CHEMWATCH

Bulletin Board

Contents

OCT. 14, 2022

(click on page numbers for links)

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

Plastic debris as a mobile source of additive chemicals in marine environments: In-situ evidence

2022-09-19

Plastic debris can act as a source of hazardous chemicals in the ocean, but the significance of its role in the environment is not yet known. To address this question, a comprehensive field study of highly contaminated and non-contaminated islands was conducted. Comparison of the plastic additive hexabromocyclododecanes and ubiquitous contaminants polychlorinated biphenyls in marine invertebrates showed that the load of stranded plastics plays a significant role in the bioaccumulation of plastic additives in the marine debris-contaminated island. Fugacity analysis indicates that net flow of hexabromocyclododecanes occurred from plastics to environmental reservoirs. Additionally, significantly higher levels of antioxidants, 2,4-di-tert-butylphenol and butylated hydroxytoluene, was found in the marine invertebrates inhabiting the marine debris-contaminated island than those inhabiting the marine debris-noncontaminated island, but ultraviolet stabilizers did not show the regional difference. This study provides the first field evidence that the movement of plastic debris in the ocean drives the dispersal of plastic additives to pristine waters.

Authors: Mi Jang, Won Joon Shim, Gi Myung Han, Youna Cho, Sang Hee Hong

Full Source: The Science of the total environment 2022 Sep 19;856(Pt 1):158893. doi: 10.1016/j.scitotenv.2022.158893.

Plastic debris can act as a source of hazardous chemicals in the ocean, but the significance of its role in the environment is not yet known.

Influences of climate change on long-term time series of persistent organic pollutants (POPs) in Arctic and Antarctic biota

2022-10-05

Time series of contaminants in the Arctic are an important instrument to detect emerging issues and to monitor the effectiveness of chemicals regulation, based on the assumption of a direct reflection of changes in primary emissions. Climate change has the potential to influence these time trends, through direct physical and chemical processes and/or changes in ecosystems. This study was part of an assessment of the Arctic Monitoring and Assessment Programme (AMAP), analysing potential links between changes in climate-related physical and biological variables and time trends of persistent organic pollutants (POPs) in Arctic biota,

CHEMWATCH
Bulletin Board
Technical
OCT. 14, 2022

with some additional information from the Antarctic. Several correlative relationships were identified between POP temporal trends in freshwater and marine biota and physical climate parameters such as oscillation indices, sea-ice coverage, temperature and precipitation, although the mechanisms behind these observations remain poorly understood. Biological data indicate changes in the diet and trophic level of some species, especially seabirds and polar bears, with consequences for their POP exposure. Studies from the Antarctic highlight increased POP availability after iceberg calving. Including physical and/or biological parameters in the POP time trend analysis has led to small deviations in some declining trends, but did generally not change the overall direction of the trend. In addition, regional and temporary perturbations occurred. Effects on POP time trends appear to have been more pronounced in recent years and to show time lags, suggesting that climate-related effects on the long time series might be gaining importance.

Authors: Katrin Vorkamp, Pernilla Carlsson, Simonetta Corsolini, Cynthia A de Wit, Rune Dietz, Matthew O Gribble, Magali Houde, Vrinda Kalia, Robert J Letcher, Adam Morris, Frank F Rigét, Heli Routti, Derek C G Muir

Full Source: Environmental science. Processes & impacts 2022 Oct 5. doi: 10.1039/d2em00134a.

Prioritization of chemicals in food for risk assessment by integrating exposure estimates and new approach methodologies: A next generation risk assessment case study

2022-09-19

Next generation risk assessment is defined as a knowledge-driven system that allows for cost-efficient assessment of human health risk related to chemical exposure, without animal experimentation. One of the key features of next generation risk assessment is to facilitate prioritization of chemical substances that need a more extensive toxicological evaluation, in order to address the need to assess an increasing number of substances. In this case study focusing on chemicals in food, we explored how exposure data combined with the Threshold of Toxicological Concern (TTC) concept could be used to prioritize chemicals, both for existing substances and new substances entering the market. Using a database of existing chemicals relevant for dietary exposure we calculated exposure estimates, followed by application of the TTC concept to identify substances of higher concern. Subsequently, a selected set of these priority substances was screened for toxicological potential using high-throughput screening (HTS) approaches. Remarkably, this approach

Next generation risk assessment is defined as a knowledge-driven system that allows for cost-efficient assessment of human health risk related to chemical exposure, without animal experimentation.

resulted in alerts for a selection of substances that are already on the market and represent relevant exposure in consumers. Taken together, the case study provides proof-of-principle for the approach taken to identify substances of concern, and this approach can therefore be considered a supportive element to a next generation risk assessment strategy.
Authors: Mirjam Luijten, R Corinne Sprong, Emiel Rorije, Leo T M van der Ven
Full Source: Frontiers in toxicology 2022 Sep 19;4:933197. doi: 10.3389/ftox.2022.933197

ENVIRONMENTAL RESEARCH

Risk of maternal exposure to mixed air pollutants during pregnancy for congenital heart diseases in offspring

2022-06-25
Objective: To explore the risk of maternal exposure to mixed air pollutants of particulate matter 1 (PM 1), particulate matter 2.5 (PM 2.5), particulate matter 10 (PM 10) and NO 2 for congenital heart disease (CHD) in offspring, and to estimate the ranked weights of the above pollutants.
Methods: 6038 CHD patients and 5227 healthy controls from 40 medical institutions in 21 cities in Guangdong Registry of Congenital Heart Disease (GRCHD) from 2007 to 2016 were included. Logistic regression model was used to estimate the effect of maternal exposure to a single air pollutant on the occurrence of CHD in offspring. Spearman correlation coefficient was used to analyze the correlation between various pollutants, and Quantile g-computation was used to evaluate the joint effects of mixed exposure of air pollutants on CHD and the weights of various pollutants.
Results: The exposure levels of PM 1, PM 2.5, PM 10 and NO 2 in the CHD group were significantly higher than those in the control group (all P<0.01). The correlation coefficients among PM 1, PM 2.5, PM 10 and NO 2 were greater than 0.80. PM 1, PM 2.5, PM 10 and NO 2 exposure were associated with a significantly increased risk of CHD in offspring. Mixed exposure of these closely correlated pollutants presented much stronger effect on CHD than exposure of any single pollutants. There was a monotonic increasing relationship between mixed exposure and CHD risk. For each quantile increase in mixed exposure, the risk of CHD increased by 47% (OR=1.47, 95% CI: 1.34-1.61). Mixed exposure had greater effect on CHD in the early pregnancy compared with middle and late pregnancy, but the greatest effect was the exposure in the whole pregnancy. The weight of PM 10 is the highest in the mixed exposure (81.3%).

Objective: To explore the risk of maternal exposure to mixed air pollutants of particulate matter 1 (PM 1), particulate matter 2.5 (PM 2.5), particulate matter 10 (PM 10) and NO 2 for congenital heart disease (CHD) in offspring, and to estimate the ranked weights of the above pollutants.
.

CHEMWATCH
Bulletin Board
Technical
OCT. 14, 2022

Conclusions: Maternal exposure to the mixture of air pollutants during pregnancy increases the risk of CHD in offspring, and the effect is much stronger than that of single exposure of various pollutants. PM 10 has the largest weights and the strongest effect in the mixed exposure.
Authors: Yanji Qu, Xinli Zhou, Xiaoqing Liu, Ximeng Wang, Boyi Yang, Gongbo Chen, Yuming Guo, Zhiqiang Nie, Yanqiu Ou, Xiangmin Gao, Yong Wu, Guanghui Dong, Jian Zhuang, Jimei Chen
Full Source: Zhejiang da xue xue bao. Yi xue ban = Journal of Zhejiang University. Medical sciences 2022 Jun 25;51(3):326-333. doi: 10.3724/zdxbyxb-2022-0073.

Beyond Particulate Matter Mass: Heightened Levels of Lead and Other Pollutants Associated with Destructive Fire Events in California

2022-10-03
As the climate warms, wildfire activity is increasing, posing a risk to human health. Studies have reported on particulate matter (PM) in wildfire smoke, yet the chemicals associated with PM have received considerably less attention. Here, we analyzed 13 years (2006-2018) of PM2.5 chemical composition data from monitors in California on smoke-impacted days. Select chemicals (e.g., aluminum and sulfate) were statistically elevated on smoke-impacted days in over half of the years studied. Other chemicals, mostly trace metals harmful to human health (e.g., copper and lead), were elevated during particular fires only. For instance, in 2018, lead was more than 40 times higher on smoke days on average at the Point Reyes monitoring station, due mostly to the Camp Fire, burning approximately 200 km away. There was an association between these metals and the combustion of anthropogenic material (e.g., the burning of houses and vehicles). Although still currently rare, these infrastructure fires are likely becoming more common and can mobilize trace metals in smoke far downwind, at levels generally unseen except in the most polluted areas of the country. We hope a better understanding of the chemicals in wildfire smoke will assist in the communication and reduction of public health risks.
Authors: Katie Boaggio, Stephen D LeDuc, R Byron Rice, Parker F Duffney, Kristen M Foley, Amara L Holder, Stephen McDow, Christopher P Weaver
Full Source: Environmental science & technology 2022 Oct 3. doi: 10.1021/acs.est.2c02099.

As the climate warms, wildfire activity is increasing, posing a risk to human health.

PHARMACEUTICAL/TOXICOLOGY

Associations of per- and polyfluoroalkyl substances (PFAS) and their mixture with oxidative stress biomarkers during pregnancy

2022-11

Background: Oxidative stress from excess reactive oxygen species (ROS) is a hypothesized contributor to preterm birth. Per- and polyfluoroalkyl substances (PFAS) exposure is reported to generate ROS in laboratory settings, and is linked to adverse birth outcomes globally. However, to our knowledge, the relationship between PFAS and oxidative stress has not been examined in the context of human pregnancy.

Objective: To investigate the associations between prenatal PFAS exposure and oxidative stress biomarkers among pregnant people.

Methods: Our analytic sample included 428 participants enrolled in the Illinois Kids Development Study and Chemicals In Our Bodies prospective birth cohorts between 2014 and 2019. Twelve PFAS were measured in second trimester serum. We focused on seven PFAS that were detected in >65 % of participants. Urinary levels of 8-isoprostane-prostaglandin-F2α, prostaglandin-F2α, 2,3-dinor-8-iso-PGF2α, and 2,3-dinor-5,6-dihydro-8-iso-PGF2α were measured in the second and third trimesters as biomarkers of oxidative stress. We fit linear mixed-effects models to estimate individual associations between PFAS and oxidative stress biomarkers. We used quantile g-computation and Bayesian kernel machine regression (BKMR) to assess associations between the PFAS mixture and averaged oxidative stress biomarkers.

Results: Linear mixed-effects models showed that an interquartile range increase in perfluorooctane sulfonic acid (PFOS) was associated with an increase in 8-isoprostane-prostaglandin-F2α (β = 0.10, 95 % confidence interval = 0, 0.20). In both quantile g-computation and BKMR, and across all oxidative stress biomarkers, PFOS contributed the most to the overall mixture effect. The six remaining PFAS were not significantly associated with changes in oxidative stress biomarkers.

Conclusions: Our study is the first to investigate the relationship between PFAS exposure and biomarkers of oxidative stress during human pregnancy. We found that PFOS was associated with elevated levels of oxidative stress, which is consistent with prior work in animal models and

Background: Oxidative stress from excess reactive oxygen species (ROS) is a hypoth-esized contributor to preterm birth.

CHEMWATCH
Bulletin Board
Technical
OCT. 14, 2022

cell lines. Future research is needed to understand how prenatal PFAS exposure and maternal oxidative stress may affect fetal development.

Authors: Kaitlin R Taibl, Susan Schantz, Max T Aung, Amy Padula, Sarah Geiger, Sabrina Smith, June-Soo Park, Ginger L Milne, Joshua F Robinson, Tracey J Woodruff, Rachel Morello-Frosch, Stephanie M Eick

Full Source: Environment international 2022 Nov;169:107541. doi: 10.1016/j.envint.2022.107541.

Antibody response to COVID-19 vaccines among workers with a wide range of exposure to per- and polyfluoroalkyl substances

2022-11

Per- and polyfluoroalkyl substances (PFAS) are a broad class of synthetic chemicals; some are present in most humans in developed countries. Several studies have shown associations between certain PFAS, such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), and reduced antibody concentration after vaccination against diseases such as Tetanus. Recent studies have reported associations between COVID-19 occurrence and exposure to certain types of PFAS. However, studies of antibody concentration after COVID-19 vaccination in relation to PFAS serum concentrations have not been reported. We examined COVID-19 antibody responses to vaccines and PFAS serum concentrations among employees and retirees from two 3M facilities, one of which historically manufactured PFOS, PFOA, and perfluorohexane sulfonic acid (PFHxS). Participants completed enrollment and follow-up study visits in the Spring of 2021, when vaccines were widely available. In total 415 participants with 757 observations were included in repeated measures analyses. Log-transformed concentrations of anti-spike IgG and neutralizing antibodies were modeled in relation to concentration of PFAS at enrollment after adjusting for antigenic stimulus group (9 groups determined by COVID-19 history and number and type of vaccination) and other variables. The fully adjusted IgG concentration was 3.45 percent lower (95% CI -7.03, 0.26) per 14.5 ng/mL (interquartile range) increase in PFOS; results for neutralizing antibody and PFOS were similar. For PFOA, PFHxS, and perfluorononanoic acid (PFNA), the results were comparable to those for PFOS, though of smaller magnitude. In our study data, the fully adjusted coefficients relating concentration of vaccine-induced antibodies to COVID-19 and interquartile range difference in serum concentration of PFOS, PFOA, PFHxS, and PFNA were inverse but small with confidence intervals that included zero. Our analysis showed that the coefficient for

Per- and polyfluoroalkyl substances (PFAS) are a broad class of synthetic chemicals; some are present in most humans in developed countries.

the four PFAS examined in detail was considerably affected by adjustment for antigenic stimulus group.
Authors: Anna K Porter, Sarah E Kleinschmidt, Kara L Andres, Courtney N Reusch, Ryan M Krisko, Oyebode A Taiwo, Geary W Olsen, Matthew P Longnecker
Full Source: Environment international 2022 Nov;169:107537. doi: 10.1016/j.envint.2022.107537.

OCCUPATIONAL

Occupational Exposures and Health Risks of Benzene, Toluene, and Xylenes (BTX) in Automobile Repair Industry in Beijing City, China

2022-10-07
This study aimed to evaluate the occupational health risks of benzene, toluene, and xylenes (BTX) exposure in the automobile repair industry in Beijing city in China. The concentrations of BTX were monitored at 140 operating positions of 51 randomly selected automobile repair enterprises in 2018. Samples analysis showed that all monitoring concentrations were not higher than the occupational exposure limits. The long-term exposure concentration ranges of benzene, toluene, and xylenes were 0.1 to 0.3, 0.1 to 49.7, and 0.2 to 49.5 mg/m3, respectively. The short-term exposure concentration ranges of benzene, toluene, and xylenes were 0.1 to 0.3, 0.1 to 98.7, and 0.2 to 100.0 mg/m3, respectively. But assessment results revealed unneglectable occupational health risks, especially the combined health risks of BTX exposure. Thereafter, effective control and improvement measures were put forward, including strengthening the management of the production, sale, and use of vehicle paints and coatings; improving ventilation; and implementing hierarchical management measures for occupational health risks.
Authors: Pengpeng Hao, Dongmei Ren, Ling Yang, Zhimin Liu, Huifang Du
Full Source: Asia-Pacific journal of public health 2022 Oct 7;10105395221131121. doi: 10.1177/10105395221131121.

This study aimed to evaluate the occupational health risks of benzene, toluene, and xylenes (BTX) exposure in the automobile repair industry in Beijing city in China.

Association between diesel exhaust exposure and mitochondrial DNA methylation

2022-10-06
Background: Diesel exhaust is an established human carcinogen, however the mechanisms by which it leads to cancer development are not fully understood. Mitochondrial dysfunction is an established contributor to carcinogenesis. Recent studies have improved our understanding of the role played by epigenetic modifications in the mitochondrial genome on tumorigenesis. In this study, we aim to evaluate the association between diesel engine exhaust (DEE) exposure with mitochondrial DNA (mtDNA) methylation levels in workers exposed to DEE.
Methods: The study population consisted of 53 male workers employed at a diesel engine manufacturing facility in Northern China who were routinely exposed to diesel exhaust in their occupational setting, as well as 55 unexposed male control workers from other unrelated factories in the same geographic area. Exposure to DEE, elemental carbon, organic carbon, and particulate matter (PM2.5) were assessed. mtDNA methylation for CpG sites (CpGs) from seven mitochondrial genes (D-Loop, MT-RNR1, MT-CO2, MT-CO3, MT-ATP6, MT-ATP8, MT-ND5) was measured in blood samples. Linear regression models were used to estimate the associations between DEE, elemental carbon, organic carbon and PM2.5 exposures with mtDNA methylation levels, adjusting for potential confounders.
Results: DEE exposure was associated with decreased MT-ATP6 (difference= -35.6%, p-value= 0.019) and MT-ATP8 methylation (difference= -30%, p-value= 0.029) compared to unexposed controls. Exposures to elemental carbon, organic carbon, and PM2.5 were also significantly and inversely associated with methylation in MT-ATP6 and MT-ATP8 genes (all p-values < 0.05).
Conclusions: Our findings suggest that DEE exposure perturbs mtDNA methylation, which may be of importance for tumorigenesis.
Authors: Wei Jie Seow, Wei Hu, Yufei Dai, Roel Vermeulen, Hyang-Min Byun, Jason Y Y Wong, Bryan A Bassig, Batel Blechter, Huawei Duan, Yong Niu, George Downward, Shuguang Leng, Bu-Tian Ji, Wei Fu, Jun Xu, Kees Meliefste, Jufang Yang, Dianzhi Ren, Meng Ye, Tao Meng, Ping Bin, H Dean Hosgood, Debra T Silverman, Nathaniel Rothman, Yuxin Zheng, Qing Lan
Full Source: Carcinogenesis 2022 Oct 6;bgac077. doi: 10.1093/carcin/bgac077.

Objective: Mitochondria are essential organelles that execute fundamental biological processes, while mitochondrial DNA is vulnerable to environmental insults.

Multiple metals exposure and blood mitochondrial DNA copy number: A cross-sectional study from the Dongfeng-Tongji cohort

2022-10-05
Objective: Mitochondria are essential organelles that execute fundamental biological processes, while mitochondrial DNA is vulnerable to environmental insults. The aim of this study was to investigate the individual and mixture effect of plasma metals on blood mitochondria DNA copy number (mtDNAcn).

Methods: This study involved 1399 randomly selected subcohort participants from the Dongfeng-Tongji cohort. The blood mtDNAcn and plasma levels of 23 metals were determined by using quantitative real-time polymerase chain reaction (qPCR) and inductively coupled plasma mass spectrometer (ICP-MS), respectively. The multiple linear regression was used to explore the association between each metal and mtDNAcn, and the LASSO penalized regression was performed to select the most significant metals. We also used the quantile g-computation analysis to assess the mixture effect of multiple metals.
Results: Based on multiple linear regression models, each 1% increase in plasma concentration of copper (Cu), rubidium (Rb), and titanium (Ti) was associated with a separate 0.16% [β(95% CI) = 0.158 (0.066, 0.249), P = 0.001], 0.20% [β(95% CI) = 0.196 (0.073, 0.318), P = 0.002], and 0.25% [β(95% CI) = 0.245 (0.081, 0.409), P = 0.003] increase in blood mtDNAcn. The LASSO regression also confirmed Cu, Rb, and Ti as significant predictors for mtDNAcn. There was a significant mixture effect of multiple metals on increasing mtDNAcn among the elder participants (aged ≥65), with an approximately 11% increase in mtDNAcn for each quartile increase in all metal concentrations [β(95% CI) = 0.146 (0.048, 0.243), P = 0.004].
Conclusions: Our results show that plasma Cu, Rb and Ti were associated with increased blood mtDNA, and we further revealed a significant mixture effect of all metals on mtDNAcn among elder population. These findings may provide a novel perspective on the effect of metals on mitochondrial dysfunction.

Authors: Ming Fu, Chenming Wang, Shiru Hong, Xin Guan, Hua Meng, Yue Feng, Yang Xiao, Yuhan Zhou, Chenliang Liu, Guorong Zhong, Yingqian You, Tianhao Wu, Handong Yang, Xiaomin Zhang, Meian He, Huan Guo
Full Source: Environmental research 2022 Oct 5;114509. doi: 10.1016/j.envres.2022.114509.