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CHEMICAL EFFECTS

Evaluation of volatile organic compound (VOC) emissions from memory foam mattresses and potential implications for consumer health risk

2022-05-16

Chemical emissions from two new memory foam mattresses were evaluated in a simulated consumer use environment over the course of 32 days. Passive 12- and 24-h samples (n = 62) were collected for various VOCs. Airborne concentrations of chemicals associated with the mattresses (2-propanol, acetone, chloromethane, toluene, and ΣVOC) peaked during the first day after installation and progressively decayed over the course of the following 31 days. Emission rates were derived using a two-phase double exponential source decay model paired with a one-compartment generalized indoor air quality model; short- and long-term emission half-lives for individual chemicals were on the order of hours (approximately 4 or 12 h) and days (approximately 24 days), respectively. Model-estimated average ΣVOC concentrations for the 32-day period of the study were approximately 20 and 33 µg/m3 for Mattress 1 and 2, respectively, while the modeled one-year average concentrations were 2.7 and 4.2 µg/m3, respectively. First-year trends for both mattresses were qualitatively similar, with the sum of 2-propanol, acetone, chloromethane, and toluene contributing to approximately 81% and 95% of the first-year ΣVOC concentration of Mattress 1 and 2, respectively. The airborne concentrations of individual chemicals and ΣVOC measured and modeled in this study were well below available health-based benchmarks for the individual chemicals and within available indoor air quality recommendations for ΣVOC, suggesting that it is unlikely that the use of the brands of mattresses evaluated in this study would pose a health risk to consumers.

Authors: E M Beckett, E Miller, K Unice, E Russman, J S Pierce

Full Source: Chemosphere 2022 May 16;134945. doi: 10.1016/j.chemosphere.2022.134945.

Chemical emissions from two new memory foam mattresses were evaluated in a simulated consumer use environment over the course of 32 days.

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Chemical composition and particle size influence the toxicity of nanoscale plastic debris and their co-occurring benzo(α)pyrene in the model aquatic organisms Daphnia magna and Danio rerio

2022-01

Little is known about how particle chemical composition and size might influence the toxicity of nanoscale plastic debris (NPD) and their co-occurring chemicals. Herein, we investigate the toxicity of 3 × 1010 particles/L polyethylene (PE, 50 nm), polypropylene (PP, 50 nm), polystyrene (PS, 200 and 600 nm), and polyvinyl chloride (PVC, 200 nm) NPD and their co-occurring benzo(a)pyrene (BaP) to Daphnia magna and Danio rerio. During the 21 days of exposure to PE 50 nm and PS 200 nm, the number of broods produced by D. magna decreased compared to other treatments. Exposure to BaP alone did not produce any effects on the reproduction of the daphnids, however, the mixture of BaP with PS (200 or 600 nm) or with PE (50 nm) reduced the number of broods. Exposure of D. rerio embryos to PE 50 nm, PS 200 nm, and PS 600 nm led to a delay in the hatching. The presence of PS 200 nm and PVC 200 nm eliminated the effects of BaP on the hatching rate of zebrafish. Our findings suggest that data generated for the toxicity of one type of NPD, e.g. PVC or PS may not be extrapolated to other types of NPD.

Authors: Fazel Abdolahpur Monikh, Manuela Durão, Pavel Vladimirovich Kipriianov, Hannu Huuskonen, Jukka Kekäläinen, Silva Uusi-Heikkilä, Emilia Uurasjärvi, Jarkko Akkanen, Raine Kortet

Full Source: NanoImpact 2022 Jan;25:100382. doi: 10.1016/j.impact.2022.100382.

Little is known about how particle chemical composition and size might influence the toxicity of nanoscale plastic debris (NPD) and their co-occurring chemicals.

Influence of microplastics on the bioconcentration of organic contaminants in fish: Is the "Trojan horse" effect a matter of concern?

2022-05-14

Microplastics (MPs) have been shown to act as sorbent phases and thus carriers of organic chemicals in the aquatic environment. Therefore, concerns exist that MP ingestion increases the uptake and accumulation of organic chemicals by aquatic organisms. However, it is unclear if this pathway is relevant compared to other exposure pathways. Here we compared the bioconcentration capacity of two hydrophobic organic chemicals (i.e., chlorpyrifos and hexachlorobenzene) in a freshwater fish (Danio rerio) when exposed to chemicals through water only and in combination with contaminated polyethylene MPs. Additionally, a suite

of biomarker analyses (acetylcholine esterase, glutathione S-transferase, alkaline phosphatase, catalase) was carried out to test whether MPs can enhance the toxic stress caused by chemicals. Two 14-day semi-static experiments (one for each chemical) were carried out with adult fish. Each experiment consisted of (1) a control treatment (no chemicals, no MPs); (2) a treatment in which fish were exposed to chlorpyrifos or hexachlorobenzene only through water; (3) a treatment in which fish were exposed to the chemicals through water and contaminated polyethylene MPs (100 mg MP/L). Two additional treatments were included for the biomarker analysis. These contained MPs at two different concentrations (5 and 100 mg MP/L) but no chemicals. The presence of contaminated MPs in contaminated water did not enhance but rather decreased the bioconcentration of both chemicals in fish compared to the treatment that contained contaminated water in absence of MPs. This was more pronounced for hexachlorobenzene, which is more hydrophobic than chlorpyrifos. Enzyme activity levels in fish were only significantly altered in the presence of MPs for alkaline phosphatase. This study indicates that MP presence in freshwater ecosystems is not expected to increase the risks associated with chemical bioconcentration in aquatic organisms and that other exposure pathways (i.e., uptake via respiration, skin permeability) may be of higher importance.

Authors: Theresa Schell, Andreu Rico, Laura Cherta, Leonor Nozal, Raquel Dafouz, Roberto Giacchini, Marco Vighi

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 May 14;119473. doi: 10.1016/j.envpol.2022.119473.

ENVIRONMENTAL RESEARCH

Iodide sources in the aquatic environment and its fate during oxidative water treatment - A critical review

2022-06-15

Iodine is a naturally-occurring halogen in natural waters generally present in concentrations between 0.5 and 100 µg L-1. During oxidative drinking water treatment, iodine-containing disinfection by-products (I-DBPs) can be formed. The formation of I-DBPs was mostly associated to taste and odor issues in the produced tap water but has become a potential health problem more recently due to the generally more toxic character of I-DBPs compared to their chlorinated and brominated analogues. This paper is a systematic and critical review on the reactivity of iodide and on the most common intermediate reactive iodine species HOI. The first step of oxidation of I- to HOI is rapid for most oxidants (apparent second-order

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rate constant, kapp > 103 M-1s-1 at pH 7). The reactivity of hypoiodous acid with inorganic and organic compounds appears to be intermediate between chlorine and bromine. The life times of HOI during oxidative treatment determines the extent of the formation of I-DBPs. Based on this assessment, chloramine, chlorine dioxide and permanganate are of the highest concern when treating iodide-containing waters. The conditions for the formation of iodo-organic compounds are also critically reviewed. From an evaluation of I-DBPs in more than 650 drinking waters, it can be concluded that one third show low levels of I-THMs (<1 µg L-1), and 18% exhibit concentrations > 10 µg L-1. The most frequently detected I-THM is CHCl2I followed by CHBrClI. More polar I-DBPs, iodoacetic acid in particular, have been reviewed as well. Finally, the transformation of iodide to iodate, a safe iodine-derived end-product, has been proposed to mitigate the formation of I-DBPs in drinking water processes. For this purpose a pre-oxidation step with either ozone or ferrate(VI) to completely oxidize iodide to iodate is an efficient process. Activated carbon has also been shown to be efficient in reducing I-DBPs during drinking water oxidation.

Authors: Henry MacKeown, Urs von Gunten, Justine Criquet

Full Source: Water research 2022 Jun 15;217:118417. doi: 10.1016/j.watres.2022.118417.

PHARMACEUTICAL/TOXICOLOGY

A user-friendly tool to assess combined exposures to indoor air pollutants in public spaces of children

2022-05-16

This manuscript describes the methodology for and early experience in the application of a screening tool to assess health risks from combined exposure to indoor air pollutants in public settings for children such as schools, kindergartens and day-care centres. The user-friendly tool incorporates tiers modified from those of the World Health Organization (WHO) framework for risk assessment of combined exposure to multiple chemicals and includes a spreadsheet for risk calculation as well as a supporting toxicological database of guidance values and points of departure (PODs) for inhalation for selected effects. Supporting resources on exposure assessment include a screening questionnaire to identify optimum sampling strategies and standardized analytical methods. The approach to assessment of combined exposure within the screening tool, including decision rules, assumptions and limitations/uncertainties is addressed, as is the nature of health-effects and reference/toxicity

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values prioritized for inclusion in the associated toxicological database. Results of early experience in application illustrate how the screening tool contributes as an important component in strategies to assess and manage indoor air pollution in public settings for children.
Authors: M E Bette Meek, Katleen De Brouwere, Tamas Szigeti, I Zastenskaya
Full Source: Food and chemical toxicology : an international journal published for the British Industrial Biological Research Association 2022 May 16;113141. doi: 10.1016/j.fct.2022.113141.

Health-related toxicity of emerging per- and polyfluoroalkyl substances: Comparison to legacy PFOS and PFOA

2022-05-13
Per- and polyfluoroalkyl substances (PFAS) are highly persistent, manufactured chemicals used in various manufacturing processes and found in numerous commercial products. With over 9000 compounds belonging to this chemical class, there is increasing concern regarding human exposure to these compounds due to their persistent, bioaccumulative, and toxic nature. Human exposure to PFAS may occur from a variety of exposure sources, including, air, food, indoor dust, soil, water, from the transfer of PFAS from non-stick wrappers to food, use of cosmetics, and other personal care products. This critical review presents recent research on the health-related impacts of PFAS exposure, highlighting compounds other than Perfluorooctanoic acid (PFOA) and Perfluoroctane sulfonate (PFOS) that cause adverse health effects, updates the current state of knowledge on PFAS toxicity, and, where possible, elucidates cause-and-effect relationships. Recent reviews identified that exposure to PFAS was associated with adverse health impacts on female and male fertility, metabolism in pregnancy, endocrine function including pancreatic dysfunction and risk of developing Type 2 diabetes, lipid metabolism and risk of childhood adiposity, hepatic and renal function, immune function, cardiovascular health (atherosclerosis), bone health including risk for dental cavities, osteoporosis, and vitamin D deficiency, neurological function, and risk of developing breast cancer. However, while cause-and-effect relationships for many of these outcomes were not able to be clearly elucidated, it was identified that 1) the evidence derived from both animal models and humans suggested that PFAS may exert harmful impacts on both animals and humans, however extrapolating data from animal to human studies was complicated due to differences in exposure/elimination kinetics, 2) PFAS precursor kinetics and toxicity mechanism data are still limited despite ongoing exposures, and 3) studies

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in humans, which provide contrasting results require further investigation of the long-term-exposed population to better evaluate the biological toxicity of chronic exposure to PFAS.
Authors: Lore Jane L Espartero, Miko Yamada, Judith Ford, Gary Owens, Tarl Prow, Albert Juhasz
Full Source: Environmental research 2022 May 13;212(Pt C):113431. doi: 10.1016/j.envres.2022.113431.

OCCUPATIONAL

Association between exposure to a mixture of benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS) and small airways function: A cross-sectional study

2022-05-18
Background: The lung is one of the primary target organs of benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS). Small airways dysfunction (SAD) might be a sensitive indicator of early chronic respiratory disease. Here, we explored the relationships between exposure to BTEXS and small airways function, and identified the priority pollutants in BTEXS mixtures. Methods: 635 petrochemical workers were recruited. Standard spirometry testing was conducted by physicians. The cumulative exposure dose (CED) of BTEXS for each worker was estimated. The peak expiratory flow (PEF), forced expiratory flow between 25 and 75% of forced vital capacity (FEF25 75%), and the expiratory flow rate found at 25%, 50%, and 75% of the remaining exhaled vital capacity (MEF25%, MEF50%, and MEF75%) were measured, SAD was also evaluated based on measured parameters. The association between exposure to BTEXS individual or mixtures and small airways function was evaluated using generalized line regression models (GLMs) and quantile g-computation models (qgcomp). Meanwhile, the weights of each homolog in the association were estimated. Results: The median CED of BTEXS are 9.624, 19.306, 24.479, 28.210, and 46.781 mg/m3·years, respectively. A unit increase in ln-transformed styrene CED was associated with a decrease in FEF25 75% and MEF50% based on GLMs. One quartile increased in BTEXS mixtures (ln-transformed) was significantly associated with a 0.325-standard deviation (SD) [95% confidence interval (CI): -0.464, -0.185] decline in FEF25 75%, a 0.529-SD (95%CI: -0.691, -0.366) decline in MEF25%, a 0.176-SD (95%CI: -0.335, -0.017) decline in MEF75%, and increase in the risk of abnormal of SAD [risk ratios (95%CI): 1.520 (95%CI: 1.143, 2.020)]. Benzene and styrene

Background:
The lung is one of the primary target organs of benzene, toluene, ethylbenzene, xylene, and styrene (BTEXS).

were the major chemicals in BTEXS for predicting the overall risk of SAD. Conclusion: Our novel findings demonstrate the significant association between exposure to BTEXS mixture and small airways function decline and the potential roles of key homologs (benzene and styrene) in SAD.
Authors: Qilong Liao, Rui Du, Rui Ma, Xin Liu, Yan Zhang, Zhaorui Zhang, Penglei Ji, Minghui Xiao, Ying Cui, Xiumei Xing, Lili Liu, Shanfeng Dang, Qifei Deng, Yongmei Xiao
Full Source: Environmental research 2022 May 18;113488. doi: 10.1016/j.envres.2022.113488.

E-waste dismantling-related occupational and routine exposure to melamine and its derivatives: Estimating exposure via dust ingestion and hand-to-mouth contact

2022-05-14
Melamine (MEL) and its derivatives are increasingly applied as nitrogenous flame retardants in consumer products. Nevertheless, limited information is available on their environmental occurrence and subsequent human exposure via multiple exposure pathways. In this study, we analysed MEL and its derivatives in dust (indication of the dust ingestion route) and hand wipe samples (indication of the hand-to-mouth route) collected in various microenvironments. The levels of ∑MELs in both dust (median: 24,100 ng/g) and participant hand samples (803 ng/m2) collected in e-waste dismantling workshops were significantly higher than those in samples collected in homes (15,600 ng/g and 196 ng/m2, respectively), dormitories (13,100 ng/g and 227 ng/m2, respectively) and hotel rooms (11,800 ng/g and 154 ng/m2, respectively). Generally, MEL dominated in dust samples collected in e-waste dismantling workshops, whereas cyanuric acid dominated in hand wipe samples. This may occur partly because the latter is an ingredient in disinfection products, which are more frequently employed in daily lives during the COVID-19 pandemic. Exposure assessment suggests that dust ingestion is an important exposure pathway among dismantling workers and the general population, whereas hand-to-mouth contact could not be overlooked in certain populations, such as children and dismantling workers not wear gloves at work.

Melamine (MEL) and its derivatives are increasingly applied as nitrogenous flame retardants in consumer products.

Authors: Leicheng Zhao, Yuan Lu, Hongkai Zhu, Zhipeng Cheng, Yu Wang, Hao Chen, Yiming Yao, Jingran Zhang, Xiaoxiao Li, Zhaoyang Sun, Chong Zhang, Hongwen Sun
Full Source: Environment international 2022 May 14;165:107299. doi: 10.1016/j.envint.2022.107299.

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How long-term metal and lead exposure among foundry workers affect COVID-19 infection outcomes in Jordan

2022-05-19
Foundry workers face a number of occupational health hazards, which may lead to an increased risk of respiratory disease, cancer, and anxiety level and are associated with endocrine, hematologic, renal, and neurological problems in humans. This study aims to evaluated thyroid functions, glutathione level, and the risk of infection with SARS-CoV-2 after vaccinated (two doses of the BNT162b2 mRNA COVID-19 vaccine) foundry workers in Jordan. We examined the efficacy BNT162b2 vaccine by calculating the rate of mortality and the degree of severity from mild to severe respiratory infections in 105 adult males foundry workers occupationally exposed to metals and Pb who had been received two doses, 21 days apart, of the BNT162b2 vaccine. Seventy-five male subjects not exposed to the Pb and who received two shots of the BNT162b2 vaccine (Pfizer-BioNTech) served as the control group. In foundry workers who were infected with COVID-19, the mortality rate (0%) was similar as in the control group (0%), and increased transmission of infection with SARS-CoV-2; the non-hospitalized infections increased nearly 3.4-times and hospitalized infections increased 4.29-times among people exposed to lead and metal contamination compared to the healthy persons control group. Also, among the foundry workers, the blood lead, FT3, and FT4 levels were significantly higher ($p < 0.0001$) and the levels of glutathione and TSH were significantly decreased ($p < 0.0001$) compared with the control group. In conclusion, long-term exposure to Pb is associated with a risk of infection with COVID-19 despite the 2 doses of the BNT162b2 vaccine (Pfizer-BioNTech). Also, exposure to Pb is associated with hyperthyroidism and a reduction in glutathione.

Foundry workers face a number of occupational health hazards, which may lead to an increased risk of respiratory disease, cancer, and anxiety level and are associated with endocrine, hematologic, renal, and neurological problems in humans.

Authors: Mohamed Saadh
Full Source: Environmental science and pollution research international 2022 May 19;1-5. doi: 10.1007/s11356-022-20845-3.

Underground salt and potash workers exposed to nitrogen oxides and diesel exhaust: assessment of specific effect biomarkers

2022-05-18
Purpose: Occupational exposure limits (OEL) for nitrogen oxides (NO, NO2) and diesel exhaust (EC-DPM) were reassessed by the German authorities in 2016/2017. We performed a clinical cross-sectional study among salt and potash underground workers exposed to these substances

at relatively high levels to examine possible indicators of acute effects on workers' health. Methods: We measured post- versus pre-shift differences in cardiovascular, inflammatory, immune, and respiratory effect biomarkers and assessed their associations with personal exposures measured during the same shift. We also compared post- versus pre-shift differences in biomarker levels between exposure groups defined based on work site and job type. Results: None of the above-ground workers exceeded the OEL for NO2 and only 5% exceeded the OEL for EC-DPM exposure. Among underground workers, 33% of miners and 7% underground maintenance workers exceeded the OEL for NO2; the OEL for EC-DPM was exceeded by 56% of miners and 17% of maintenance workers. Some effect biomarkers (thrombocytes, neutrophils, MPO, TNF-α, IgE, FeNO) showed statistically significant differences between pre- versus post-shift measurements; however, there were no consistent associations between pre- and post-shift differences and exposure group or personal exposure measurements during the shift. Conclusions: We did not find evidence of associations between workplace exposure to NO, NO2 or EC-DPM and clinically relevant indicators of acute cardiovascular, inflammatory and immune, or respiratory effects among salt and potash underground workers in Germany.

Authors: Lisa Gamrad-Streubel, Lisa-Marie Haase, Katharina K Rudolph, Katrin Rühle, Annette M Bachand, Lori Crawford, Kenneth A Mundt, Jürgen Bünger, Dirk Pallapies, Dirk Taeger, Swaantje Casjens, Anja Molkenthin, Savo Neumann, Jörg Giesen, Volker Neumann, Thomas Brüning, Thomas Birk

Full Source: International archives of occupational and environmental health 2022 May 18. doi: 10.1007/s00420-022-01876-2.