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Technical

OCT. 13, 2023

CHEMICAL EFFECTS

Assessment of 18 endocrine disrupting chemicals in tap water samples from Klang Valley, Malaysia

2023-10-06

Multiclass of endocrine disrupting chemicals (EDCs) such as nine perfluoroalkyl and polyfluoroalkyl substances (PFAS), five bisphenols, and four parabens were analysed in tap water samples from Malaysia's Klang Valley region. All samples were analysed using liquid chromatography mass tandem spectrometry (LC-MS/MS) with limit of quantitation (LOQ) ranged between 0.015 and 5 ng/mL. Fifteen of the 18 EDCs were tested positive in tap water samples, with total EDC concentrations ranging from 0.28 to 5516 ng/L for all 61 sampling point locations. In a specific area of the Klang Valley, the total concentration of EDCs was found to be highest in Hulu Langat, followed by Sepang, Putrajaya, Petaling, Kuala Lumpur, Seremban, and Gombak/Klang. PFAS and paraben were the most found EDCs in all tap water samples. Meanwhile, ethyl paraben (EtP) exhibited the highest detection rate, with 90.2% of all locations showing its presence. Over 60% of the regions showed the presence of perfluoro-n-butanoic acid (PFBA), perfluoro-n-hexanoic acid (PFHXA), perfluoro-n-octanoic acid (PFOA), perfluoro-n-nonanoic acid (PFNA), and perfluoro-1-octanesulfonate (PFOS), whereas the frequency of detection for other compounds was less than 40%. The spatial distribution and mean concentrations of EDCs in the Klang Valley regions revealed that Hulu Langat, Petaling Jaya, and Putrajaya exhibited higher levels of bisphenol A (BPA). On the other hand, Kuala Lumpur and Sepang displayed the highest mean concentrations of PFBA. In the worst scenario, the estimated daily intake (EDI) and risk quotient of some EDCs in this study exceeded the acceptable daily limits recommended by international standards, particularly for BPA, PFOA, PFOS, and PFNA, where the risk quotient (RQ) was found to be greater than 1, indicating a high risk to human health. The increasing presence of EDCs in tap water is undoubtedly a cause for concern as these substances can have adverse health consequences. This highlights the necessity for a standardised approach to evaluating EDC exposure and its direct impact on human populations' health.

Authors: Didi Erwandi Mohamad Haron, Minoru Yoneda, Rafidah Hod, Mohd Redzuan Ramli, Mohd Yusmaidie Aziz

Full Source: Environmental science and pollution research international 2023 Oct 6. doi: 10.1007/s11356-023-30022-9.

Multiclass of endocrine disrupting chemicals (EDCs) such as nine perfluoroalkyl and polyfluoroalkyl substances (PFAS), five bisphenols, and four parabens were analysed in tap water samples from Malaysia's Klang Valley region.

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Impact of chemical mixtures from wastewater treatment plant effluents on human immune cell activation: An effect-based analysis

2023-10-05

Background: Humans are exposed to many different chemicals on a daily basis, mostly as chemical mixtures, usually from food, consumer products and the environment. Wastewater treatment plant effluent contains mixtures of chemicals that have been discarded or excreted by humans and not removed by water treatment. These effluents contribute directly to water pollution, they are used in agriculture and may affect human health. The possible effect of such chemical mixtures on the immune system has not been characterized.

Objective: The aim of this study was to investigate the effect of extracts obtained from four European wastewater treatment plant effluents on human primary immune cell activation.

Methods: Immune cells were exposed to the effluent extracts and modulation of cell activation was performed by multi-parameter flow cytometry. Messenger-RNA (mRNA) expression of genes related to immune system and hormone receptors was measured by RT-PCR. Results: The exposure of immune cells to these extracts, containing 339 detected chemicals, significantly reduced the activation of human lymphocytes, mainly affecting T helper and mucosal-associated invariant T cells. In addition, basophil activation was also altered upon mixture exposure. Concerning mRNA expression, we observed that 12 transcripts were down-regulated by at least one extract while 11 were up-regulated. Correlation analyses between the analyzed immune parameters and the concentration of chemicals in the WWTP extracts, highlighted the most immunomodulatory chemicals.

Discussion: Our results suggest that the mixture of chemicals present in the effluents of wastewater treatment plants could be considered as immunosuppressive, due to their ability to interfere with the activation of immune cells, a process of utmost importance for the functionality of the immune system. The combined approach of immune effect-based analysis and chemical content analysis used in our study provides a useful tool for investigating the effect of environmental mixtures on the human immune response.

Authors: Ambra Maddalon, Arkadiusz Pierzchalski, Jannike Lea Krause, Mario Bauer, Saskia Finckh, Werner Brack, Ana C Zenclussen, Marina Marinovich, Emanuela Corsini, Martin Krauss, Gunda Herberth

Full Source: The Science of the total environment 2023 Oct 5:906:167495. doi: 10.1016/j.scitotenv.2023.167495.

Background: Humans are exposed to many different chemicals on a daily basis, mostly as chemical mixtures, usually from food, consumer products and the environment.

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ENVIRONMENTAL RESEARCH

Cosmetic UV filters in the environment-state of the art in EU regulations, science and possible knowledge gaps

2023-10

Objective: The aim of this work was to review the principals of environmental hazard and risk assessment (ERA) of cosmetic UV filters registered under EU REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). Furthermore, effects as obtained from non-standardized testing methods and organisms from scientific literature were compared against the predicted no effect concentrations (PNECs) as derived based on standardized test methods for the various environmental compartments under REACH.

Methods: The REACH dossiers at the ECHA webpage were screened for available information related to basic physico-chemical data (i.e. water solubility, octanol-water partitioning coefficient), PNECs and associated data (data basis, assessment factors (AFs)). Scientific literature was screened for available ecotoxicity data and the adverse effect levels were compared against the derived PNECs under REACH. Current approaches for environmental risk assessments of UV filters were evaluated for its applicability for a direct release scenario.

Results: Under REACH, PNECs were derived for all hazardous UV filters. Although, PNECs were often derived for various environmental compartments (i.e. freshwater, marine water, sediment, soil), results from literature focused on aquatic data. Effects as observed within scientific literature matches in principle with the hazardous profile of the UV filters. Effects levels both on the acute and the chronic toxicity as retrieved from the non-standardized test organisms (literature) were above the derived PNECs under REACH. Currently, ERAs performed for cosmetic UV filters under REACH are solely tonnage driven and thus do not fully capture the use in sunscreens and associated leisure activities.

Conclusion: Existing EU REACH regulation is considered as sufficient to evaluate the environmental safety of UV filters used in sunscreens. To cover the direct release of UV filters due to various leisure activities into the aquatic freshwater and marine environment, an additional application-based ERA is considered necessary.

Authors: Sascha Pawlowski, Laura Henriette Luetjens, Alina Preibisch, Stephanie Acker, Mechtild Petersen-Thiery

Full Source: International journal of cosmetic science 2023 Oct:45 Suppl 1:52-66. doi: 10.1111/ics.12898.

Objective: The aim of this work was to review the principals of environmental hazard and risk assessment (ERA) of cosmetic UV filters registered under EU REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals).

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Roadside vegetated filter strips to simultaneously lower stormwater pollution loadings and improve economics of biorefinery feedstocks

2023-10-05

Roadside vegetated filters strips (VFSs) reduce roadway runoff pollution by intercepting stormwater and reducing pollutant loads. VFS maintenance and operating costs can be reduced by designing the VFSs to serve as sites for production of marketable biomass. This biomass can provide feedstock for the emerging bioeconomy producing renewable fuels and biobased chemicals and products. Economic evaluation is needed to quantify the benefit of combining VFS with bioenergy biomass production. This evaluation requires a place-based approach to quantify availability of land, transportation costs, and benefits to sensitive habitats. We evaluated roadside land, within the state right-of-way, in Western Washington, to determine the total area available for implementing VFSs. These data were then used to estimate the volume and cost, of biomass produced on the filter strips, and the resultant reduction in pollutants emitted through highway runoff. The analysis showed that up to 5600 ha were available for roadside VFSs that would be within transportation distance of the theoretical biorefinery location. This space could produce up to 97 dry Gg per year of poplar biomass. The resulting reduction in biorefinery feedstock cost was up to \$24 per dry Mg compared to biomass from dedicated tree farms. The results showed that combining roadside poplar with traditional dedicated poplar feedstocks can reduce the feedstock cost of the biorefinery from \$76 to \$67 per Mg for a biorefinery processing 150 Gg biomass per year. Environmental impact analysis showed that within the study area half of urban roadways and one-third of rural roadways in highly sensitive aquatic areas were amenable to VFS. Construction of VFS in these amenable areas would reduce total loadings to sensitive aquatic areas in urban areas by 26% for TSS, copper, and zinc, and by 10% for phosphorus, and nitrogen and by 21% for lead. The impact for rural sensitive areas was even greater where the VFS had potential to reduce total loadings to sensitive aquatic areas by 38% for TSS, copper, and zinc, by 15% for phosphorus and nitrogen, and by 31% for lead. This research showed an approach combining geographic information system (GIS) mapping and economic analysis to document simultaneous evaluation of

Roadside vegetated filter strips (VFSs) reduce roadway runoff pollution by intercepting stormwater and reducing pollutant loads.

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cost and environmental benefits when considering use of non-traditional land for bioenergy crop production.

Authors: Hisham El-Husseini, Amira N Chowyuk, Richard R Gustafson, Heidi L Gough, Renata Bura

Full Source: Journal of environmental management 2023 Oct 5:347:119168. doi: 10.1016/j.jenvman.2023.119168.\

Prenatal exposure to poly- and perfluoroalkyl substances and the incidence of asthma in early childhood

2023-10-05

EXPOSURE TO POLY: and perfluoroalkyl substances (PFAS) in early life may increase the risk of childhood asthma, but evidence has been inconsistent. We estimated associations between maternal serum concentrations of PFAS during pregnancy and clinician-diagnosed asthma incidence in offspring through age eight. We included 597 mother-child pairs with PFAS quantified in mid-pregnancy serum and childhood medical records reviewed for asthma diagnoses. We used separate Cox proportional hazards models to assess the relationship between log-transformed concentrations of five PFAS and the incidence of asthma. We estimated associations between the PFAS mixture and clinician-diagnosed asthma incidence using quantile-based g-computation. PFAS concentrations were similar to those among females in the US general population. Seventeen percent of children (N = 104) were diagnosed with asthma during follow-up. Median (interquartile range) duration of follow-up was 4.7 (4.0, 6.2) years, and median age at asthma diagnosis was 1.7 (0.9, 2.8) years. All adjusted hazard ratios (HRs) were elevated, but all 95% confidence intervals (CI) included the null. The HR (95% CI) of asthma for a one-quartile increase in the PFAS mixture was 1.17 (0.86, 1.61). In this cohort of children followed to eight years of age, prenatal PFAS concentrations were not significantly associated with incidence of clinician-diagnosed asthma.

Authors: Lauren M Zell-Baran, Carina Venter, Dana Dabelea, Jill M Norris, Deborah H Glueck, John L Adgate, Jared M Brown, Antonia M Calafat, Kaci Pickett-Nairne, Anne P Starling

Full Source: Environmental research 2023 Oct 5:117311. doi: 10.1016/j.envres.2023.117311.

EXPOSURE TO POLY: and perfluoroalkyl substances (PFAS) in early life may increase the risk of childhood asthma, but evidence has been inconsistent.

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PHARMACEUTICAL/TOXICOLOGY

Gestational hypertension, preeclampsia, and gestational diabetes mellitus after high exposure to perfluoroalkyl substances from drinking water in Ronneby, Sweden

2023-10-05

Background: Leakage of fire-fighting foam from an airfield caused contamination of the drinking water supplied to a third of the population in Ronneby, resulting in very high serum levels of predominantly perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS). The results of studies investigating the association between exposure to perfluorinated alkyl substances (PFAS) and pregnancy complications are inconsistent, and studies at high exposures of PFOS and PFHxS are lacking. Objectives: To investigate the association between exposure to high levels of PFAS and gestational hypertension and preeclampsia, and gestational diabetes mellitus.

Methods: We retrieved data on 27 292 childbirths between 1995 and 2013 from the National Medical Birth Register for women that had a residential address in Blekinge county for at least one year before delivery. Residential history was used as a proxy for exposure by categorizing women into high-, intermediate-, or background exposed based on their residential address during the five-year period before childbirth. Data on confounders were retrieved from administrative registers. The outcomes were defined based on International Classification of Diseases codes. We used logistic regression to estimate odds ratios (OR) for gestational hypertension and preeclampsia, and gestational diabetes mellitus. We also investigated effect modification by fetal sex.

Results: We found no evidence of increased risk of gestational hypertension and preeclampsia (OR 0.80; CI 0.63-1.03), nor gestational diabetes (OR 1.03; CI 0.67-1.58) after high PFAS exposure. There was no effect modification by fetal sex.

Discussion: This was the first study to investigate the association between high exposure to PFOS and PFHxS and pregnancy complications. The results from this study add important knowledge to public health management as new hotspots with high levels of PFAS are continuously discovered.

Authors: Matilda Ebel, Lars Rylander, Tony Fletcher, Kristina Jakobsson, Christel Nielsen

Full Source: Environmental research 2023 Oct 5:117316. doi: 10.1016/j.envres.2023.117316.

Background: Leakage of fire-fighting foam from an airfield caused contamination of the drinking water supplied to a third of the population in Ronneby, resulting in very high serum levels of predominantly perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS).

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Characteristic and health risk of per- and polyfluoroalkyl substances from cosmetics via dermal exposure

2023-10-05

In this work, 45 cosmetic samples were collected from China, and 27 target per- and polyfluoroalkyl substances (PFAS) were analyzed by ultrahigh-performance liquid chromatography-high resolution mass spectrometry. PFAS were found in all samples, including the products marketed for pregnant women, and the total concentrations of PFAS measured in each sample were in the range of 4.05 - 94.9 ng/g. Short-chain perfluorinated carboxylic acids were the dominant compounds contributing to over 60% of the total content. Perfluorobutanoic acid, with high placental transfer efficiency, was the major PFAS in cosmetics for pregnant women. Three emerging PFAS, 2-perfluorohexyl ethanoic acid, 3-perfluoropentyl propanoic acid (5:3) and perfluoro-2-propoxypropanoic acid, were also identified in the cosmetic samples at quantifiable levels. Significantly, positive correlations between individual PFAS were observed, indicating that there may be a common source for PFAS in these samples. Statistical analyses suggested that using plastic containers and precursor substances may be potential sources of PFAS in terminal products, and product aging may increase PFAS levels. From the PFAS analysis of the cosmetics, the margin of safety (MoS) and hazard quotient (HQ) were calculated to assess human health risks through dermal exposure by using these products. Although the MoS and HQ values obtained were deemed acceptable, the cumulative effect caused by composite and long-term exposure to these contaminants needs to be given greater attention by health authorities.

Authors: Xia Lin, Yudong Xing, Huijun Chen, Yan Zhou, Xin Zhang, Peng Liu, Jiaoyang Li, Hian Kee Lee, Zhenzhen Huang
Full Source: Environmental pollution (Barking, Essex : 1987) 2023 Oct 5:338:122685. doi: 10.1016/j.envpol.2023.122685.

OCCUPATIONAL

Butyl benzyl phthalate exposure impact on the gut health of *Metaphire guillelmi*

2023-10-04

Agricultural films are extensively utilized in high-intensity agriculture, with China's annual usage reaching 1.5 million tons. Unfortunately, the recovery rate is less than 60%, leading to an inevitable accumulation of plastic mulch in agricultural soils. This accumulation primarily introduces butyl benzyl phthalate (BBP) into soil ecosystems, whose specific effects remain

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largely unclear, thereby posing potential risks. The present study focuses on the exposure impact of BBP on earthworms, *Metaphire guillelmi*, a commonly found endogenic earthworm within real farmland, as it provides insight into the direct interaction between biota gut health and contaminants. Specifically, we studied the biomarkers related to oxidative stress, the digestive system, and neurotoxicity within the gut of *Metaphire guillelmi*, and the integrated biological response (IBR) index was utilized to track these markers at different timeframes after BBP exposures. Our findings indicate that BBP exposures lead to oxidative damage, digestive system inhibition, and neurotoxicity, with IBR indexes of 14.6 and 17.3 on the 14th and 28th days, respectively. Further, the underlying mechanisms at a molecular level through molecular docking were investigated. The results showed that the most unstable interaction was with the Na⁺K⁺-ATPase (binding energy: -2.25 kcal-1), while BBP displayed stable bonds with superoxide dismutase and 8-hydroxydeoxyguanosine via hydrogen bonds and hydrophobic interaction. These interactions resulted in changes in protein conformation and their normal physiological functions, offering new insights into the molecular mechanism underlying enzymatic activity changes. This study has significant implications for the prediction of toxicity, environmental risk assessment, and the establishment of regulations related to BBP.

Authors: Mengyao Yao, Jingran Qian, Xiaoni Chen, Jilong Liu, Xiaoqing Yang, Peng Gao, Cheng Zhang

Full Source: Waste management (New York, N.Y.) 2023 Oct 4:171:443-451. doi: 10.1016/j.wasman.2023.09.038.

Wildfire exposure and academic performance in Brazil: A causal inference approach for spatiotemporal data

2023-10-05

As the frequency and intensity of wildfires are projected to globally amplify due to climate change, there is a growing need to quantify the impact of exposure to wildfires in vulnerable populations such as adolescents. In our study, we applied rigorous causal inference methods to estimate the effect of wildfire exposure on the academic performance of high school students in Brazil between 2009 and 2015. Using longitudinal data from 8183 high schools across 1571 municipalities in Brazil, we estimated that the average performance in most academic subjects decreases under interventions that increase wildfire exposure, e.g., a decrease of 1.8 % (p = 0.01) in the natural sciences when increasing the wildfire density from 0.0035 wildfires/km² (first quantile in the sample) to 0.0222 wildfires/km² (third quartile). Furthermore, these effects

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considerably worsened over time. Our findings highlight the adverse impact of wildfires on educational outcomes.

Authors: Sean McGrath, Rajarshi Mukherjee, Weeberb J Réquia, Wan-Chen Lee

Full Source: *The Science of the total environment* 2023 Oct 5:167625. doi: 10.1016/j.scitotenv.2023.167625.

Exposure to nonylphenol in early life causes behavioural deficits related with autism spectrum disorders in rats

2023-09-27

Early-life exposure to environmental endocrine disruptors (EDCs) is a potential risk factor for autism spectrum disorder (ASD). Exposure to nonylphenol (NP), a typical EDC, is known to cause some long-term behavioural abnormalities. Moreover, these abnormal behaviours are the most frequent psychiatric co-morbidities in ASD. However, the direct evidence for the link between NP exposure in early life and ASD-like behavioural phenotypes is still missing. In the present study, typical ASD-like behaviours induced by valproic acid treatment were considered as a positive behavioural control. We investigated impacts on social behaviours following early-life exposure to NP, and explored effects of this exposure on neuronal dendritic spines, mitochondria function, oxidative stress, and endoplasmic reticulum (ER) stress. Furthermore, primary cultured rat neurons were employed as in vitro model to evaluate changes in dendritic spine caused by exposure to NP, and oxidative stress and ER stress were specifically modulated to further explore their roles in these changes. Our results indicated rats exposed to NP in early life showed mild ASD-like behaviours. Moreover, we also found the activation of ER stress triggered by oxidative stress may contribute to dendritic spine decrease and synaptic dysfunction, which may underlie neurobehavioural abnormalities induced by early-life exposure to NP.

Authors: Mingdan You, Siyao Li, Siyu Yan, Dianqi Yao, Tingyu Wang, Yi Wang

Full Source: *Environment international* 2023 Sep 27:180:108228. doi: 10.1016/j.envint.2023.108228.

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