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CHEMICAL EFFECTS

Air monitoring of tire-derived chemicals in global megacities using passive samplers

2022-09-21

Pollution from vehicle tires has received world-wide research attention due to its ubiquity and toxicity. In this study, we measured various tire-derived contaminants semi-quantitatively in archived extracts of passive air samplers deployed in 18 major cities that comprise the Global Atmospheric Passive Sampling (GAPS) Network (GAPS-Megacities). Analysis was done on archived samples, which represent one-time weighted passive air samples from each of the 18 monitoring sites. The target analytes included cyclic amines, benzotriazoles, benzothiazoles, and p-phenylenediamine (PPD) derivatives. Of the analyzed tire-derived contaminants, diphenylguanidine was the most frequently detected analyte across the globe, with estimated concentrations ranging from 45.0 pg/m³ in Beijing, China to 199 pg/m³ in Kolkata, India. The estimated concentration of 6PPD-quinone and total benzothiazoles (including benzothiazole, 2-methylthio-benzothiazole, 2-methyl-benzothiazole, 2-hydroxy-benzothiazole) peaked in the Latin American and the Caribbean region at 1 pg/m³ and 100 pg/m³, respectively. In addition, other known tire-derived compounds, such as hexa(methoxymethyl)melamine, phenylguanidine, and various transformation products of 6PPD, were also monitored and characterized semi-quantitatively or qualitatively. This study presents some of the earliest data on airborne concentrations of chemicals associated with tire-wear and shows that passive sampling is a viable strategy for monitoring airborne tire contamination. Due to the presence of many tire-derived contaminants in urban air across the globe as highlighted by this study, there is a need to determine the associated exposure and toxicity of these chemicals to humans.

Authors: Cassandra Johannessen, Amandeep Saini, Xianming Zhang, Tom Harner

Full Source: Environmental pollution (Barking, Essex : 1987) 2022 Sep 21;120206. doi: 10.1016/j.envpol.2022.120206.

An assessment of volatile organic compounds pollutant emissions from wood materials: A review

2022-09-15

Various construction materials and interior equipment contain volatile organic compounds (VOCs). Their higher quantities in indoor air are linked

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to poor health consequences and are controversial regarding health risks, given that people spend so much time indoors. As a result, VOCs in indoor air cause concern regarding sick building syndrome (SBS). From a historical perspective, wood and wood-based panels have been frequently employed. Nonetheless, wood appears to be a product and a material of the future in today's world. The emission of volatile organic compounds (VOC) from wood and wood products is essential when assessing the impact of different materials on the indoor environment. The emission rate is affected by both the wood species and the boundary circumstances (drying, storage, etc.). The issue of VOCs emitted from wood, and wood-based panels are addressed in this review paper. The most prevalent VOCs were listed. The advantages and limits of using VOCs for analytical determination from these composites are discussed.

Authors: Xihe Zhou, Zhisong Yan, Xiang Zhou, Chengming Wang, Hailiang Liu, Handong Zhou

Full Source: Chemosphere 2022 Sep 15;136460. doi: 10.1016/j.chemosphere.2022.136460.

Uptake, Transport, and Toxicity of Pristine and Weathered Micro- and Nanoplastics in Human Placenta Cells

2022-09

Background: The first evidence of micro- and nanoplastic (MNP) exposure in the human placenta is emerging. However, the toxicokinetics and toxicity of MNPs in the placenta, specifically environmentally relevant particles, remain unclear.

Objectives: We examined the transport, uptake, and toxicity of pristine and experimentally weathered MNPs in nonsyncytialized and syncytialized BeWo b30 choriocarcinoma cells.

Methods: We performed untargeted chemical characterization of pristine and weathered MNPs using liquid chromatography high-resolution mass spectrometry to evaluate compositional differences following particle weathering. We investigated cellular internalization of pristine and weathered polystyrene (PS; 0.05-10µm) and high-density polyethylene (HDPE; 0-80µm) particles using high-resolution confocal imaging and three-dimensional rendering. We investigated the influence of particle coating with human plasma on the cellular transport of PS particles using a transwell setup and examined the influence of acute MNP exposure on cell viability, damage to the plasma membrane, and expression of genes involved in steroidogenesis.

Results: Chemical characterization of MNPs showed a significantly higher number of unique features in pristine particles in comparison with

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weathered particles. Size-dependent placental uptake of pristine and weathered MNPs was observed in both placental cell types after 24 h exposure. Cellular transport was limited and size-dependent and was not influenced by particle coating with human plasma. None of the MNPs affected cell viability. Damage to the plasma membrane was observed only for 0.05 μ m PS particles in the nonsyncytialized cells at the highest concentration tested (100 μ g/mL). Modest down-regulation of hsd17b1 was observed in syncytialized cells exposed to pristine MNPs. Discussion: Our results suggest that pristine and weathered MNPs are internalized and translocated in placental cells in vitro. Effects on gene expression observed upon pristine PS and HDPE particle exposure warrant further examination. More in-depth investigations are needed to better understand the potential health risks of MNP and chemicals associated with them under environmentally relevant exposure scenarios.

Authors: Hanna M Dusza, Eugene A Katrukha, Sandra M Nijmeijer, Anna Akhmanova, A Dick Vethaak, Douglas I Walker, Juliette Legler
Full Source: Environmental health perspectives 2022 Sep;130(9):97006.
doi: 10.1289/EHP10873.

ENVIRONMENTAL RESEARCH

Predicting selection for antimicrobial resistance in UK wastewater and aquatic environments: Ciprofloxacin poses a significant risk

2022-09-02

Antimicrobial resistance (AMR) is a threat to human and animal health, with the environment increasingly recognised as playing an important role in AMR evolution, dissemination, and transmission. Antibiotics can select for AMR at very low concentrations, similar to those in the environment, yet their release into the environment, e.g., from wastewater treatment plants, is not currently regulated. Understanding the selection risk antibiotics pose in wastewater and receiving waters is key to understanding if environmental regulation of antibiotics is required. We investigated the risk of selection occurring in UK wastewater and receiving waters by determining where measured environmental concentration data (n = 8187) for four antibiotics (ciprofloxacin, azithromycin, clarithromycin, and erythromycin) collected in England and Wales 2015-2018 (sites n = 67) exceeded selective concentration thresholds derived from complex microbial community evolution experiments undertaken previously. We show that selection for AMR by ciprofloxacin is likely to have occurred

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routinely in England and Wales wastewater during the 2015-2018 period, with some seasonal and regional trends. Wastewater treatment reduces the selection risk posed by ciprofloxacin significantly, but not completely, and predicted risk in surface waters remains high in several cases. Conversely, the potential risks posed by the macrolides (azithromycin, clarithromycin, and erythromycin) were lower than those posed by ciprofloxacin. Our data demonstrate further action is needed to prevent selection for AMR in wastewater, with environmental quality standards for some antibiotics required in the future, and that selection risk is not solely a concern in low/middle income countries.

Authors: April Hayes, Laura May Murray, Isobel Catherine Stanton, Lihong Zhang, Jason Snape, William Hugo Gaze, Aimee Kaye Murray
Full Source: Environment international 2022 Sep 2;169:107488. doi: 10.1016/j.envint.2022.107488.

PHARMACEUTICAL/TOXICOLOGY

Dermal thirdhand smoke exposure induces oxidative damage, initiates skin inflammatory markers, and adversely alters the human plasma proteome

2022-09-19

Background: Thirdhand smoke (THS) exposure correlated with significant metabolism of carcinogenic chemicals and the potential to cause detrimental health effects. Human harm research of THS exposure is limited to one other study and overall, there is a general lack of knowledge of the human health responses to THS exposure.

Methods: This was a clinical investigation to evaluate the health effects of 3-h dermal THS exposure from urine and plasma. 10 healthy, non-smoking subjects were recruited for dermal exposure for 3 h exposed to clothing impregnated with filtered clean air or THS. Exposures to clean air or THS occurred 20-30 days apart.

Findings: In THS-exposed group, there was a significant elevation of urinary 8-OHdG, 8-isoprostane, protein carbonyls. The THS 3-h exposure identified proteomics pathways of inflammatory response ($p=2.18 \times 10^{-8}$), adhesion of blood cells ($p=2.23 \times 10^{-8}$), atherosclerosis ($p=2.78 \times 10^{-9}$), and lichen planus ($p=1.77 \times 10^{-8}$). Nine canonical pathways were significantly activated including leukocyte extravasation signaling (z-score=3.0), and production of nitric oxide and reactive oxygen in macrophages (z-score=2.1). The THS 22-h proteomics pathways revealed inflammation of organ ($p=3.09 \times 10^{-8}$), keratinization of the epidermis

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($p=4.0 \times 10^{-7}$), plaque psoriasis ($p=5.31 \times 10^{-7}$), and dermatitis ($p=6.0 \times 10^{-7}$). Two activated canonical pathways were production of nitric oxide and reactive oxygen in macrophages (z-score=2.646), and IL-8 signaling (z-score=2.0).

Interpretation: This is a clinical study demonstrating that acute dermal exposure to THS mimics the harmful effects of cigarette smoking, alters the human plasma proteome, initiates mechanisms of skin inflammatory disease, and elevates urinary biomarkers of oxidative harm.

Funding: Funding was provided by the Tobacco Related Disease Research Program (TRDRP) 24RT-0037 TRDRP, 24RT-0039 TRDRP, and 28PT-0081 TRDRP.

Authors: Shane Sakamaki-Ching, Suzaynn Schick, Gabriela Grigorean, Jun Li, Prue Talbot

Full Source: EBioMedicine 2022 Sep 19;84:104256. doi: 10.1016/j.ebiom.2022.104256.

Molecular consequences of the exposure to toxic substances for the endocrine system of females

2022-09-21

Endocrine-disrupting chemicals (EDCs) are common in the environment and in everyday products such as cosmetics, plastic food packaging, and medicines. These substances are toxic in small doses (even in the order of micrograms) and enter the body through the skin, digestive or respiratory system. Numerous studies confirm the negative impact of EDCs on living organisms. They disrupt endocrine functions, contributing to the development of neoplastic and neurological diseases, as well as problems with the circulatory system and reproduction. EDCs affect humans and animals by modulating epigenetic processes that can lead to disturbances in gene expression or failure and even death. They also affect steroid hormones by binding to their receptors as well as interfering with synthesis and secretion of hormones. Prenatal exposure may be related to the impact of EDCs on offspring, resulting in effects of these substances on the ovaries and leading to the reduction of fertility through disturbances in the function of steroid receptors or problems with steroidogenesis and gametogenesis. Current literature indicates the need to continue research on the effects of EDCs on the female reproductive system. The aim of this review was to identify the effects of endocrine-disrupting chemicals on

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the female reproductive system and their genetic effects based on recent literature.

Authors: Alicja Kowalczyk, Marcjanna Wrzecińska, Ewa Czerniawska-Piątkowska, José Pedro Araújo, Przemysław Cwynar

Full Source: Biomedicine & pharmacotherapy = Biomedecine & pharmacotherapie 2022 Sep 21;155:113730. doi: 10.1016/j.biopha.2022.113730.

Air Quality and Cancer Prevalence Trends across the Sub-Saharan African Regions during 2005-2020

2022-09-09

Poor air quality and environmental pollution remain some of the main etiological factors leading to cancers and cancer-related deaths worldwide. As a result of human activities, deleterious airborne chemicals can be dispersed not only in the environment but also released in occupational environments and industrial areas. Air pollutants and cancer links are now established through various oxidative stress-related mechanisms and related DNA damages. Generally, ambient and indoor air pollutants have been understudied in sub-Saharan Africa (SSA) compared to other regions in the world. Our study not only highlights the deleterious effects of air pollutants in these developing countries, but it has strived to examine the trends and correlations between cancers and some air pollutants-carbon dioxide, other greenhouse gases, PM2.5, and human development index in some SSA countries, where recent cancer burdens were reported as high. Our results showed strikingly higher yearly trends of cancers and above-mentioned air pollutant levels in some sub-Saharan countries during 2005-2020. Relative risks (RR) of these air pollutants-related cancer case rates were, however, below, or slightly above 1.0, or not statistically significant possibly due to other responsible and confounding factors which were not considered in our analyses due to data unavailability. We recommend new approaches to monitoring, minimizing, and creating awareness of the trends of hazardous air pollutants in sub-Saharan Africa, which will help ameliorate cancer prevalence and support the reduction in air pollution levels within regulatory limits, thereby relieving the cumulative burdens of cancers. Utilization of the findings from the study will support large-scale public health and health policy efforts on cancer management through environmental stewardship in SSA countries having the poorest outcome and the shortest survival rates from cancers.

Authors: Omolola Okunromade, Jingjing Yin, Clara Ray, Atin Adhikari

Full Source: International journal of environmental research and public health 2022 Sep 9;19(18):11342. doi: 10.3390/ijerph191811342.

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OCCUPATIONAL

Lipidomics Profiles and Lipid Metabolite Biomarkers in Serum of Coal Workers' Pneumoconiosis

2022-08-26

As a serious occupational pulmonary fibrosis disease, pneumoconiosis still lacks effective biomarkers. Previous studies suggest that pneumoconiosis may affect the body's lipid metabolism. The purpose of this study was to explore lipidomics profiles and lipid metabolite biomarkers in the serum of coal workers' pneumoconiosis (CWP) by a population case-control study. A total of 150 CWP cases and 120 healthy controls from Beijing, China were included. Blood lipids were detected in serum biochemistry. Lipidomics was performed in serum samples for high-throughput detection of lipophilic metabolites. Serum high density lipoprotein cholesterol (HDL-C) decreased significantly in CWP cases. Lipidomics data found 131 differential lipid metabolites between the CWP case and control groups. Further, the top eight most important differential lipid metabolites were screened. They all belonged to differential metabolites of CWP at different stages. However, adjusting for potential confounding factors, only three of them were significantly related to CWP, including acylhexosylceramide (AHEXCER 43:5), diacylglycerol (DG 34:8) and dimethyl-phosphatidylethanolamine (DMPE 36:0|DMPE 18:0_18:0), of which good sensitivity and specificity were proven. The present study demonstrated that lipidomics profiles could change significantly in the serum of CWP patients and that the lipid metabolites represented by AHEXCER, DG and DMPE may be good biomarkers of CWP.

Authors: Zhangjian Chen, Jiaqi Shi, Yi Zhang, Jiahe Zhang, Shuqiang Li, Li Guan, Guang Jia

Full Source: *Toxics* 2022 Aug 26;10(9):496. doi: 10.3390/toxics10090496.

Effects of Noise and Chemical Exposure on Peripheral and Central Auditory Pathways in Normal-hearing Workers

2022-07

Objectives: To assess the effects of noise and chemical exposure on peripheral and central auditory pathways in normal-hearing workers exposed to chemicals or high noise levels and compare the groups with each other and with workers not exposed to either of these agents. **Methods:** A total of 54 normal-hearing workers were divided into three groups (chemical, noise, control) and submitted to the following assessments: conventional and extended high-frequency pure-tone

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audiometry; transient and distortion-product otoacoustic emissions, the inhibitory effect of the efferent auditory pathway; and Staggered Spondaic Word (SSW) and Pitch Pattern Sequence (PPS) test.

Results: There were no significant differences between the groups in extended high-frequency hearing thresholds. Significantly lower amplitudes were observed in the noise group for otoacoustic emissions. There were significantly more absences of the inhibitory effect of the efferent system in the noise group. There was no difference between the groups in the SSW test, while in PPS, the noise group performed worse than the control group.

Conclusion: These findings suggest that noise exposure produced deleterious effects on the workers' peripheral and central auditory systems, despite their normal hearing thresholds. The chemical group did not have significantly different results from those of the control group. It is important that individuals exposed to noise or chemicals have their auditory pathways monitored with complementary assessments.

Authors: Júlio Cs Trabanco, Bruno Morita, Carla Gentile Matas, Karina Mary de Paiva, Renata R Moreira, Seisse Gg Sanches, Alessandra G Samelli
Full Source: *Noise & health* 2022 Jul-Sep;24(114):182-190. doi: 10.4103/nah.nah_10_22.

Direct evidence on occurrence of emerging liquid crystal monomers in human serum from E-waste dismantling workers: Implication for intake assessment

2022-09-20

Liquid crystal monomers (LCMs) are widely used chemicals and ubiquitous emerging organic pollutants in the environment, some of which have persistent, bio-accumulative, and toxic potentials. Elevated levels of LCMs have been found in the e-waste dismantling associated areas. However, information on their internal exposure bio-monitoring is scarce. For the first time, occurrences of LCMs were observed in the serum samples of occupational workers (n = 85) from an e-waste dismantling area in South China. Twenty-nine LCMs were detected in serum samples of the workers, with a median value of 35.2 ng/mL (range: 7.78-276 ng/mL). Eight noticed LCMs were found to have relatively high detection frequencies ranging from 52.9% to 96.5%. The correlation analysis of individual LCMs indicated potential common applications and similar sources to the LCMs in occupational workers. Fluorinated LCMs were identified as the predominant monomers in the workers. Additionally, the estimated daily intake of the LCMs in the occupational workers was significantly higher than those in residents from the reference areas (p < 0.05, Mann-Whitney

Liquid crystal monomers (LCMs) are widely used chemicals and ubiquitous emerging organic pollutants in the environment, some of which have persistent, bio-accumulative, and toxic potentials.

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U Test, median values: 1.46 ng/kg bw/day versus 0.40 ng/kg bw/day), indicating a substantially higher exposure level to e-waste dismantling workers.

Authors: Yuhe Li, Tao Zhang, Zhipeng Cheng, Qianru Zhang, Ming Yang, Leicheng Zhao, Shaohan Zhang, Yuan Lu, Hongwen Sun, Lei Wang
Full Source: Environment international 2022 Sep 20;169:107535. doi: 10.1016/j.envint.2022.107535.