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CHEMICAL EFFECTS

Properties and Reactivity of Iron-Organic Matter-Arsenic Composites and their Influence on Arsenic Behavior in Microbial Reduction and Oxidation Processes

2025-03-28

The biogeochemistry of arsenic in soils is strongly controlled by iron oxides and soil organic matter (SOM). The present study intends to elucidate the behavior of arsenic in Fe-SOM-As composites formed through adsorption or coprecipitation under redox conditions. The X-ray diffraction (XRD) and high-resolution transmission electron microscopy (HRTEM) showed that crystalline minerals were generated during Fe-HA-As coprecipitation, while other composites exhibited an amorphous structure. In an anoxic environment, iron-reducing bacteria reduced Fe(III) and As(V) to Fe(II) and As(III), respectively, enhancing the mobility of arsenic. The presence of SOM increased the concentrations of dissolved Fe(II) and As(III) through complexation. Notably, elevated As(III) and reduced Fe(II) were observed in the HA-containing coprecipitation group due to the weak adsorption capacity of crystalline minerals, which released As(V) into solution and competed with Fe(III) for electrons. Under oxic conditions, superoxide, hydrogen peroxide, and hydroxyl radical (OH) were formed through the oxidation of Fe(II) and reduced SOM. As(III) was subsequently oxidized by superoxide and •OH, and the process was dominated by •OH. Substantial •OH in the HA-containing coprecipitation group mainly oxidized dissolved As(III), while limited •OH in other groups contributed greater to adsorbed As(III). These findings contribute substantially to understanding the mechanisms of the coupled transformation of iron and arsenic in soil under fluctuating redox conditions.

Authors: Ruixia Han, Zhe Wang, Jitao Lv, Kaiwen He, Siyao Liu, Zhe Zhu, Jerome Nriagu, H Henry Teng, Yong-Guan Zhu, Gang Li

Full Source: Environmental science & technology 2025 Mar 28. doi: 10.1021/acs.est.5c00696.

Unraveling the complexity of organophosphorus pesticides: Ecological risks, biochemical pathways and the promise of machine learning

2025-03-27

Organophosphorus pesticides (OPPs) are widely used in agriculture but pose significant ecological and human health risks due to their persistence and toxicity in the environment. While microbial degradation offers a promising solution, gaps remain in understanding the enzymatic mechanisms, degradation pathways, and ecological impacts of OPP transformation products. This review aims to bridge these gaps by integrating traditional microbial degradation research with emerging machine learning (ML) technologies. We hypothesize that ML can enhance OPP degradation studies by improving the efficiency of enzyme discovery, pathway prediction, and ecological risk assessment. Through a comprehensive analysis of microbial degradation mechanisms, environmental factors, and ML applications, we propose a novel framework that combines biochemical insights with data-driven approaches. Our review highlights the potential of ML to optimize microbial strain screening, predict degradation pathways, and identify key active sites, offering innovative strategies for sustainable pesticide management. By integrating traditional research with cutting-edge ML technologies, this work contributes to the journal's scope by promoting eco-friendly solutions for environmental protection and pesticide pollution control.

Organophosphorus pesticides (OPPs) are widely used in agriculture but pose significant ecological and human health risks due to their persistence and toxicity in the environment.

Authors: Zhongtian Dong, Yining Zhu, Ruijie Che, Tao Chen, Jie Liang, Mingzhu Xia, Fenghe Wang

Full Source: The Science of the total environment 2025 Mar 27:974:179206. doi: 10.1016/j.scitotenv.2025.179206.

Dynamic Characteristics of Metabolism and Small Extracellular Vesicles during Malignant Transformation of BEAS-2B Cells Induced by Coal Tar Pitch Extract

2025-03-26

Lung cancer poses a significant global burden with rising morbidity and mortality. Coal tar pitch-induced lung cancer is an occupational disease where early detection is crucial but challenging due to unclear pathogenesis. We established a malignant transformation model using BEAS-2B cells treated with coal tar pitch extract (CTPE). Macro- and micro-observations showed CTPE-induced alterations, including changes in cell morphology, enhanced proliferation and migration abilities, upregulated EGFR expression, modified levels of CYP1A1 and GSTM1 metabolizing enzymes, and a transition towards a mesenchymal phenotype. These findings strongly suggest that the cells have undergone malignant transformation. Metabolomics analysis revealed changes in 1120 metabolites, with 31 co-expressed, mainly in energy and amino acid metabolism. Small extracellular vesicles (SEVs) concentrations and EGFR levels were significantly altered. Correlation analysis identified a relationship between these biomarkers, implying their potential

Lung cancer poses a significant global burden with rising morbidity and mortality.

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significance as early events in the initiation and progression of lung cancer. These findings provide valuable insights and a rationale for lung cancer screening and mechanistic investigations, thereby contributing to a deeper understanding of the disease.
Authors: Xia Liu, Lihua Ding, Aiai Zhang, Feifei Feng, Fang Zhou, Yongjun Wu
Full Source: Environmental pollution (Barking, Essex : 1987) 2025 Mar 26:126108. doi: 10.1016/j.envpol.2025.126108.

ENVIRONMENTAL RESEARCH

Ecotoxic effect of mycogenic silver nanoparticles in water and soil environment

2025-03-28
Silver nanoparticles (AgNPs) are one of the most widely used nanomaterials due to their antimicrobial properties. Among the AgNPs synthesis methods, the biological route has become preferable because of its efficiency and eco-friendly character. Filamentous fungi can be successfully used in biosynthesis of AgNPs. The extensive application of AgNPs and their ever increasing production raise concerns about their environmental safety. AgNPs can be released during manufacturing processes or by leaching from AgNPs-supplemented products, and then enter the natural environment. Water and soil ecosystems are most exposed to the AgNPs presence. The present study aimed at evaluating the ecotoxicological potential of AgNPs derived from Gloeophyllum striatum fungus. The assessment was performed using organisms from water and soil ecosystems. Our results suggest that the presence of AgNPs can threaten the organisms inhabiting exposed ecosystems and the adverse effects of AgNPs differ depending on the organism species. Freshwater crustacean Daphnia magna was found to be the most sensitive among the tested species with EC50 values ranging 0.026-0.027 µg/mL after 48 h exposure. Crop plants were the least affected by the presence of AgNPs with EC50 values above tested AgNPs concentration range. Moreover, it was noted that ecotoxicological potential varied depending on the AgNPs synthesis scheme and these differences were the most visible in the case of S. polyrhiza.
Authors: Aleksandra Tończyk, Katarzyna Niedziałkowska, Katarzyna Lisowska
Full Source: Scientific reports 2025 Mar 28;15(1):10815. doi: 10.1038/s41598-025-95485-x.

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PHARMACEUTICAL/TOXICOLOGY

Plasma perfluoroalkyl substances and breast cancer risk in Brazilian women: a case-control study

2025-03-28
Background: Per- and polyfluoroalkyl substances (PFAS) are persistent environmental pollutants, and have been detected in human blood. Although PFAS may increase the risk of breast cancer in humans, findings from previous epidemiological studies on the link between PFAS and breast cancer are controversial. Additionally, most studies of PFAS to date did not distinguish between isomers. Here, we examined the association of PFAS exposure and breast cancer risk in Brazilian women, who represent a racially and ethnically diverse group.
Methods: We conducted a case-control study of 471 women with breast cancer and 471 matched controls attending hospitals in São Paulo, Brazil from 2001 to 2006. Plasma concentrations of PFAS congeners were measured using in-port arylation gas chromatography-isotope dilution mass spectrometry with electron capture negative ionization. Linear and branched PFAS isomers were isolated and quantified separately. We derived multivariable-adjusted odds ratios and 95% confidence intervals for breast cancer and hormone-receptor subtypes according to plasma PFAS concentration.
Results: In overall analyses, higher plasma concentrations of n-perfluoroheptane sulfonate (n-PFHpS), perfluoro-3-methyl-heptane sulfonate (3 m-PFOS), and n-perfluorononanoic acid were significantly associated with increased risk of breast cancer. Adjusted odds ratios for low, medium, and high n-PFHpS concentrations were 1.00, 1.28, and 2.00 (95% confidence interval = 1.15, 3.48), respectively (P for trend = 0.015). Furthermore, plasma 3 m-PFOS concentration and total perfluorooctanoic acid concentration were significantly associated with increased risk of breast cancer among mixed-ethnicity women. In Caucasian women, a higher plasma perfluoro-4-methyl-heptane sulfonate concentration was also associated with increased risk of breast cancer. Increased plasma n-PFHpS concentration was significantly associated with higher risk of hormone receptor-positive breast cancer but not with increased risk of hormone receptor-negative breast cancer.
Conclusions: Several plasma PFAS appear to increase the risk of breast cancer. Our findings suggest the importance of isomer analysis, subgroup analysis by ethnicity, and breast cancer subtype analysis for accurately characterizing this risk.

Clinical trial number: Not applicable.
Authors: Hiroaki Itoh, Kouji H Harada, Gerson Shigeaki Hamada, Zhaoqing Lyu, Tomoko Fujitani, Mariko Harada Sassa, Taiki Yamaji, Shoichiro Tsugane, Motoki Iwasaki
Full Source: Environmental health: a global access science source 2025 Mar 28;24(1):13. doi: 10.1186/s12940-025-01168-5.

Recycling process of decoration and demolition waste is a neglected source for emerging concerns in particulate phase: PAHs as an example

2025-03-25
Decoration and demolition waste (DDW) has been widely studied because of its annual surge in output, complex composition, and high utilization potential. DDW recycling is a key element of circular economy, with the potential for emerging pollutants in the particulate phase. Thus, this study selected polycyclic aromatic hydrocarbons (PAHs) as the representative and investigated their emission characteristics and occupational risk in the particulate phase, including 2.5-μm (PM2.5), inhalable (PM10), total suspended particles (TSP), and dust samples of different sizes (75-100 μm, 50-75 μm, and < 50 μm), from dust collectors during DDW recycling. Acenaphthylene (Acy), chrysene (Chr), benz[a]anthracene (BaA), fluoranthene (Fla), pyrene (Pyr), phenanthrene (Phe) were detected in all samples. PM2.5 and dust in 75-100 μm own the highest total occupation risk of 1.51 × 10-13 and 2.07 × 10-15, respectively. Chr and BaA had the control priority with the converted toxicity of 162.82 ng/g and 233.35 ng/g. Moreover, nontarget screening was applied to mining out isophorone, benzophenone, and other carcinogenic micropollutants in the PM2.5, PM10, TSP, and dust samples. Global PAHs from DDW recycling production can reach 193.44 ± 241.80 kg/a under reasonable estimation. This study provides strong evidence that DDW recycling is a neglected source of concern in the particulate phase.
Authors: Nana Zang, Pinjing He, Hua Zhang, Xiaoxing Zhang, Fan Lü
Full Source: Environment international 2025 Mar 25:198:109393. doi: 10.1016/j.envint.2025.109393.

PCDD/Fs in human tissues: A review of global biomonitoring data

2025-03-27
This review investigates the concentrations of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) in internal human organs and tissues - excluding blood - with a particular focus on adipose tissue studies conducted worldwide up to January 2025. A thorough analysis of published literature highlights significant geographical and temporal trends in human PCDD/F exposure, including potential associations between PCDD/F levels and various health conditions. Several research gaps are identified, and proposals for future studies are given. Studies from Europe, Asia, and North America demonstrated a general decline in tissue PCDD/F concentrations over recent decades, particularly from the 1970s to early 2000s, attributed to successful emission control measures. Adipose tissue PCDD/F levels were typically higher in industrialized regions, with occupational exposure studies showing significantly elevated concentrations compared to the general population. Notable regional variations were observed, with some Asian countries continuing to show relatively high PCDD/F levels despite the overall declining trend. The review also highlighted potential associations between PCDD/F exposure and various health conditions, including endometriosis and cryptorchidism, though causal relationships remain unclear. Physiologically Based Pharmacokinetic (PBPK) modeling studies estimate valuable insights into the distribution and accumulation of these compounds in human tissues. Research gaps identified include limited data from developing countries and other underrepresented regions. It is also important to acknowledge the variability in analytical methods and reporting units across the reviewed studies, which may complicate direct comparisons of results. This review emphasizes the importance of continued biomonitoring efforts, particularly in underrepresented regions, to track exposure trends and protect vulnerable populations.
Authors: Jose L Domingo, Martí Nadal
Full Source: Chemosphere 2025 Mar 27:377:144345. doi: 10.1016/j.chemosphere.2025.144345.

OCCUPATIONAL

Effects of urban airborne particulate matter exposure on the human upper respiratory tract microbiome: a systematic review

2025-03-28
Exposure to air pollutants has a direct impact on human health, resulting in increased mortality rates. Airborne particulate matter (PM) has major adverse effects on health and can be classified as high-risk respiratory particles (fine/PM2.5, aerodynamic diameter < 2.5 μm) or thoracic particles

(coarse/PM10, aerodynamic diameter < 10 µm). In addition, airborne PM can carry microbial communities that alter the commensal microbiota and lead to dysbiosis. Our aim was to synthesize the current research evidence describing the association between air pollution exposure and the microbiome composition of the upper respiratory tract (URT) of the adult population. In this work, a systematic search of the PubMed, EMBASE and Scopus databases was conducted. A total of 9 studies published from 2018 to 2023 were included. 66.5% of the participants were exposed to PM2.5 concentrations higher than 40 µg/m3, and data showed that PM2.5 atmospheric levels were positively correlated with PM10 ($rs = 0.95$, $p < 0.001$). All the reviewed studies performed 16S rRNA sequencing of the V3-V4 region from URT samples, using different methods. Overall, evidence of URT microbiome alterations after high PM exposure was observed, with seasonal and geographical influence. Discordant findings were found about bacterial diversity, with a predominant decrease after exposure to high PM levels. Regarding microbiome composition, the relative abundance of the Actinobacteria phylum declined following exposure to high levels of PM, but that of Bacteroidetes and Fusobacteria increased. The studies showed a low-middle risk of bias due to heterogeneity regarding sample processing, sequencing methods, and confounder control. To confirm the observed evidence of an association between PM levels and alterations in the URT microbiome, we strongly recommend that future research work be conducted in accordance with standard guidelines for reporting microbiome studies. In summary, the entry of fine and coarse particles into the URT is associated with microbial dysbiosis, increasing the risk of developing respiratory diseases and allergies. Prospero registration: This systematic review was registered on PROSPERO (CRD42023416230).

Authors: Sonia Arca-Lafuente, Beatriz Nuñez-Corcuera, Rebeca Ramis, Spyros Karakitsios, Denis Sarigiannis, Saúl García Dos Santos, Amanda Fernández-Rodríguez, Verónica Briz

Full Source: Respiratory research 2025 Mar 28;26(1):118. doi: 10.1186/s12931-025-03179-9.

Quantitative microbial risk assessment of pathogen exposure from rainwater used in high-pressure vehicle washing

2025-03

A literature-based quantitative microbial risk assessment (QMRA) was performed for the fit-for-purpose use of roof-collected rainwater in high-pressure vehicle washing. Our exposure assessment combined

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estimates of enteric pathogens in roof runoff (available for Salmonella, Campylobacter, and Giardia spp.) with an experimental study that directly measured vehicle washing exposure doses via a conserved tracer. For dose-response modeling, we considered a disability-adjusted life year (DALY) endpoint to capture the disease burden of potential pathogen infections. Annual risks for domestic and occupational scenarios were compared to a 10-6 DALY per person per year (ppy) benchmark using either untreated water or water treated to achieve previously reported log reduction targets (LRTs) for other forms of non-potable use. Combined across pathogens, vehicle washing using untreated roof-collected rainwater resulted in 95th percentile risks of 10-1.4 and 10-2.4 DALY ppy for occupational and recreational exposures, respectively, exceeding the selected benchmark. Treatment following indoor use or irrigation LRTs met the benchmark for domestic but not occupational use, suggesting that home vehicle washing can be included with other non-potable uses following existing treatment guidances. We also calculated new setting-specific LRTs for both scenarios (1.0-3.5 for domestic and 3.0-5.5 for occupational depending on pathogen), providing explicit risk-based treatment guidance for these applications.

Authors: John M Johnston, Michael A Jahne

Full Source: Journal of water and health 2025 Mar;23(3):428-438. doi: 10.2166/wh.2025.365.

Oil spill cleanup related exposures to benzene, toluene, ethylbenzene, xylenes, and n-hexane and incident diabetes mellitus

2025-03-26

Background and objectives: Exposure to benzene, toluene, ethylbenzene, xylenes, and n-hexane (BTEX-H) may contribute to the development of diabetes. Oil spill response and cleanup (OSRC) workers are exposed to BTEX-H but there are few relevant studies. We studied incident diabetes over 10 years of follow-up among OSRC workers.

Methods: This analysis includes 21,726 participants (82.2% male, mean age 39.9 years; 66.5% White race) in the Gulf Long-term Follow-up Study - a prospective cohort of Deepwater Horizon (DWH) oil spill OSRC workers followed from 2011-2013 through 2021. Individual estimates of cumulative work-related exposures to specific BTEX-H chemicals and an aggregate sum (total BTEX-H) were derived from a job-exposure matrix that linked exposure group estimates derived from exposure measurements to self-reported DWH work histories. We used Cox models to estimate associations of quartiles of exposure to individual BTEX-H

chemicals and total BTEX-H with diabetes incidence. We used quantile-based g-computation, quantifying associations with exposure to the BTEX-H chemicals, treating them as separate components in a mixture. We examined differences in associations by neighborhood disadvantage using the Area Deprivation Index (ADI) and by self-classified race in stratified analyses.
Results: Exposure to the BTEX-H chemicals was associated with diabetes, with elevated hazard ratios for third and fourth quartiles of exposure compared to the first quartile. For example, total BTEX-H, Q3 and Q4 HRs were 1.10 95%CI (0.91, 1.33) and 1.27 95%CI (1.05, 1.53), respectively. The HR associated with a three-quartile increase in the BTEX-H mixture was 1.31 95%CI (1.07, 1.59). Stratified analyses showed little variation by race and suggestions of variation by ADI.
Conclusion: Exposures to BTEX-H chemicals were associated with incident diabetes among OSRC workers for the individual BTEX-H chemicals, total BTEX-H, and the BTEX-H mixture. The range of exposures in this study make these findings relevant to other low to moderate exposure settings.
Authors: Hanna V Jardel, Alexander P Keil, Chantel L Martin, David B Richardson, Mark R Stenzel, Patricia A Stewart, Kate E Christenbury, Lawrence S Engel, Dale P Sandler
Full Source: Environmental research 2025 Mar 26:121487. doi: 10.1016/j.envres.2025.121487.