CHEMWATCH

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CONTACT US

subscribers@chemwatch.net
tel +61 3 9572 4700
fax +61 3 9572 4777

1227 Glen Huntly Rd
Glen Huntly
Victoria 3163 Australia

CHEMICAL EFFECTS

Indoor PM from residential coal combustion: Levels, chemical composition, and toxicity

2024-02-08

Indoor air quality is crucial for human health due to the significant time people spend at home, and it is mainly affected by internal sources such as solid fuel combustion for heating. This study investigated the indoor air quality and health implications associated with residential coal burning covering gaseous pollutants (CO, CO2 and total volatile organic compounds), particulate matter, and toxicity. The PM10 chemical composition was obtained by ICP-MS/OES (elements), ion chromatography (water-soluble ions) and thermal-optical analysis (organic and elemental carbon). During coal combustion, PM10 levels were higher (up to 8.8 times) than background levels and the indoor-to-outdoor ratios were, on average, greater than unity, confirming the existence of a significant indoor source. The chemical characterisation of PM10 revealed increased concentrations of organic carbon and elemental carbon during coal combustion as well as arsenic, cadmium and lead. Carcinogenic risks associated with exposure to arsenic exceeded safety thresholds. Indoor air quality fluctuated during the study, with varying toxicity levels assessed using the Aliivibrio fischeri bioluminescence inhibition assay. These findings underscore the importance of mitigating indoor air pollution associated with coal burning and highlight the potential health risks from long-term exposure. Effective interventions are needed to improve indoor air quality and reduce health risks in coal-burning households.

Authors: Estela D Vicente, Ana I Calvo, Tsend-Ayush Sainnokhoi, Nora Kováts, Ana Sánchez de la Campa, Jesús de la Rosa, Fernanda Oduber, Teresa Nunes, Roberto Fraile, Mário Tomé, Célia A Alves

Full Source: The Science of the total environment 2024 Feb 8:918:170598. doi: 10.1016/j.scitotenv.2024.170598.

The potential health risks of N,N-dimethylformamide: An updated review

2024-02-10

N,N-dimethylformamide (DMF) is a universally used industrial material with exponential growth in production and consumption worldwide. The frequently reported occupational DMF poisoning cases in some countries and the gradually recognized unavoidable health risks to the general population highlight that DMF should still be a matter of concern.

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Previous studies have demonstrated that the liver is the primary target organ of DMF exposure and multiple mechanisms have been revealed. However, most of these studies investigate the detrimental effects of acute and subacute DMF exposure, while the effects of chronic DMF exposure are rarely studied. Furthermore, the key mechanism for the acute hepatotoxicity of DMF remains to be elucidated. Future research may focus on the identification of efficient preventive measures against the toxicity of DMF to occupational workers, the investigation of the detrimental effects of DMF at environmentally relevant doses, and the studies on the elimination and recycling of DMF in industrial wastes. Herein, we present an updated review of the metabolism of DMF, the biomarker of DMF exposure, underlying molecular mechanisms of DMF-induced hepatotoxicity, and the toxicity of DMF to both occupational workers and general populations and discuss the possible directions in future studies.

Authors: Shu-Jun Hong, Xiu-Ning Zhang, Zhan Sun, Tao Zeng

Full Source: Journal of applied toxicology : JAT 2024 Feb 10. doi: 10.1002/jat.4590.

ENVIRONMENTAL RESEARCH

Linking antibiotic resistance gene patterns with advanced faecal pollution assessment and environmental key parameters along 2300 km of the Danube River

2024-01-31

The global spread of antimicrobial resistance (AMR) in the environment is a growing health threat. Large rivers are of particular concern as they are highly impacted by wastewater discharge while being vital lifelines serving various human needs. A comprehensive understanding of occurrence, spread and key drivers of AMR along whole river courses is largely lacking. We provide a holistic approach by studying spatiotemporal patterns and hotspots of antibiotic resistance genes (ARGs) along 2311 km of the navigable Danube River, combining a longitudinal and temporal monitoring campaign. The integration of advanced faecal pollution diagnostics and environmental and chemical key parameters allowed linking ARG concentrations to the major pollution sources and explaining the observed patterns. Nine AMR markers, including genes conferring resistance to five different antibiotic classes of clinical and environmental relevance, and one integrase gene were determined by probe-based qPCR. All AMR targets could be quantified in Danube River water, with intI1 and sul1 being ubiquitously abundant, qnrS, tetM,

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blaTEM with intermediate abundance and blaOXA-48like, blaCTX-M-1 group, blaCTX-M-9 group and blaKPC genes with rare occurrence. Human faecal pollution from municipal wastewater discharges was the dominant factor shaping ARG patterns along the Danube River. Other significant correlations of specific ARGs were observed with discharge, certain metals and pesticides. In contrast, intI1 was not associated with wastewater but was already established in the water microbiome. Animal contamination was detected only sporadically and was correlated with ARGs only in the temporal sampling set. During temporal monitoring, an extraordinary hotspot was identified emphasizing the variability within natural waters. This study provides the first comprehensive baseline concentrations of ARGs in the Danube River and lays the foundation for monitoring future trends and evaluating potential reduction measures. The applied holistic approach proved to be a valuable methodological contribution towards a better understanding of the environmental occurrence of AMR.

Authors: Iris Schachner-Groehs, Michael Koller, Melanie Leopold, Claudia Kolm, Rita B Linke, Stefan Jakwerth, Stoimir Kolarević, Margareta Kračun-Kolarević, Wolfgang Kandler, Michael Sulyok, Julia Vierheilig, Marwene Toumi, Rózsa Farkas, Erika Toth, Clemens Kittinger, Gernot Zarfel, Andreas H Farnleitner, A K T Kirschner

Full Source: Water research 2024 Jan 31:252:121244. doi: 10.1016/j.watres.2024.121244.

Dust-phase phthalates in university dormitories in Beijing, China: pollution characteristics, potential sources, and non-dietary oral exposure

2024-02-09

This study aimed to determine dust-phase phthalate levels in 112 dormitories of 14 universities during autumn and winter, investigate their potential sources, and estimate phthalate exposure via dust ingestion. Twelve phthalates were detected, among which di-(2-ethylhexyl) phthalate (DEHP) and dicyclohexyl phthalate (DCHP) were the most abundant, followed by di-isobutyl phthalate (DiBP) and di-n-butyl phthalate (DnBP). The median concentrations and contributions of DCHP and DEHP were the highest. The contributions of di-n-octyl phthalate and di-nonyl phthalate were higher in winter than in autumn. Potential sources included iron furniture, chemical fiber textiles, clothes, and personal care products. Medium-density fiberboard furniture is a potential sink for phthalates. In two seasons, DEHP, DCHP, DiBP, and DnBP were the main phthalates ingested by college students . The median oral exposure of ten

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phthalates was higher in females than in males. College students have a high risk of exposure to DEHP in dormitories.

Authors: Ruixin Zhang, Fang Liu, Lixin Wang, Zaixing Wu, Liujia Fan, Bing Liu, Hong Shang

Full Source: International journal of environmental health research 2024 Feb 9:1-19. doi: 10.1080/09603123.2024.2313184.

Microplastic contamination in the agricultural soil-mitigation strategies, heavy metals contamination, and impact on human health: a review

2024-02-10

Microplastic pollution has emerged as a critical global environmental issue due to its widespread distribution, persistence, and potential adverse effects on ecosystems and human health. Although research on microplastic pollution in aquatic environments has gained significant attention. However, a limited literature has summarized the impacts of microplastic pollution the agricultural land and human health. Therefore, In the current review, we have discussed how microplastic(s) affect the microorganisms by ingesting the microplastic present in the soil, alternatively affecting the belowground biotic and abiotic components, which further elucidates the negative effects on the above-ground properties of the crops. In addition, the consumption of these crops in the food chain revealed a potential risk to human health throughout the food chain. Moreover, microplastic pollution has the potential to induce a negative impact on agricultural production and food security by altering the physiochemical properties of the soil, microbial population, nutrient cycling, and plant growth and development. Therefore, we discussed in detail the potential hazards caused by microplastic contamination in the soil and through the consumption of food and water by humans in daily intake. Furthermore, further study is urgently required to comprehend how microplastic pollution negatively affects terrestrial ecosystems, particularly agroecosystems which drastically reduces the productivity of the crops. Our review highlights the urgent need for greater awareness, policy interventions, and technological solutions to address the emerging threat of microplastic pollution in soil and plant systems and mitigation strategies to overcome its potential impacts on human health. Based on

Microplastic pollution has emerged as a critical global environmental issue due to its widespread distribution, persistence, and potential adverse effects on ecosystems and human health.

existing studies, we have pointed out the research gaps and proposed different directions for future research.
Authors: Muhammad Tariq, Babar Iqbal, Ismail Khan, Ali Raza Khan, Eun Hea Jho, Abdul Salam, Huan Zhou, Xin Zhao, Guanlin Li, Daolin Du
Full Source: Plant cell reports 2024 Feb 10;43(3):65. doi: 10.1007/s00299-024-03162-6.

PHARMACEUTICAL/TOXICOLOGY

Occupational asbestos exposure and risk of esophageal cancer: A systematic review and meta-analysis

2024-02-10
Esophageal cancer (EC), which includes squamous cell carcinoma (ESCC) and adenocarcinoma (EAC), is an important cancer with poor prognosis and high mortality rate. Several occupational exposures have been associated with EC. We aim to investigate the association between occupational asbestos exposure and EC risk, considering types of asbestos and histology of the disease. We included studies mentioned in the list of references in previous reviews and pooled analyses, and we conducted an independent search in PubMed and Scopus. Forest plots of relative risks (RR) were constructed based on the association between occupational asbestos and EC risk. Random-effects models were used to address heterogeneity between 48 independent cohort and case-control studies. We found an association between occupational asbestos exposure and EC (meta-relative risk [RR] = 1.20, 95% confidence interval [CI] = 1.09-1.32; I2 = 58.8%, p-heterogeneity [het] <.001). The results of stratification by job (p-het = .20) indicate an increased RR among asbestos product workers (RR = 1.39, 95% CI = 1.07-1.81), asbestos applicators (RR = 1.41, 95% CI = 1.20-1.67), and construction workers (RR = 1.12, 95% CI = 1.02-1.24). There was no heterogeneity in meta-RR according to outcome (p = .29), geographic region (p = .69), year of publication (p = .59), quality score (p = .73), asbestos type (p = .93), study design (p = .87), and gender (p = .88), control for potential confounders (p = .20), year of first employment (p = .94) and exposure level (p = .43). The stratification analysis by histology type found an increased RR for both ESCC 1.33(1.03-1.71) and EAC 1.45(1.03-2.04) (p-het = .68). We didn't find evidence of publication bias (p = .07). The results of our study suggest that occupational asbestos exposure is associated with an increased risk of EC in both histology types.
Authors: Monireh Sadat Seyyedsalehi, Paolo Boffetta
Full Source: International journal of cancer 2024 Feb 10. doi: 10.1002/ijc.34881.

Esophageal cancer (EC), which includes squamous cell carcinoma (ESCC) and adenocarcinoma (EAC), is an important cancer with poor prognosis and high mortality rate.

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Environmental chemical TCPOBOP exposure alters milk liposomes and offspring growth trajectories in mice

2024-02-08
Exposure to environmental endocrine disruptors (EEDs) has become a global health concern, and EEDs are known to be potent inducers of constitutive androstane receptor (CAR). 1,4-bis [2-(3,5-dichloropyridyloxy)] benzene (TCPOBOP, hereafter abbreviated as TC), a specific ligand for CAR, has been considered as a potential EED. Here, we analyzed the effect of TC exposure to female mice on the histological morphology of their alveoli in the basic unit of lactation. We quantified differences in the milk metabolome of the control and TC-exposed group while assessing the correlations between metabolites and neonatal growth. Mammary histological results showed that TC exposure inhibited alveolar development. Based on the milk metabolomic data, we identified a total of 1505 differential metabolites in both the positive and negative ion mode, which indicated that TC exposure affected milk composition. As expected, the differential metabolites were significantly enriched in the drug metabolism pathway. Further analyses revealed that differential metabolites were significantly enriched in multiple lipid metabolic pathways, such as fatty acid biosynthesis, suggesting that most differential metabolites were concentrated in lipids. Simultaneously, a quantitative analysis showed that TC exposure led to a decrease in the relative abundance of total milk lipids, affecting the proportion of some lipid subclasses. Notably, a portion of lipid metabolites were associated with neonatal growth. Taken together, these findings suggest that TC exposure may affect milk lipidomes, resulting in the inability of mothers to provide adequate nutrients, ultimately affecting the growth and health of their offspring.
Authors: Shijia Pan, Wen Yu, Jia Zhang, Yuan Guo, Xiaoxiao Qiao, Pengfei Xu, Yonggong Zhai
Full Source: Ecotoxicology and environmental safety 2024 Feb 8:272:116061. doi: 10.1016/j.ecoenv.2024.116061.

Exposure to environmental endocrine disruptors (EEDs) has become a global health concern, and EEDs are known to be potent inducers of constitutive androstane receptor (CAR).

Long-term cadmium exposure induces epithelial-mesenchymal transition in breast cancer cells by activating CYP1B1-mediated glutamine metabolic reprogramming in BT474 cells and MMTV-Erbb2 mice

2024-02-07
Cadmium (Cd) exposure is known to enhance breast cancer (BC) progression. Cd promotes epithelial-mesenchymal transition (EMT) in BC

cells, facilitating BC cell aggressiveness and invasion, but the underlying molecular mechanisms are unclear. Hence, transgenic MMTV-Erbb2 mice (6 weeks) were orally administered Cd (3.6 mg/L, approximately equal to 19.64 μM) for 23 weeks, and BC cells (BT474 cells) were exposed to Cd (0, 0.1, 1 or 10 μM) for 72 h to investigate the effect of Cd exposure on EMT in BC cells. Chronic Cd exposure dramatically expedited tumor metastasis to multiple organs; decreased E-cadherin density; and increased Vimentin, N-cadherin, ZEB1, and Twist density in the tumor tissues of MMTV-Erbb2 mice. Notably, transcriptomic analysis of BC tumors revealed cytochrome P450 1B1 (CYP1B1) as a key factor that regulates EMT progression in Cd-treated MMTV-Erbb2 mice. Moreover, Cd increased CYP1B1 expression in MMTV-Erbb2 mouse BC tumors and in BT474 cells, and CYP1B1 inhibition decreased Cd-induced BC cell malignancy and EMT in BT474 cells. Importantly, the promotion of EMT by CYP1B1 in Cd-treated BC cells was presumably controlled by glutamine metabolism. This study offers novel perspectives into the effect of environmental Cd exposure on driving BC progression and metastasis, and this study provides important guidance for comprehensively assessing the ecological and health risks of Cd.

Authors: Jingdian Li, Peng Gao, Mingke Qin, Junhua Wang, Yan Luo, Ping Deng, Rongrong Hao, Lei Zhang, Mindi He, Chunhai Chen, Yonghui Lu, Qinlong Ma, Min Li, Miduo Tan, Liting Wang, Yang Yue, Hui Wang, Li Tian, Jia Xie, Mengyan Chen, Zhengping Yu, Zhou Zhou, Huifeng Pi

OCCUPATIONAL

Effects of wearing medical gowns at different temperatures on the physiological responses of female healthcare workers during the COVID-19 Pandemic

2024-02-06

Background: Using medical gowns with high protection against COVID-19 among healthcare workers (HCWs) may limit heat exchange, resulting in physiological challenges.

Objective: This study aimed to compare the physiological and neurophysiological responses of female HCWs when using two typical medical gowns at different temperatures during the COVID-19 pandemic.

Methods: Twenty healthy female HCWs participated in this study. Participants wore two types of medical gowns: Spunbond gown (SG) and laminate gown (LG). They walked on a treadmill in a controlled climate chamber for 30 minutes at three different temperatures (24, 28, and 32°C). Heart rate (HR), skin surface temperature (ST), clothing surface temperature (CT), ear temperature (ET), blood oxygen percentage (SaO2), galvanic skin response (GSR), and blood pressure were measured before and after walking on a treadmill. The study's results were analyzed using SPSS26.

Results: The study found that LG led to an average increase of 0.575°C in CT compared to SG at the same temperatures ($P < 0.03$). The average HR increased by 6.5 bpm in LG at 28°C compared to SG at a comfortable temperature ($P = 0.01$). The average ET in SG and GSR in LG at 32°C increased by 0.39°C and 0.25μS, respectively, compared to the comfortable temperature ($P < 0.02$).

Conclusion: The study recommends maintaining a comfortable temperature range in hospitals to prevent physiological challenges among HCWs wearing medical gowns with high protection against COVID-19. This is important because using LG, compared to SG, at high temperatures can increase HR, ET, CT, and GSR.

Authors: Sepideh Zand, Masoud Shafiee Motlagh, Rostam Golmohammadi, Mohsen Aliabadi, Leili Tapak, Mohammad Babamiri

Full Source: Work (Reading, Mass.) 2024 Feb 6. doi: 10.3233/WOR-230360.

Occupational exposure to organotin substances: Development of a liquid chromatographic separation method for 11 organotin compounds in workplace air samples via HPLC-ICP-MS

2024-02-02

Organotin compounds (OTCs) are widely regulated but rank among the most used organometallic compounds in various industrial sectors. They are significantly more toxic than inorganic tin compounds. At workplaces, OTCs can be released as vapors or dust particles and can be absorbed by inhalation or skin contact. Occupational exposure thus represents a great risk for the absorption of OTCs for employees. Methods for OTCs speciation in workplace air monitoring currently do not exist. This study describes the development of a separation method for eleven in Germany regulated OTCs via HPLC-ICP-MS. The method allows a near baseline separation of MMT, MBT, MOT, MPhT, DMT, DBT, DPhT, TMT, TBT, TPhT and TTMT within 22 min on a C18 column and a ternary solvent and flow rate gradient using methanol, acetonitrile, and ultrapure water + 6% (v/v) acetic acid + 0.17% (m/v) α-tropolone. Ten analytes show linearity in the working range of 10 - 100 μg OTCs/L with $R^2 > 0.999$. Due to its high volatility the analyte TTMT showed a quadratic relationship between concentration and signal intensity with $R^2 = 0.9998$. The determination of the instrumental limits resulted in detection limits between 0.14 and 0.57 μg Sn/L and

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Organotin compounds (OTCs) are widely regulated but rank among the most used organometallic compounds in various industrial sectors.

limits of quantification between 0.49 and 1.97 µg Sn/L. Over the course of this study thermal instability and cross reactivity of OTC in solution became apparent. Formation of two reaction products in mixed OTCs solutions have been observed. These effects will further be examined within development of appropriate sampling and sample preparation for workplace air to provide a suitable method for the determination of OTCs at workplaces according to normative references.

Authors: Carina Cläsgens, Tobias Schwank, Katrin Pitzke

Full Source: Journal of chromatography. A 2024 Feb 2:1718:464695. doi: 10.1016/j.chroma.2024.464695.