CHEMWATCH

# Bulletin Board

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## CHEMICAL EFFECTS

### Semi-Volatile Organic Compounds in Car Dust: A Pilot Study in Jeddah, Saudi Arabia

2021-04-30

People may spend a significant amount of their daily time in cars and thus be exposed to chemicals present in car dust. Various chemicals are emitted from during car use, contaminating the car dust. In this study, we compiled published and unpublished data on the occurrence of phthalates, flame retardants (FRs), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) in Saudi car dust. Phthalates, a class of chemical commonly used as plasticizers in different car parts, were the major pollutants found in car dust, with a median value of ∑phthalates 1,279,000 ng/g. Among other chemicals, organophosphate flame retardants (OPFRs) were found to be between 1500-90,500 ng/g, which indicates their use as alternative FRs in the car industry. The daily exposure to Saudi drivers (regular and taxi drivers) was below the respective reference dose (RfD) values of the individual chemicals. However, the estimated incremental lifetime cancer risk (ILCR) values due to chronic exposure to these chemicals was >1 × 10-5 for taxi drivers for phthalates and PAHs, indicating that the long-term exposure to these chemicals is a cause of concern for drivers who spend considerable time in cars. The study has some limitations, due to the small number of samples, lack of updated RfD values, and missing cancer slope factors for many studied chemicals. Despite these limitations, this study indicates the possible range of exposure to drivers from chemicals in car dust and warrants further extensive studies to confirm these patterns.

Authors: Nadeem Ali, Mohammad W Kadi, Hussain Mohammed Salem Ali Albar, Muhammad Imtiaz Rashid, Sivaraman Chandrasekaran, Ahmed Saleh Summan, Cynthia A de Wit, Govindan Malarvannan

Full Source: International journal of environmental research and public health 2021 Apr 30;18(9):4803. doi: 10.3390/ijerph18094803.

People may spend a significant amount of their daily time in cars and thus be exposed to chemicals present in car dust.

### Identification of chemicals of emerging concern in urine of Flemish adolescents using a new suspect screening workflow for LC-QTOF-MS

2021-04-27

An essential step in human biomonitoring or molecular epidemiology programs is to estimate human exposure to environmental chemicals. Despite significant progress in the capabilities of analytical methods, the number of pollutants and their metabolites keeps increasing continuously. Some of these relatively unknown chemicals of emerging concern (CECs) may pose significant health risks to humans and biota, but remain virtually undetected in traditional HBM-studies. Non-target and suspect screening techniques based on high-resolution mass spectrometry (HRMS) perform the detection and identification of compounds without any a priori compound selection or chemical information and provide a more holistic overview of human exposure. In this study, 50 urine samples (25 female and 25 male) from a larger cohort of the Flemish Environment and Health Study (FLEHS IV, 2016-2020) have been submitted to suspect screening analysis, with the aim of detecting and identifying new CECs. For this purpose, an analytical method has been developed, optimised and evaluated in terms of analytical performance. Satisfactory results were obtained in terms of reproducibility, sensitivity and quality control. Data-mining was performed through the combination of two different workflows. The use of two complementary workflows enhanced the number of identified compounds. As a result, 45 CECs have been identified with a level of confidence ranged between 3 and 1. Most of the identified compounds were metabolisation products, many of which were currently not included in the targeted measurements of FLEHS IV. The identified chemicals and metabolites could be used as candidate biomarkers of exposure in future studies. Overall, the newly developed suspect screening workflow of this pilot study provided complementary and promising results for future HBM-programs.

Authors: Noelia Caballero-Casero, Gabriela Castro, Michiel Bastiaensen, Celine Gys, Nik van Larebeke, Greet Schoeters, Adrian Covaci

Full Source: Chemosphere 2021 Apr 27;280:130683. doi: 10.1016/j.chemosphere.2021.130683.

### Comparative study on intercalation-exfoliation and thermal activation modified kaolin for heavy metals immobilization during high-organic solid waste pyrolysis

2021-04-30

With the new municipal solid waste classification policy implemented in China, attention on achieving the waste-to-energy disposal of "dry waste" has been growing. Pyrolysis conversion of organic waste into value-added chemicals is a promising method to treat solid waste. However, after removing the non-combustible components of "dry waste", the obtained high-organic solid waste (HSW) contains various heavy metals, which requires urgent attention during thermochemical conversion. To mitigate heavy metals risk, kaolin was employed as additive during HSW pyrolysis,

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and intercalation-exfoliation and thermal activation modifications were performed on the kaolin to further immobilize and stabilize heavy metals in the derived chars. The characterization results illustrated that the interlayer spacing, pore volume and diameter of kaolin were expanded after intercalation-exfoliation modification, providing more opportunities for the adsorption of metals. The thermal activation method favored the transformation of kaolin into metakaolin via dehydroxylation to enhance its nonhexacoordinated Al proportion and chemisorption. During 450-650 °C, kaolin exhibited an effective solid enrichment performance for targeting heavy metals, and the intercalation-exfoliation and thermal activation modification further enhanced the adsorption capacity of the kaolin for Cd, Cr, Pb and Cr, Cu, Pb, Zn, respectively. Compared with Cu and Zn, additives demonstrated better stabilization effects for Cd, Pb, and Cr, transforming more bioavailable fractions to the residual speciation. Overall, a higher pyrolytic temperature (650 °C) and the addition of effective additives could simultaneously increase the residual fraction and decrease the bioavailable fraction of heavy metals in HSW-derived chars, reducing the potential ecological risk.

Authors: Haoran Du, Zhaoping Zhong, Bo Zhang, Deqiang Zhao, Xudong Lai, Ningbo Wang, Jiefei Li

Full Source: Chemosphere 2021 Apr 30;280:130714. doi: 10.1016/j.chemosphere.2021.130714.

## Sourcing data on chemical properties and hazard data from the US-EPA CompTox Chemicals Dashboard: A practical guide for human risk assessment

2021-04-29

For the past six decades, human health risk assessment of chemicals has relied on in vivo data from human epidemiological and experimental animal toxicological studies to inform the derivation of cancer and non-toxicity values. The ongoing evolution of this risk assessment paradigm in an environmental landscape of data-poor chemicals has highlighted the need to develop and implement non-testing methods, so-called New Approach Methodologies (NAMs). NAMs include a growing number of in silico and in vitro data streams designed to inform hazard properties of chemicals, including kinetics and dynamics at different levels of biological organization, environmental fate and transport, and exposure. NAMs provide a fit-for-purpose science-basis for human hazard and risk characterization of chemicals ranging from data-gap filling applications to broad evidence-based decision-making. Systematic assembly and delivery of empirical and predicted data for chemicals are paramount

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to advancing chemical evaluation, and software tools serve an essential role in delivering these data to the scientific community. The CompTox Chemicals Dashboard (from here on referred to as the "Dashboard") is one such tool and is a publicly available web-based application developed by the US Environmental Protection Agency to provide access to chemistry, toxicity and exposure information for ~900,000 chemicals. The Dashboard is increasingly becoming a valuable resource for assessors tasked with the evaluation of potential human health risks associated with chemical exposures. In this context, the significant amount of information present in the Dashboard facilitates: 1) assembly of information on physicochemical properties and environmental fate and transport and exposure parameters and metrics; 2) identification of cancer and non-cancer health effects from extant human and experimental animal studies in the public domain and/or information not available in the public domain (i.e., "grey literature"); 3) systematic literature searching and review for developing cancer and non-cancer hazard evidence bases; and 4) access to mechanistic information that can aid or augment the analysis of traditional toxicology evidence bases, or potentially, serve as the primary basis for informing hazard identification and dose-response when traditional bioassay data are lacking. Finally, in silico predictive tools developed to conduct structure-activity or read-across analyses are also available within the Dashboard. This practical tutorial is intended to address key questions from the human health risk assessment community dealing with chemicals in both food and in the environment. Perspectives for future development or refinement of the Dashboard highlight foreseen activities to further support the research and risk assessment community in cancer and non-cancer chemical evaluations.

Authors: Antony J Williams, Jason C Lambert, Kris Thayer, Jean-Lou C M Dorne

Full Source: Environment international 2021 Apr 29;154:106566. doi: 10.1016/j.envint.2021.106566.

# ENVIRONMENTAL RESEARCH

## Microplastics around an Arctic seabird colony: Particle community composition varies across environmental matrices

2021-06-15

Plastic pollution is a contaminant of global concern, as it is present even in remote ecosystems - like the Arctic. Arctic seabirds are vulnerable

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to ingesting plastic pollution, and these ingested particles are shed in the form of microplastics via guano. This suggests that Arctic seabird guano may act as a vector for the movement of microplastics into and around northern ecosystems. While contaminant-laden guano deposition patterns create a clear concentration gradient of chemicals around seabird colonies, this has not yet been investigated with plastic pollution. Here we tested whether a contaminant gradient of plastic pollution exists around a seabird colony that is primarily comprised of northern fulmars (Fulmarus glacialis) in the Canadian Arctic. Atmospheric deposition, surface water, and surface sediment samples were collected below the cliff-side of the colony and at increasing intervals of 1 km from the colony. Fulmars were also collected when foraging away from their colony. Microplastics and other anthropogenic microparticles were identified in all three environmental matrices as well as fulmar guano. Fibers were the most common shape in fulmar guano, atmospheric deposition and surface sediment, and fragments were the most common shape in surface water. We did not find a gradient of microplastic concentrations in environmental matrices related to distance from the colony. Combined, these results suggest that fulmars are not the primary source of microplastic around this colony. Further research is warranted to understand sources of microplastics to the areas around the colonies, including to what extent seabirds transport and concentrate microplastics in Arctic ecosystems, and whether concentrations proximate to large colonies may be species dependent.

Authors: Bonnie M Hamilton, Madelaine P T Bourdages, Catherine Geoffroy, Jesse C Vermaire, Mark L Mallory, Chelsea M Rochman, Jennifer F Provencher

Full Source: The Science of the total environment 2021 Jun 15;773:145536. doi: 10.1016/j.scitotenv.2021.145536.

## Hazard evaluation of indoor environment based on long-term pollutant emission characteristics of building insulation materials: An empirical study

2021-04-25

Insulation materials are essential components in construction, and their main objective is to increase the efficiency of thermal energy by minimizing internal and external thermal exchange. Accordingly, research and development studies are being actively conducted to increase the thermal resistance of insulation materials, and high-performance insulation materials that use organic chemicals have been developed after industrialization. However, thermal insulation comprising chemicals poses a potential risk of pollutant emissions and can cause health problems. In this study, five types of insulation materials and the contaminants generated from the building materials used in insulation construction were quantitatively analyzed. In addition, an empirical study on the discharge of pollutants was conducted using a test bed, and the effects of the pollutants discharged from the insulation material on the indoor environment were examined by analyzing the pollutant concentration for 90 days. In addition, we analyzed the effect of an insulation material on an indoor environment through the standard specifications. Moreover, the necessity of legal management of the emission of contaminants from insulation materials was proposed based on the empirical research results.

Authors: Seunghwan Wi, Yujin Kang, Sungwoong Yang, Young Uk Kim, Sumin Kim

Full Source: Environmental pollution (Barking, Essex : 1987) 2021 Apr 25;285:117223. doi: 10.1016/j.envpol.2021.117223.

Insulation materials are essential components in construction, and their main objective is to increase the efficiency of thermal energy by minimizing internal and external thermal exchange.

## Car and truck tire wear particles in complex environmental samples - A quantitative comparison with “traditional” microplastic polymer mass loads

2021-06-15

Tire wear particles (TWP) are assumed to be the most dominant source of environmental microplastics (MP). Besides rubber components around 60% of tires are additives such as filling material and various chemicals added for vulcanization. The inevitably released TWP in daily traffic are therefore considered a threat to the ecosystem. Nevertheless, published studies on MP mass loads often exclude elastomers. Data concerning composition and concentrations of TWP compared to prominent “traditional” MP polymers, such as polyethylene, polypropylene, poly(ethylene terephthalate) and poly(vinyl chloride), are missing. Identification and quantification of TWP was implemented in an existing pyrolysis-gas chromatography-mass spectrometry (Py-GC/MS) method for MP determination. An approach to differentiate between car and truck tire wear and to quantify their respective mass loads is presented. Complex environmental samples such as road dust, fresh water and marine sediments, blue mussels, and marine salts were partly retrospectively analyzed using Py-GC/MS. The results showed ratios of car to truck tire wear up to 16 to 1 and underline the dominance of car compared to truck tire wear mass loads in all analyzed samples. Even though some retrospective data sets might be affected by suboptimal density separation conditions (NaBr, ρ = 1.5 g/cm3), TWP concentrations in road dust clearly exceeded those of “traditional” MP (Ø 5 g TWP vs 0.3

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g MP per kg road dust (dry weight). Samples included in this study, which were archived further away from TWP sources such as roads, reflected decreasing TWP concentrations (Ø 24 µg TWP vs. 107 µg MP per kg sediment (dry weight); Ø 126 µg TWP vs. 378 µg MP per kg marine salt) or were no longer present (blue mussels), while "traditional" polymers were still ubiquitously distributed.
Authors: Isabel Goßmann, Maurits Halbach, Barbara M Scholz-Böttcher
Full Source: The Science of the total environment 2021 Jun 15;773:145667. doi: 10.1016/j.scitotenv.2021.145667.

## OCCUPATIONAL

### Metabolomics screening of serum biomarkers for occupational exposure of titanium dioxide nanoparticles

2021-05-07
Although nanotoxicology studies have shown that respiratory exposure of titanium dioxide nanoparticles (TiO2 NPs) could induce adverse health effects, limited biomarkers associated with occupational exposure of TiO2 NPs were reported. The purpose of this study is to screen serum biomarkers among workers occupationally exposed to TiO2 NPs using metabolomics. Compared with the control group, a total of 296 serum metabolites were differentially expressed in the TiO2 NPs-exposed group, of which the relative expression of 265 metabolites increased, and the remaining 31 decreased. Three machine learning methods including random forest (RF), support vector machines (SVM), and boruta screened eight potential biomarkers and simultaneously selected a metabolite, Liquoric acid. Through multiple linear regression analysis to adjust the influence of confounding factors such as gender, age, BMI, smoking and drinking, occupational exposure to TiO2 NPs was significantly related to the relative expression of the eight potential biomarkers. Meanwhile, the receiver operating characteristic curves (ROCs) of these potential biomarkers had good sensitivity and specificity. These potential biomarkers were related to lipid peroxidation, and had biological basis for occupational exposure to TiO2 NPs. Therefore, it was demonstrated that the serum metabolites represented by Liquoric acid were good biomarkers of occupational exposure to TiO2 NPs.
Authors: Zhangjian Chen, Shuo Han, Jiahe Zhang, Pai Zheng, Xiaodong Liu, Yuanyuan Zhang, Guang Jia
Full Source: Nanotoxicology 2021 May 7;1-18. doi: 10.1080/17435390.2021.1921872.

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### Long-term exposure to particulate matter and residential greenness in relation to androgen and progesterone levels among rural Chinese adults

2021-05-04
Background: Population-based studies on the associations of long-term exposure to particulate matter (PM) with androgen and progesterone are still scant. Residential greenness is benefits health by promoting physical activity, reducing air pollution, and improving mental health, but it remains unclear whether it is related to androgen and progesterone levels among humans.
Aims: This study aimed to explore the individual and interactive effects of PM and residential greenness on serum testosterone and progesterone levels among rural Chinese adults.
Methods: A total of 6017 subjects were recruited from the baseline of the Henan Rural Cohort Study in 2016. Serum testosterone and progesterone were measured with liquid chromatography-tandem mass spectrometry. Particulate matters (PM) (PM1, PM2.5, and PM10) were assessed by machine learning algorithms. Residential greenness was assessed using the normalized difference vegetation index (NDVI) within 500-m, 1000-m, and 3000-m buffers around participants' residences. The effects of air pollutants and residential greenness and their interaction on serum testosterone and progesterone levels were assessed using linear mixed-effects models with township as a random intercept.
Results: After adjusting for potential confounding factors, a 1 µg/m3 increase in PM2.5 or PM10 was associated with a 0.037 or 0.030 ng/ml increase in serum testosterone, respectively, in females and with a 0.111 or 0.182 ng/ml decrease in serum progesterone, respectively, in males. A 1 µg/m3 increase in PM1, PM2.5 or PM10 was associated with a 0.222, 0.306, or 0.295 ng/ml decrease in serum progesterone, respectively, among females. Moreover, a 0.1-unit increase in NDVI was associated with a 0.310 ng/ml increase in serum testosterone and a 0.170 ng/ml increased in serum progesterone in males, as well as with a 0.143 ng/ml increase in serum progesterone in females. Interaction effects of PM and residential greenness on serum testosterone and progesterone levels were observed, indicating that the effects of residential greenness on serum testosterone and progesterone were modified by high levels of PM. In addition, physical activity significantly mediated 2.92% of the estimated association between greenness and testosterone levels.
Conclusions: Our study suggested that long-term exposure to PM was positively associated with serum testosterone in males but negatively associated with progesterone levels in both genderssin. In addition,

Background: Population-based studies on the associations of long-term exposure to particulate matter (PM) with androgen and progesterone are still scant.

positive associations of residential greenness with serum testosterone and progesterone levels were observed, but they were modified by high levels of PM. Furthermore, the estimated effects of residential greenness on testosterone levels were partly mediated by physical activity.

Authors: Dandan Wei, Shanshan Li, Xue Liu, Li Zhang, Pengling Liu, Keliang Fan, Luting Nie, Lulu Wang, Xiaotian Liu, Jian Hou, Wenqian Huo, Songcheng Yu, Linlin Li, Tao Jing, Xing Li, Wenjie Li, Yuming Guo, Chongjian Wang, Zhenxing Mao

Full Source: Environment international 2021 May 4;153:106483. doi: 10.1016/j.envint.2021.106483.

## PHARAMACEUTICAL/TOXICOLOGY

### Blood lead levels and lung cancer mortality: An updated analysis of NHANES II and III

2021-05-07

Previous analyses within the National Health and Nutrition Examination Survey (NHANES) II and III cycles suggested an association between blood lead levels (BLLs) and lung cancer mortality, although the evidence was limited by small case numbers. To clarify this relationship, we conducted updated analyses of 4,182 and 15,629 participants in NHANES II and III, respectively, (extending follow-up 20 and 8 years) aged ≥20 with BLL measurements and mortality follow-up through 2014. We fit multivariable Cox models to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) relating BLLs and lung cancer with adjustment for smoking and other factors. We did not observe an overall association between BLLs and lung cancer after adjustment for smoking (both surveys) and serum cotinine and environmental tobacco smoke exposure (NHANES III), although suggestive associations were observed among women (NHANES II: HR 2.7, 95% CI 0.7, 10.0 for ≥20.0 µg/dl vs. <10.0 µg/dl, Ptrend = 0.07; NHANES III: HR 11.2, 95% CI 2.1, 59.4 for ≥10.0 µg/dl vs. <2.5 µg/dl, Ptrend = 0.04). After stratifying on smoking status, an association with elevated BLLs was observed in NHANES II only among former smokers (HR 3.2, 95% CI 1.3, 8.0 for ≥15 vs. <15 µg/dl) and in NHANES III only among current smokers (HR 1.7, 95% CI 1.1, 2.8 for ≥5 vs. <5 µg/dl). In summary, we found elevated BLLs to be associated with lung cancer mortality among women in both NHANES II and III. Given the absence of an association among non-smokers, we cannot rule out residual confounding as an explanation for our findings.

Previous analyses within the National Health and Nutrition Examination Survey (NHANES) II and III cycles suggested an association between blood lead levels (BLLs) and lung cancer mortality, although the evidence was limited by small case numbers.

Authors: Jongeun Rhee, Barry I Graubard, Mark P Purdue

Full Source: Cancer medicine 2021 May 7. doi: 10.1002/cam4.3943.