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CHEMICAL EFFECTS

Fate of household and personal care chemicals in typical urban wastewater treatment plants indicate different seasonal patterns and removal mechanisms

2021-12-01

Studies on the presence and fate of household and personal care chemicals (HPCCs) in wastewater treatment plants (WWTPs) are important due to their increasing consumption worldwide. The seasonal patterns and removal mechanisms of HPCCs are not well understood for WWTPs that apply different treatment technologies. To answer these questions, the sewage and sludge samples were taken from 10 typical WWTPs in Northeast China. Levels of UV filters in the influents in the warm season were significantly greater than that of the cold season ($p < 0.05$). Significant seasonal differences were found for the removals of many HPCCs. Results revealed that the highest removal efficiencies were found for linear alkylbenzene sulphonates with values ranging from 97.2% to 99.7%, and the values were 50.0%-99.9% for other HPCCs. The SimpleTreat model demonstrated that the studied WWTPs were operating with high efficiency at the time of sampling. The sorption of HPCCs to sludge can be strongly associated with their physicochemical parameters. Mass balance calculation suggested that sorption was the dominant mechanism for the removal of antimicrobials, while degradation and/or biotransformation were the other mechanisms for removing the most HPCCs in the WWTPs. This study real the factors influencing the seasonal patterns and removal mechanisms which imply the need for further studies to fully understands the plant and human health implications as sludge could be used in the municipal land application of biosolids.

Authors: Wen-Long Li, Zi-Feng Zhang, John Kilgallon, Chris Sparham, Yi-Fan Li, Yi-Xing Yuan

Full Source: Environmental pollution (Barking, Essex : 1987) 2021 Dec 1;294:118618. doi: 10.1016/j.envpol.2021.118618.

Bioaccumulation and trophic transfer of organic ultraviolet absorbents in the food web of a freshwater lake: Implications for risk estimation

2021-12-01

Organic ultraviolet absorbents (UVAs) are increasingly reported in environmental matrices and organisms. However, available information on the bioaccumulation of UVAs in freshwater species is insufficient

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and their trophodynamics in lake food webs remain unknown. We measured the concentrations of twelve UVAs in the wild species from Lake Chaohu. Except for UV-320 not detected, the other UVAs were prevalent in the study species and their total concentrations were in the range of 5.44-131 ng/g dry weight, which were comparable to the concentrations reported in other waters. Compound and species-specific accumulations of UVAs in the organisms were observed. In the lake, the log-transformed concentrations of 4-methyl benzylidene camphor, octyl p-dimethylaminobenzoate, UV-326, and UV-327 related significantly to the trophic levels of species separately. The calculated trophic magnification factors (TMFs) of the four UVAs were 3.79, implying trophic magnification, and 0.18, 0.40 and 0.58, suggesting trophic dilution, respectively. These suggested that the magnification potential and the associated risks of individual UVAs in freshwater lake differed. To our knowledge, this is the first report of these TMFs in lake food webs. However, more investigation is needed to characterize their trophodynamic behaviors in lakes because food web characteristics likely affect trophic transfer of these chemicals.

Authors: Yang Lyu, Fuyong Zhong, Zhenwu Tang, Ying He, Xue Han
Full Source: Environmental pollution (Barking, Essex : 1987) 2021 Dec 1;294:118612. doi: 10.1016/j.envpol.2021.118612.

Elevated temperature alleviates benzophenone-3 toxicity in *Daphnia magna*

2021-11-26

Water temperature rises due to thermal discharge and global warming and the potential resulting impacts on the ecotoxicity of emerging chemicals are a growing concern. Benzophenone-3 (BP-3) is an ultraviolet filter added to personal care and plastic products, which is detected at highest concentrations during the hot summer season. This study aimed to investigate the effect of elevated temperature on acute (48 h) and chronic (21 d) BP-3 toxicity in *Daphnia magna*. Neonates (<24 h) acclimated at 28 °C showed much lower acute toxicity ($EC_{50} = 3.91$ and 2.69 mg L⁻¹ at 20 and 28 °C, respectively) than those acclimated at 20 °C ($EC_{50} = 2.96$ and 2.04 mg L⁻¹ at 20 and 28 °C, respectively). The body length, embryonic development, and the number of offspring in *D. magna* offspring exposed to BP-3 for 21 d were significantly decreased after exposure to 0.8 mg L⁻¹ BP-3 at 20 °C. However, these adverse effects of BP-3 in *D. magna* were significantly ameliorated at 28 °C. Under these conditions, stress response genes such as Hb (hemoglobin), Hsp70 (heat shock protein), Cyp4 (cytochrome P450), and GST (glutathione-S-transferase) were significantly upregulated. These findings suggest that elevated temperature activated

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stress responses in *D. magna*, leading to enhanced protection against BP-3 toxicity. This study will contribute to a better understanding of the ecotoxicological impacts of toxic chemicals on aquatic organisms at elevated temperature.

Authors: Hyungjoon Im, Jerry Collince Achar, Taeyong Shim, Jinho Jung
Full Source: Aquatic toxicology (Amsterdam, Netherlands) 2021 Nov 26;242:106047. doi: 10.1016/j.aquatox.2021.106047.

Screening of organic chemicals in surface water of the North River by high resolution mass spectrometry

2021-12-03

Wide use of various chemicals has resulted in water pollution, which has become a global environmental concern. So far limited information is available on what chemicals in our water. Here we investigated the occurrence and profiles of organic chemicals in the North River, South China by applying non-target screening analysis with high resolution mass spectrometry. A total of 402 organic chemicals belonging to eleven categories were identified in the North River, with notable presence of industrial chemicals, pharmaceuticals and pesticides. Among these detected chemicals, over half of the tentatively identified compounds were rarely reported in the surface water, with a few compounds, e.g., sisomicin, simeton, 2-methyl-4,6-dinitrophenol, xanthurenic acid and indole-3-carboxylic acid that have never been documented in the North River before, while the metabolites like 4-acetamidopyrine were also observed. The maximum concentration of the identified chemicals in the North River was above 300 ng/L (Sulfamonomethoxine). Principle component analysis results of the obtained dataset showed significant seasonal distribution, which could be linked to variations in wastewater discharge, river dilution and anthropogenic activities such as pesticide spray. Agricultural activities in the upper reaches led to detection of various pesticides in the river basin, especially in the wet season. The findings from this study demonstrated the widespread presence of chemicals in our waterway, and further retrospective analysis would reveal more information about chemicals of emerging concern.

Authors: Jia-Hui Zhao, Li-Xin Hu, Yu-Qing Wang, Yu Han, You-Sheng Liu, Jian-Liang Zhao, Guang-Guo Ying
Full Source: Chemosphere 2021 Dec 3;133174. doi: 10.1016/j.chemosphere.2021.133174.

Wide use of various chemicals has resulted in water pollution, which has become a global environmental concern.

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ENVIRONMENTAL RESEARCH

Pollution in the Arctic Ocean: An overview of multiple pressures and implications for ecosystem services

2021-12-07

The Arctic is undergoing unprecedented change. Observations and models demonstrate significant perturbations to the physical and biological systems. Arctic species and ecosystems, particularly in the marine environment, are subject to a wide range of pressures from human activities, including exposure to a complex mixture of pollutants, climate change and fishing activity. These pressures affect the ecosystem services that the Arctic provides. Current international policies are attempting to support sustainable exploitation of Arctic resources with a view to balancing human wellbeing and environmental protection. However, assessments of the potential combined impacts of human activities are limited by data, particularly related to pollutants, a limited understanding of physical and biological processes, and single policies that are limited to ecosystem-level actions. This manuscript considers how, when combined, a suite of existing tools can be used to assess the impacts of pollutants in combination with other anthropogenic pressures on Arctic ecosystems, and on the services that these ecosystems provide. Recommendations are made for the advancement of targeted Arctic research to inform environmental practices and regulatory decisions.

Authors: Bryony L Townhill, Efstathios Reppas-Chrysovitinos, Roxana Sühning, Crispin J Halsall, Elena Mengo, Tina Sanders, Kirsten Dähnke, Odile Crabeck, Jan Kaiser, Silvana N R Birchenough
Full Source: Ambio 2021 Dec 7. doi: 10.1007/s13280-021-01657-0.

The Arctic is undergoing unprecedented change.

Short-term exposure to ambient air pollution and risk of daily hospital admissions for anxiety in China: A multicity study

2022-02-15

The potential impact of short-term exposure to ambient air pollution on risk of anxiety remains uncertain. We performed a detailed evaluation based on data from national insurance databases in China. Daily hospital admissions for anxiety disorders were identified in 2013-2017 from the national insurance databases covering up to 261 million urban residents in 56 cities in China. A two-stage time-series study was conducted to evaluate the associations between short-term exposure to major ambient air pollutants, including fine particles, inhalable particles, nitrogen dioxide

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(NO₂), sulfur dioxide (SO₂), ozone, and carbon monoxide, and risk of daily hospital admissions for anxiety. Significant associations between short-term exposures to ambient NO₂ and SO₂ and risk of daily hospital admissions for anxiety were found in the overall analysis. Per 10 µg/m³ increases in NO₂ at lag0 and SO₂ at lag6 were associated with significant increases of 1.37% (95% CI: 0.14%, 2.62%) and 1.53% (95% CI: 0.59%, 2.48%) in anxiety admissions, respectively. Stronger associations were found in the southern region and patients <65 years for SO₂. Short-term exposure to ambient air pollution is associated with increased risk of anxiety admissions, which may provide important implications for promotion of mental health in the public.

Authors: Yating Ma, Wanzhou Wang, Zichuan Li, Yaqin Si, Jinxi Wang, Libo Chen, Chen Wei, Hualiang Lin, Furong Deng, Xinbiao Guo, Xiaoli Ni, Shaowei Wu

Full Source: Journal of hazardous materials 2022 Feb 15;424(Pt B):127535. doi: 10.1016/j.jhazmat.2021.127535.

OCCUPATIONAL

Evaluation of human exposure to parabens in north eastern Poland through hair sample analysis

2021-12-08

Parabens (PBs) are a group of substances commonly used in industry. They also pollute the environment, penetrate into living organisms and adversely affect various internal organs. During this study, the degree of exposure of people living in Olsztyn, a city in north eastern Poland, to selected parabens most often used in industry was studied. The chemicals under investigation included: methyl paraben-MePB, ethyl paraben-EtPB, propyl paraben-PrPB, benzyl paraben BePB and butyl paraben -BuPB. To this aim, hair samples collected from the scalps of 30 volunteers were analyzed using a liquid chromatography-mass spectrometry technique. All PBs studied were present in a high percentage of analyzed samples (from 76.7% in the case of BePB to 100% in the case of MePB and PrPB). The mean concentration levels were 4425.3 pg/mg for MePB, 704.0 pg/mg for EtPB, 825.7 pg/mg for PrPB, 135.2 pg/mg for BePB and 154.5 pg/mg for BuPB. Significant differences in PB concentration levels between particular persons were visible. On the other hand, gender, age and artificial hair coloring did not cause statistically significant differences in PB levels. Obtained results have clearly indicated that people living in north eastern Poland are exposed to various PBs, and therefore these substances may

Parabens (PBs) are a group of substances commonly used in industry.

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affect their health status. However, the evaluation of PBs influence on human health requires further research.

Authors: Joanna Wojtkiewicz, Manolis Tzatzarakis, Elena Vakonaki, Krystyna Makowska, Slawomir Gonkowski

Full Source: Scientific reports 2021 Dec 8;11(1):23673. doi: 10.1038/s41598-021-03152-8.

Is the New EN689 a Better Standard to Test Compliance With Occupational Exposure Limits in the Workplace?

2021-12-02

Objective: To evaluate the performance of three measurement strategies to test compliance with occupational exposure limits of similarly exposed groups (SEGs): the old and new versions of EN689, and the BOHS-NVvA guidance on measuring compliance.

Methods: Respirable dust exposures concentrations (n = 1383) measured within the member companies of IMA-Europe were used to compare compliance decisions between the three measurement strategies. A total of 210 SEGs of which 158 with repeated measurements were analysed. An R studio OHcomplianceStrategies package was created for the purpose. Results: The old EN689 strategy resulted in the highest number of compliant SEGs in the preliminary tests and statistical test (49-52% and 83%) with lower percentages of compliance with the new EN689 standard (32-44% and 71%). The percentage of non-compliant SEGs was relatively similar between the old and new EN689 for the preliminary tests (1-12% versus 6-11%). However, the new EN689 declared almost twofold more SEGs non-compliant when applying the statistical test (29% versus 17%). The BOHS-NVvA individual test showed results in between the 26% non-compliant SEGs.

Conclusion: This study showed differences in compliance decisions between the old and new EN689, with the new EN689 being considerably more stringent and resulting in more non-compliant SEGs.

Authors: Antonio D'Errico, Remko Houba, Hans Kromhout

Full Source: Annals of work exposures and health 2021 Dec 2;wxab111. doi: 10.1093/annweh/wxab111.

Effect of occupational co-exposure to lead and cadmium on selected immunomodulatory cytokines

2021-12-07

Occupational exposure to heavy metals like lead (Pb) and cadmium (Cd) is associated with the development of several diseases. The objective of this

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study was to determine the effect of occupational co-exposure to Pb and Cd on the blood levels of selected immune-modulatory cytokines related to T helper (Th), that is, Th1, interleukin-2 (IL-2), Th2, (IL-4 and IL-10), and Th17, (IL-17) cells. The study comprised 207 individuals divided into two groups: exposed (n = 110) and nonexposed (n = 97). Blood Pb and Cd were determined using Graphite Furnace Atomic Absorption Spectroscopy, and serum levels of cytokines were measured using enzyme-linked immunosorbent assay (ELISA). The study revealed significantly higher blood Pb and Cd levels in the exposed group. A significant decrease in Th1 cytokine-IL-2 and Th2 cytokine-IL-10 was found, while IL-4 (Th2 cytokine) and IL-17 (Th17) levels were higher in the exposed group. In the mixed exposure analysis, among all the selected cytokines, IL-4 levels were significantly different between individuals having higher levels of both Pb and Cd versus lower levels of Pb and Cd. While IL-2 levels were highest among the low Pb and Cd group, the IL-17 levels were highest among individuals with higher Cd levels. The study demonstrated that co-exposure to low levels of Pb and Cd might have an immune-modulatory effect. The data suggested a metal-induced pro-inflammatory immune response.

Authors: Taru Goyal, Prasenjit Mitra, Preeti Singh, Shailja Sharma, Purvi Purohit, Praveen Sharma

Full Source: Toxicology and industrial health 2021 Dec 7;7482337211019172. doi: 10.1177/07482337211019172.

PHARMACEUTICAL/TOXICOLOGY

Tafenoquine exposure assessment, safety, and relapse prevention efficacy in children with Plasmodium vivax malaria: open-label, single-arm, non-comparative, multicentre, pharmacokinetic bridging, phase 2 trial

2021-12-03

Background: Single-dose tafenoquine 300 mg is approved for Plasmodium vivax malaria relapse prevention in patients at least 16 years old. We aimed to determine appropriate oral tafenoquine paediatric dosing regimens, including a dispersible formulation, and evaluated tafenoquine efficacy and safety in children infected with P vivax.

Methods: This open-label, single-arm, non-comparative, multicentre, pharmacokinetic bridging, phase 2 study enrolled children (2-15 years) who weighed 5 kg or more, with glucose-6-phosphate dehydrogenase activity more than 70% of the local population median, and P vivax

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malaria infection, from three community health centres in Vietnam and one in Colombia. Patients received 3-day chloroquine plus oral single-dose tafenoquine as dispersible tablets (50 mg) or film-coated tablets (150 mg). Dosing groups were assigned by body weight, predicted to achieve similar median exposures as the approved 300 mg dose for adults: patients who weighed 5 kg or more to 10 kg received 50 mg, those who weighed more than 10 to 20 kg received 100 or 150 mg, those who weighed more than 20 to 35 kg received 200 mg, and patients who weighed more than 35 kg received 300 mg. Population pharmacokinetic analysis was done to develop a paediatric population pharmacokinetic model. The primary outcome was the tafenoquine area under the concentration-time curve extrapolated to infinity (AUC[0-∞]) by patient body weight in the pharmacokinetic population (all patients who received tafenoquine with at least one valid pharmacokinetic sample) estimated from a paediatric population pharmacokinetic model. A key prespecified secondary outcome was 4-month recurrence-free efficacy. This trial is registered with ClinicalTrials.gov, NCT02563496.

Findings: Between Feb 6, 2017, and Feb 17, 2020, 60 patients were enrolled into the study: 14 (23%) received tafenoquine 100 mg, five (8%) 150 mg, 22 (36%) 200 mg, and 19 (32%) 300 mg. The paediatric population pharmacokinetic model predicted adequate tafenoquine exposure at all doses. The predicted median AUC(0-∞) was 73.8 (90% prediction interval [PI] 46.9-117.0) µg × h/mL with the 50 mg dose for patients who weighed 5 kg or more to 10 kg, 87.5 (55.4-139.0) µg × h/mL with the 100 mg dose for body weight more than 10 to 20 kg, 110.7 (70.9-174.0) µg × h/mL with the 200 mg dose for body weight more than 20 to 35 kg, and 85.7 (50.6-151.0) µg × h/mL with the 300 mg dose for body weight more than 35 kg. 4-month recurrence-free efficacy was 94.7% (95% CI 84.6-98.3). Adverse events were consistent with previous studies, except for the seven (12%) of 60 patients who had post-dose vomiting or spitting with the 50 mg dispersed tablet. Following mitigation strategies, there were no additional occurrences of this adverse event. There were no deaths during the study. Interpretation: For the prevention of P vivax relapse in children, single-dose tafenoquine, including a dispersible formulation, had exposure, safety, and efficacy consistent with observations in adolescents and adults, notwithstanding post-dose vomiting.

Funding: GlaxoSmithKline and Medicines for Malaria Venture.

Translations: For the Vietnamese and Spanish translations of the abstract see Supplementary Materials section.

Authors: Iván D Vélez, Tran T Hien, Justin A Green, Ana Martin, Hema Sharma, Victoria M Rousell, John J Breton, Terry B Ernest, Katie Rolfe,

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Maxine Taylor, Khadeeja Mohamed, Siôn W Jones, Nguyen Hoang Chau,
Nhu Thi Hoa, Stephan Duparc, Lionel K Tan, Navin Goyal
Full Source: The Lancet. Child & adolescent health 2021 Dec 3;S2352-
4642(21)00328-X. doi: 10.1016/S2352-4642(21)00328-X.