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CHEMICAL EFFECTS

Deep eutectic solvents for the determination of endocrine disrupting chemicals

2023-11-04

The harmful effects of endocrine disrupting chemicals (EDCs) to humans and other organisms in the environment have been well established over the years, and more studies are ongoing to classify other chemicals that have the potential to alter or disrupt the regular function of the endocrine system. In addition to toxicological studies, analytical detection systems are progressively being improved to facilitate accurate determination of EDCs in biological, environmental and food samples. Recent microextraction methods have focused on the use of green chemicals that are safe for analytical applications, and present very low or no toxicity upon disposal. Deep eutectic solvents (DESs) have emerged as one of the viable alternatives to the conventional hazardous solvents, and their unique properties make them very useful in different applications. Notably, the use of renewable sources to prepare DESs leads to highly biodegradable products that mitigate negative ecological impacts. This review presents an overview of both organic and inorganic EDCs and their ramifications on human health. It also presents the fundamental principles of liquid phase and solid phase microextraction methods, and gives a comprehensive account of the use of DESs for the determination of EDCs in various samples.

Authors: Dotse Selali Chormey, Buse Tuğba Zaman, Tülay Borahan Kustanto, Sezin Erarpat Bodur, Süleyman Bodur, Elif Özturk Er, Sezgin Bakırdere

Full Source: Talanta 2023 Nov 4;268(Pt 2):125340. doi: 10.1016/j.talanta.2023.125340.

The harmful effects of endocrine disrupting chemicals (EDCs) to humans and other organisms in the environment have been well established over the years, and more studies are ongoing to classify other chemicals that have the potential to alter or disrupt the regular function of the endocrine system.

Participant-collected household dust for assessing microorganisms and semi-volatile organic compounds in urban homes

2023-11-10

Dust samples collected by researchers and study participants from 43 U.S. urban homes were analyzed and compared to evaluate the feasibility of using participant-collected samples to assess indoor environmental exposures. The microbial and chemical composition of participant-collected (and shipped) samples were compared to researcher-collected samples from the same household, using dust recovered from each home's

heating, ventilation, and air conditioning (HVAC) filter. The bacterial and fungal communities present in all dust samples were determined via MiSeq 16S and ITS sequencing, and the concentrations of 27 semi-volatile organic compounds (7 orthophosphates, 6 phthalates, and 14 brominated flame retardants) were determined via GC-MS. Self-report data on the home environment was collected via an online survey of study participants. While the researcher-collected samples (RCS) yielded greater mass than the participant-collected samples (PCS), the alpha and beta diversities of the bacterial and fungal communities recovered in the RCS and PCS were not significantly different, indicating that PCS is a viable option for indoor microbiome studies of residential homes. The microbial communities recovered in both cases reflected the dominance of human-associated bacterial taxa and outdoor-associated fungal taxa with similar pathogen-associated taxa present in each sample type. In both PCS and RCS, the amount of carpet in the home and the frequency of bleach use had a significant effect on the composition of fungal communities. Semi-volatile organic compounds (SVOCs) of potential human health concern, were commonly detected in the homes. Organophosphates and phthalates were recovered at a similar frequency in both PCS and RCS. Measured SVOC concentration levels were consistent with previous indoor studies although differences were observed between PCS and RCS for several SVOCs. This study demonstrates the potential and challenges associated with participant-collected dust samples for indoor environment studies.

Authors: D Jarma, J P Maestre, J Sanchez, S Brodfuehrer, L E Katz, S Horner, K A Kinney

Full Source: The Science of the total environment 2023 Nov 10:908:168230. doi: 10.1016/j.scitotenv.2023.168230.

Plants are known to be the natural factory for the production of flavor chemicals.

Radiocarbon (14C) accelerator mass spectrometry as a convenient tool for differentiation of flavor chemicals of synthetic origin from biobased sources and their in-vivo toxicity assessment

2023-11-09

Plants are known to be the natural factory for the production of flavor chemicals. Essential oils comprised of aldehyde as a functional group are potent in deciphering flavor effects in beverages and fresh and prepared food products. In the majority, these are manufactured through synthetic routes, resulting in high product carbon footprints or CO2 equivalents in total greenhouse gas emission. FDA has banned some of the synthetic flavor chemicals due to the health hazards associated with them. However, consumer's preference for natural is at stake due to the absence of quantitative traceability tools. The accelerator mass spectrometer (AMS) analysis revealed a distinction between natural and fossil-derived citral and its blends in Cymbopogon essential oils. The plant-derived citral contained a percent modern carbon (pMC) value in the range of 99-100 %. In contrast, the fossil fuel-derived citral showed zero pMC. Similarly, blends of Cymbopogon oils with 30-50 % (w/w) of fossil origin citral contained pMC equivalent to the proportions of modern carbon. These results showed the usefulness of AMS in quantifying the amount of 14C associated with flavor ingredients. Besides, acute oral toxicity data revealed Cymbopogon oils as the safe flavoring substance at the highest 2000 mg/kg body weight dose in Swiss albino mice.

Authors: C S Chanotiya, Yatish Pant, R K Lal, Pankaj Kumar, Parmanand Kumar, Laldingngheti Bawitlung, Manoj Semwal, P K Trivedi, Anirban Pal

Full Source: The Science of the total environment 2023 Nov 9:168357. doi: 10.1016/j.scitotenv.2023.168357.

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ENVIRONMENTAL RESEARCH

This study aimed to investigate the spatial distribution of micropollutants in wastewater related to catchment area, and their environmental risks and fate.

Catchment area, fate, and environmental risks investigation of micropollutants in Danish wastewater

2023-11-10

This study aimed to investigate the spatial distribution of micropollutants in wastewater related to catchment area, and their environmental risks and fate. About 24-h flow proportional effluent (n = 26) wastewater samples were collected from eight WWTPs across Denmark. From five of these WWTPs corresponding influent samples (n = 20) were collected. Samples were enriched by multi-layer solid phase and analysed by liquid chromatography-high-resolution mass spectrometry and comprehensive two-dimensional gas chromatography with high-resolution mass spectrometry detection. We detected and quantified 79 micropollutants from a list of 291 micropollutants in at least one influent or effluent wastewater sample. From this we found that 54 micropollutants decreased in concentrations during wastewater treatment, while O-desmethylvenlafaxine, carbamazepine, amitriptyline, benzothiazole, terbutryn, and citalopram increased in concentrations through the WWTP. The toxicity of effluent wastewater samples was assessed by EC50 using Raphidocelis subcapitata (R. subcapitata) and LC50 using the crustacean Daphnia magna (D. Magna), for which six micropollutants were detected above the predicted no-effect concentration. Our study demonstrates that catchment area influences the micropollutant composition of wastewater.

Out of 19 pharmaceuticals, the measured concentration in influent wastewater was predicted within a factor of 10 from sale numbers and human excretion, which demonstrates the strong influence of catchment area on micropollutant composition.
Authors: Kristoffer Kilpinen, Jason Devers, Mafalda Castro, Selina Tisler, Mathias B Jørgensen, Peter Mortensen, Jan H Christensen
Full Source: Environmental science and pollution research international 2023 Nov 10. doi: 10.1007/s11356-023-30331-z.

Occurrence, behavior and fate of liquid crystal monomers in municipal wastewater

2023-10-26
Liquid crystal monomers (LCMs), the essential substances used in the display screen of electronic devices, have been proposed as a class of emerging chemicals of concern. Despite their detection in various environmental matrices, little is known about the presence of LCMs in municipal sewage systems. This study aimed to investigate the occurrence, distribution, and fate of 64 LCMs released into the aqueous environment from a municipal wastewater treatment plant (WWTP) in Hong Kong, China. In total 14 LCMs were detected in WWTP samples. Specifically, the Σ14LCMs concentrations in crude influent, final effluent, and final sludge were found to be 16.8 ± 0.3 ng/L, 2.71 ± 0.05 ng/L, and 19.2 ± 1.0 ng/g dry weight, respectively. Among them, 10 fluorinated LCMs (F-LCMs) were determined to be present at concentrations of 8.90 ± 0.10 ng/L, 1.69 ± 0.05 ng/L, and 9.94 ± 1.00 ng/g dry weight, respectively. The predominant non-fluorinated LCMs (NF-LCMs) detected in all samples were 3OCB and EPhEMOB, while 2OdF3B was the dominant F-LCM. The overall removal rate of total LCMs was 83.8 ± 0.3 %, with 25.4 ± 4.8 % being removed by biodegradation and UV treatment. Compared to NF-LCMs, F-LCMs were more resistant to biodegradation. Despite the significant removal of LCMs through WWTP, the remaining LCMs in final effluent could result in an annual emission of 3.04 kg of total LCMs from the population of Hong Kong. This study provides the first evidence of LCMs contamination in municipal wastewater, possibly arising from routine electronic devices usage. Further investigation is needed to elucidate the potential impact of LCMs emission via WWTP effluent on the aquatic receiving ecosystem.
Authors: Yuting Zhan, Qianqian Jin, Huiju Lin, Danyang Tao, Lok Yung Law, Jiaji Sun, Yuhe He
Full Source: Water research 2023 Oct 26:247:120784. doi: 10.1016/j.watres.2023.120784.

Liquid crystal monomers (LCMs), the essential substances used in the display screen of electronic devices, have been proposed as a class of emerging chemicals of concern.

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PHARMACEUTICAL/TOXICOLOGY

Global, regional and national burdens of non-melanoma skin cancer attributable to occupational exposure to solar ultraviolet radiation for 183 countries, 2000-2019: A systematic analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury

2023-11-06
Background: A World Health Organization (WHO) and International Labour Organization (ILO) systematic review reported sufficient evidence for higher risk of non-melanoma skin cancer (NMSC) amongst people occupationally exposed to solar ultraviolet radiation (UVR). This article presents WHO/ILO Joint Estimates of global, regional, national and subnational occupational exposures to UVR for 195 countries/areas and the global, regional and national attributable burdens of NMSC for 183 countries, by sex and age group, for the years 2000, 2010 and 2019.
Methods: We calculated population-attributable fractions (PAFs) from estimates of the population occupationally exposed to UVR and the risk ratio for NMSC from the WHO/ILO systematic review. Occupational exposure to UVR was modelled via proxy of occupation with outdoor work, using 166 million observations from 763 cross-sectional surveys for 96 countries/areas. Attributable NMSC burden was estimated by applying the PAFs to WHO's estimates of the total NMSC burden. Measures of inequality were calculated.
Results: Globally in 2019, 1.6 billion workers (95 % uncertainty range [UR] 1.6-1.6) were occupationally exposed to UVR, or 28.4 % (UR 27.9-28.8) of the working-age population. The PAFs were 29.0 % (UR 24.7-35.0) for NMSC deaths and 30.4 % (UR 29.0-31.7) for disability-adjusted life years (DALYs). Attributable NMSC burdens were 18,960 deaths (UR 18,180-19,740) and 0.5 million DALYs (UR 0.4-0.5). Men and older age groups carried larger burden. Over 2000-2019, attributable deaths and DALYs almost doubled.
Conclusions: WHO and the ILO estimate that occupational exposure to UVR is common and causes substantial, inequitable and growing attributable burden of NMSC. Governments must protect outdoor workers from hazardous exposure to UVR and attributable NMSC burden and inequalities.
Authors: Frank Pega, Natalie C Momen, Kai N Streicher, Maria Leon-Roux, Subas Neupane, Mary K Schubauer-Berigan, Joachim Schüz, Technical Advisory Group on Occupational Burden of Disease Estimation, Marissa

Background: A World Health Organization (WHO) and International Labour Organization (ILO) systematic review reported sufficient evidence for higher risk of non-melanoma skin cancer (NMSC) amongst people occupationally exposed to solar ultraviolet radiation (UVR).

Baker, Tim Driscoll, Irina Guseva Canu, Hannah M Kiiver, Jian Li, Jamaji C Nwanaji-Enwerem, Michelle C Turner, Susana Viegas, Paul J Villeneuve
Full Source: Environment international 2023 Nov 6:108226. doi: 10.1016/j.envint.2023.108226.

Review on heavy metal contaminants in freshwater fish in South India: current situation and future perspective

2023-11-10

The primary natural resource we use in our daily lives for a variety of activities is freshwater for drinking and various developmental goals. Furthermore, the pace of human population increase worldwide is rising rapidly and has a great impact on the Earth's natural resources. Natural water quality has diminished owing to various anthropogenic activities. Water is crucial to the life cycle. On the other hand, chemical and agricultural industries pollute heavy metals. Acute and chronic diseases caused by heavy metals, such as slow metabolism and damage to the gills and epithelial layer of fish species, are divided into two categories. Pollutants can also harm liver tissues and result in ulceration as well as diseases such as fin rot, tail rot, and gill disease. The most prevalent heavy metals are As, Cr, Pb, and Hg, which are systemic toxicants that affect human health. These metals are categorized as carcinogens by the US Environmental Protection Agency and the worldwide agency for cancer research because they cause organ damage even at low exposure levels. The focus of the current study is to review various freshwater sources of heavy metal pollution.

The primary natural resource we use in our daily lives for a variety of activities is freshwater for drinking and various developmental goals.

Authors: Saranya Elumalai, Kolandhasamy Prabhu, Gopi Palani Selvan, Pasiyappazham Ramasamy
Full Source: Environmental science and pollution research international 2023 Nov 10. doi: 10.1007/s11356-023-30659-6.

OCCUPATIONAL

Effects of personal exposure to the oxidative potential of PM2.5 on oxidative stress biomarkers in pregnant women

2023-11-09

Oxidative stress is a prominent pathway for the health effects associated with fine particulate matter (PM2.5) exposure. Oxidative potential (OP) of PM has been associated to several health endpoints, but its impact on biomarkers of oxidative stress remains insufficient. 300 pregnant women from the SEPAGES cohort (France) carried personal PM2.5 samplers for a week and OP was measured using ascorbic acid (AA) and dithiothreitol (DTT) assays, and normalized by 1) PM2.5 mass (OPm) and 2) sampled air volume (OPv). A pool of three urine spots collected on the 7th day of PM sampling was analyzed for biomarkers, namely 8-hydroxy-2-deoxyguanosine (8-OHdG), malondialdehyde (MDA) and 8-isoprostaglandin-F2α (8-isoPGF2α). Associations were investigated using adjusted multiple linear regressions. OP effects were additionally investigated by stratifying by median PM2.5 concentration (14 µg m-3). In the main models, no association was observed with 8-isoPGF2α, nor MDA. An interquartile range (IQR) increase in OPmAA exposure was associated with increased 8-OHdG (percent change: 6.2 %; 95 % CI: 0.2 % to 12.6 %). In the stratified analysis, exposure to OPmAA was associated to 8-OHdG for participants exposed to low levels of PM2.5 (percent change: 11.4 %; 95 % CI: 3.3 % to 20.1 %), but not for those exposed to high levels (percent change: -1.0 %; 95 % CI: -10.6 % to 9.6 %). Associations for OPmDTT also followed a similar pattern (p-values for OPmAA-PM and OPmDTT-PM interaction terms were 0.12 and 0.11, respectively). Overall, our findings suggest that OPmAA may be associated with increased DNA oxidative damage. This association was not observed with PM2.5 mass concentration exposure. The effects of OPmAA in 8-OHdG tended to be stronger at lower (below median) vs. higher concentrations of PM2.5. Further epidemiological, toxicological and aerosol research are needed to further investigate the OPmAA effects on 8-OHdG and the potential modifying effect of PM mass concentration on this association.

Authors: Anouk Marsal, Jean-Jacques Sauvain, Aurélien Thomas, Sarah Lyon-Caen, Lucille Joanna S Borlaza, Claire Philippat, Jean-Luc Jaffrezo, Anne Boudier, Sophie Darfeuil, Rhabira Elazzouzi, Johanna Lepeule, Ryan Chartier, Sam Bayat, Rémy Slama, Valérie Siroux, Gaëlle Uzu
Full Source: The Science of the total environment 2023 Nov 9:168475. doi: 10.1016/j.scitotenv.2023.168475.

Application of Nanoconfinement Technology for Highly Effective Monitoring of Chemical Exposure During Military Service

2023-11-08

Introduction: There is myriad of volatile compounds to which military personnel are exposed that can potentially have negative effects on their health. Military service occurs in a broad array of environments so it is difficult to predict the hazardous compounds to which the personnel might be exposed. XploSafe is developing passive diffusive samplers to

Introduction: There is myriad of volatile compounds to which military personnel are exposed that can potentially have negative effects on their health.

facilitate the sampling and quantification of a wide range of chemical vapor exposures that personnel may be exposed to in the workplace. Materials and methods: Passive diffusive samplers were constructed by filling porous Teflon tubes with OSU-6, a nanoporous silica sorbent, to produce sampler tokens. Three of these tokens were placed within a badge to fabricate passive samplers. Absorption experiments were performed to determine linear exposure regimes, sampling rates, and limits of quantification for 11 compounds, representing 8 chemical classes. Results: The sampling rates were determined for 11 compounds representing 8 chemical classes. The measured linear ranges for the studied compounds are sufficiently large to allow effective sampling for 8 hours or longer. Accurate dosimetry is possible even with exposure times of days or weeks. The samplers were able to detect the presence of five airborne compounds in a paint booth of a military contractor located in Bristow, Oklahoma, and determine their average exposure concentrations. Conclusions: OSU-6 based sampler badges were able to detect the presence and quantify the average exposures of five airborne compounds in a paint booth of a military contractor located in Bristow, Oklahoma. Experiments show that these samplers can adsorb and quantify a broad array of different volatile organic compounds whose high sampling rates coupled with high capacity provide both sensitivity and the ability to quantify over a large range of exposures. This technology can meet the requirements for personal samplers to create Individual Longitudinal Exposure Record for each military person.

Authors: Nicholas Materer, Allen Apblett, Evgueni Kadossov, Shoaib Shaikh, Michael Teicheira

Full Source: Military medicine 2023 Nov 8;188(Supplement_6):363-368. doi: 10.1093/milmed/usad157.

Workers involved in the processing of electronic waste (e-waste) are potentially exposed to toxic chemicals, including phthalates and alternative plasticizers (APs).

HBM4EU e-waste study: Occupational exposure of electronic waste workers to phthalates and DINCH in Europe

2023-11-09

Workers involved in the processing of electronic waste (e-waste) are potentially exposed to toxic chemicals, including phthalates and alternative plasticizers (APs). Dismantling and shredding of e-waste may lead to the production of dust that contains these plasticizers. The aim of this study, which was part of the European Human Biomonitoring Initiative (HBM4EU), was to assess the exposure to phthalates (e.g. di-(2-ethylhexyl) phthalate (DEHP), diethyl phthalate (DEP), di-butyl phthalate (DBP), butyl-benzyl phthalate (BBzP), di-isononyl phthalate (DiNP), di-

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isodecyl phthalate (DiDP) and cyclohexane-1,2-dicarboxylic di-isononyl ester (DINCH) in e-waste workers from ten European companies. This was achieved by (i) analysing urine samples from 106 e-waste workers collected at the beginning and at the end of the work week, (ii) comparing these with urine samples from 63 non-occupationally exposed controls, and (iii) analysing settled floor dust collected in e-waste premises. Significantly higher urinary concentrations of seven out of thirteen phthalates and DINCH metabolites were found in the e-waste workers compared to the control population. However, no significant differences were found between pre- and post-shift concentrations in the e-waste workers. Concentrations of DBP, DEHP and DiDP in dust were weakly to moderately positively correlated with their corresponding urinary metabolite concentrations in the e-waste workers (Spearman's ρ = 0.4, 0.3 and 0.2, respectively). Additionally, significantly lower urinary concentrations of nine phthalates and DINCH metabolites were found in e-waste workers using respiratory protective equipment (RPE) during their work activities, reflecting the potential benefits of RPE to prevent occupational exposure to phthalates and DINCH. The estimated daily intake (EDI) values obtained in this study were lower than the corresponding tolerable daily intake (TDI) adopted by the European Food Safety Authority (EFSA) for the general population, suggesting that the risk for negative health consequences in this population of e-waste workers from exposure to phthalates and DINCH is expected to be low. This was confirmed by the urinary metabolite concentrations of all workers being lower than the HBM4EU guidance values derived for the occupational exposed and general population. This study is one of the first to address the occupational exposure to phthalates and DINCH in Europe in e-waste dismantling workers, combining a human biomonitoring approach with analysis of settled indoor dust.

Authors: Paulien Cleys, Emilie Hardy, Yu Ait Bamai, Giulia Poma, Adam Cseresznye, Govindan Malarvannan, Paul T J Scheepers, Susana Viegas, Simo P Porras, Tiina Santonen, Lode Godderis, Jelle Verdonck, Katrien Poels, Carla Martins, Maria João Silva, Henriqueta Louro, Inese Martinsone, Lāsma Akūlova, An van Nieuwenhuyse, Martien Graumans, Selma Mahiout, Radu Corneliu Duca, Adrian Covaci

Full Source: International journal of hygiene and environmental health 2023 Nov 9:255:114286. doi: 10.1016/j.ijheh.2023.114286.

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Authors: authors
Full Source: