling pathways. By employing network pharmacology, protein interactions, and molecular docking, our findings highlight the potential risks posed by plasticizers. These results underscore the need for further epidemiological and clinical research to fully understand the implications of plasticizer exposure on breast cancer risk, thus informing future preventive and therapeutic strategies.

Objective: The objective of this study was to elucidate the molecular mechanisms underlying the potential contribution of commonly utilized plasticizers, including Diethyl phthalate (DEP), Dimethyl phthalate (DMP), and Dioctyl phthalate (DOP), to the pathogenesis of breast cancer.

Authors: Na He, Jing Zhang, Mingyu Liu, Li Yin
Full Source: Ecotoxicology and environmental safety 2024 Aug 22:284:116866. doi: 10.1016/j.ecoenv.2024.116866.

Characterization of PM2.5 Emissions from On-Road Vehicles in the Tunnel of a Major Middle Eastern City

2024-08-20

Traffic emissions are an important source of air pollution worldwide, but in the Middle East, this problem is exacerbated by weak or no enforcement of emission regulations. Comprehensive measurements of fine PM emission factors (EFs) from road transport in the region have not yet been conducted, but such data are necessary for quantitative assessments of the health impact of transport emissions in the region. To address this need, PM2.5 samples collected inside the Salim Slam tunnel in Beirut, Lebanon were analyzed for carbonaceous matter (organic carbon (OC) and elemental carbon (EC)), water-soluble ions, elements, and selected organic compounds. The OC/EC ratio was 1.8 for the total fleet and 2.6 for light-duty vehicles (LDV), in agreement with the dominant proportion of gasoline LDV in the Lebanese fleet. A Cu/Sb ratio of 4.2±0.1 was observed, offering a valuable metric for detecting brake wear emissions in subsequent studies conducted in the region. The EFs of carbonaceous matter, elements and ions generally varied by a factor 0.1 and 10 in comparison to literature values, while those for alkanes and polycyclic aromatic hydrocarbons were similar to the upper values previously reported. The average number size distribution was characterized by a single mode around 35 nm. The particles number EF (for diameters between 10-480 nm) was within the range of 1014-1015 particles per kg of fuel. The chemical mass balance model showed an average contribution to EF of 62% from non-exhaust sources. This study highlights the need for more enforceable stringent vehicular regulations because of the local practices (i.e., removal of catalyst) and some EF values are very high compared to other studies/countries.

Traffic emissions are an important source of air pollution worldwide, but in the Middle East, this problem is exacerbated by weak or no enforcement of emission regulations.

Authors: Nansi Fakhri, Marc Fadel, Charbel Abdallah, Cyril Karam, Minas Iakovides, Konstantina Oikonomou, Paola Formenti, Jean-François Doussin, Agnès Borbon, Jean Sciare, Patrick L Hayes, Charbel Afif
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Aug 20:124769. doi: 10.1016/j.envpol.2024.124769.

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OCCUPATIONAL

Incidence of cardiovascular disease in a cohort of mine workers exposed to ultrafine aluminum powder in Ontario, Canada

2024-08-23

Background: A retrospective cohort study was conducted to estimate associations between an ultrafine aluminum powder, McIntyre Powder (MP), and cardiovascular disease incidence in a cohort of mine workers from Ontario, Canada. Disease outcomes included ischemic heart disease (IHD), acute myocardial infarction (AMI), congestive heart failure (CHF), and strokes and transient ischemic attacks (STIA).

Methods: Using work history records from the Ontario Mining Master File (MMF) mine workers were followed for disease incidence in administrative health records. The analysis included 25,813 mine workers who were exposed to MP between 1943 and 1979 and followed for cardiovascular disease (CVD) diagnoses between 2006 and 2018. Cardiovascular disease cases were ascertained using physician, hospital, and ambulatory care records. Poisson regression models were used to estimate age and birth-year adjusted incidence rate ratios (RR) and 95% confidence intervals (CI) for associations between MP exposure and CVD outcomes.

Results: Ever-exposure to MP was positively associated with modest increases in the incidence rate of IHD, AMI, and CHF, but not STIA, using both assessment approaches. Duration of self-reported MP exposure was positively associated with monotonically increasing rates of IHD and AMI compared to never-exposed miners, with the greatest association observed among miners with >20 years of exposure (for IHD: RR 1.24, 95% CI: 0.91-1.68; and for AMI: RR 1.52, 95% CI 1.01-2.28).

Conclusion: Mine workers ever-exposed to MP had modestly elevated rates of CVD. The rate of CVD diagnoses appeared to increase with longer duration of exposure when assessed by both self-reported exposure and through historical records.

Authors: Andrew Zarnke, Sarah Rhodes, Nathan DeBono, Colin Berriault, Sandra C Dorman

Full Source: American journal of industrial medicine 2024 Aug 23. doi: 10.1002/ajim.23646.

Background: A retrospective cohort study was conducted to estimate associations between an ultrafine aluminum powder, McIntyre Powder (MP), and cardiovascular disease incidence in a cohort of mine workers from Ontario, Canada.

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Human exposure to uranium through drinking water and its detrimental impact on the human body organs

2024-08-24

Human exposure to high concentrations of uranium is a major concern due to the risk of developing numerous internal organ malignancies over time. In addition to the numerous attributes of uranium in the nuclear power industry, the radiological characteristics and chemical toxicity of uranium present a substantial risk to human health. This study aims to evaluate potential negative health impacts associated with the ingestion of uranium through drinking water in the Noida and Greater Noida region within the Gautam Buddha districts of Uttar Pradesh (India), due to extreme industrial revolution in this geological location. The mean concentration of uranium in drinking water of the examined area was estimated to range from 0.23 to 78.21 µg l-1. The hair compartment biokinetic model is used to estimate the retention and radiological doses of uranium in distinct organs and tissues. Studies on time-dependent factors revealed variations in uranium retention, with lower levels observed in the Gastrointestinal Tract (GIT) region and higher levels on cortical bone surfaces causes the skeletal deformities. The kidney, liver, and other soft tissues (OST) exhibited a non-saturation pattern in the retention of uranium via exposure of drinking water. The age-wise non-carcinogenic and carcinogenic doses were estimated for the health hazards studies. The outcome of this study will be useful for water resource management authorities to supply safe potable water to the local residents.

Authors: Ansumali Ashish, Pargin Bangotra, Venus Dillu, Mukesh Prasad, Sushmita Banerjee, Rohit Mehra, Nand Lal Singh

Full Source: Environmental geochemistry and health 2024 Aug 24;46(10):397. doi: 10.1007/s10653-024-02150-9.

Human exposure to high concentrations of uranium is a major concern due to the risk of developing numerous internal organ malignancies over time.

Foliar Exposure of Deuterium Stable Isotope-Labeled Nanoplastics to Lettuce: Quantitative Determination of Foliar Uptake, Transport, and Trophic Transfer in a Terrestrial Food Chain

2024-08-22

Nanoplastics (NPs) are widely detected in the atmosphere and are likely to be deposited on plant leaves. However, our understanding of their foliar uptake, translocation, and trophic transfer profiles is limited due to a lack of quantitative analytical tools to effectively probe mechanisms of action. Here, using synthesized deuterium (2H) stable isotope-labeled polystyrene nanoplastics (2H-PSNPs), the foliar accumulation and translocation of NPs

in lettuce and the dynamics of NP transfer along a lettuce-snail terrestrial food chain were investigated. Raman imaging and scanning electron microscopy demonstrated that foliar-applied NPs aggregated on the leaf surface, entered the mesophyll tissue via the stomatal pathway, and eventually translocated to root tissues. Quantitative analysis showed that increasing levels of foliar exposure to 2H-PSNPs (0.1, 1, and 5 mg/L in spray solutions, equivalent to receiving 0.15, 1.5, and 7.5 μg/d of NPs per plant) enhanced NP accumulation in leaves, with concentrations ranging from 0.73 to 15.6 μg/g (dw), but only limited translocation (<5%) to roots. After feeding on 5 mg/L 2H-PSNP-contaminated lettuce leaves for 14 days, snails accumulated NPs at 0.33 to 10.7 μg/kg (dw), with an overall kinetic trophic transfer factor of 0.45, demonstrating trophic dilution in this food chain. The reduced ingestion rate of 3.18 mg/g/day in exposed snails compared to 6.43 mg/g/day can be attributed to the accumulation of 2H-PSNPs and elevated levels of chemical defense metabolites in the lettuce leaves, which decreased the palatability for snails and disrupted their digestive function. This study provides critical quantitative information on the characteristics of airborne NP bioaccumulation and the associated risks to terrestrial food chains.

Authors: Xiaofeng Jiang, Jason C White, Erkai He, Cornelis A M Van Gestel, Xinde Cao, Ling Zhao, Xiaoyun Xu, Wenbo Guo, Hao Qiu

Full Source: Environmental science & technology 2024 Aug 22. doi: 10.1021/acs.est.4c03123.