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CHEMICAL EFFECTS

Decoding Adverse Effects of Organic Contaminants in the Aquatic Environment: A Meta-analysis of Species Sensitivity, Hazard Prediction, and Ecological Risk Assessment

2024-10-04

Aquatic organisms in the environment are frequently exposed to a variety of organic chemicals, while these biological species may show different sensitivities to different chemical groups present in the environment. This study evaluated species sensitivity, hazards, and risks of six classes of organic chemicals in the aquatic environment. None of the taxonomic groups were the most sensitive or tolerant to all chemicals, as one group sensitive to one class of chemicals might possess adaptations to other chemical groups. Polychlorinated biphenyls were generally the most toxic chemical group, followed by polybrominated diphenyl ethers, polycyclic aromatic hydrocarbons, and pharmaceuticals and personal care products, while per- and polyfluoroalkyl substances and phthalate esters were the less toxic chemical groups. The hazard of organic chemicals was closely related to their physicochemical properties, including hydrophobicity and molecular weight. It was shown that 20% of the evaluated chemicals exhibited medium or high ecological risks with the worst-case scenario in the Pearl River Estuary. This novel work represented a comprehensive comparison of chemical hazards and species sensitivity among different classes of organic chemicals, and the reported results herein have provided scientific evidence for ecological risk assessment and water quality management to protect aquatic ecosystems against organic chemicals.

Authors: Yi Yang, Xue-Min Zhao, Racliffe Weng Seng Lai, Yuan Liu, Shan Liu, Xiaowei Jin, Guang-Jie Zhou

Full Source: Environmental science & technology 2024 Oct 4. doi: 10.1021/acs.est.4c04862.

Aquatic organisms in the environment are frequently exposed to a variety of organic chemicals, while these biological species may show different sensitivities to different chemical groups present in the environment.

Bio-organic substitution in tobacco (Nicotiana tabacum L) cultivation: Optimum strategy to lower carbon footprint and boost net ecosystem economic benefit

2024-10-03

The partial substitution of organic manure for chemical nitrogen fertilizers, known as organic substitution, is widely regarded as a cleaner and more sustainable production strategy. However, few studies have quantified greenhouse gas emissions, product income and net ecosystem economic benefit (NEEB) using a life cycle assessment (LCA) approach, particularly for typical tobacco (Nicotiana tabacum L.) production. Here, we quantified the yield and quality of a typical tobacco production in Qujing, Yunnan, China, through field experiments and calculated its carbon footprint and NEEB using the LCA approach. Four organic substitution strategies were established with equal nitrogen inputs, including synthesized chemical fertilizer (SN), farmyard organic manure (NF), commercial organic manure (NC), and bio-organic (Trichoderma viride Pers.) manure (NT), each substituting 15% of synthesized nitrogen fertilizer. Compared to the SN strategy, the NT strategy significantly increased yield and income by 10.3% and 9.6%, respectively. In contrast, the NF strategy significantly reduced income, while the NC strategy showed no significant difference. Both the NC and NT strategies significantly reduced N2O cumulative emissions (by 15.9% and 8.0%, respectively), increased δSOC (by 38.4% and 15.0%, respectively), and decreased carbon footprint compared to the SN strategy. However, the NF strategy significantly increased the income-scaled carbon footprint, even though it also notably reduced N2O cumulative emissions (by 22.6%) and increased δSOC (by 7.9%). The NT strategy achieved a win-win scenario of low environmental risk and high economic returns of tobacco production with significantly increased NEEB (by 10.6%) compared to the SN strategy (37.60 × 103 CNY yr-1). This suggests that the bio-organic Trichoderma manure substituting 15% synthesized nitrogen fertilizer is the best organic substitution strategy for sustainable tobacco production.

Authors: Bingxue Wang, Xiaopeng Deng, Ruibao Wang, Xinan Zongguo, Wenjie Tong, Erdeng Ma, Ying Jiao, Yubing Dong, Yali Zhang, Zhengqin Xiong

Full Source: Journal of environmental management 2024 Oct 3:370:122654. doi: 10.1016/j.jenvman.2024.122654.

Background: Organic solvents are used in formulating an extensive range of products for professional use.

Occupational exposure to organic solvents during pregnancy and child behavior from early childhood to adolescence

2024-10-04

Background: Organic solvents are used in formulating an extensive range of products for professional use. Animal and human studies suggest that in utero solvent exposure may affect neurodevelopment. Our objective was to assess the association between occupational exposure to solvents during pregnancy and child behavior aged 2-12 years.
Methods: The French mother-child cohort PELAGIE (2002-2006) included 3,421 women recruited in early pregnancy. Occupational exposure to

solvents was self-reported. For 459 children, parents used a questionnaire derived from the Child Behavior Checklist and the Preschool Social Behavior Questionnaire to assess their child's behavior, at age 2, and the Strengths and Difficulties Questionnaire at ages 6 and 12. A cross-lagged structural equation modeling approach was used to assess direct and indirect associations between exposure and child behavior.
Results: At age 2, an increased externalizing behavior score was suggested with prenatal exposure to solvents (mean change in standardized score (95%CI): 0.28 (-0.01, 0.57) for occasional exposure and 0.23 (-0.05, 0.51) for regular exposure). At ages 6 and 12, distinct sex-specific patterns were observed: among boys, no association with externalizing behavior was observed, while among girls, an association was seen for both occasional and regular exposure (total effect at age 12: 0.45 (0.06,0.83) and 0.40 (0.03, 0.76), respectively). For both sexes, occasional exposure may be associated with internalizing behavior at ages 6 and 12 (total effect at age 6: 0.37 (0.06, 0.68) and at age 12: 0.27 (-0.08, 0.62)).
Conclusions: Occupational exposure to solvents during pregnancy may impact child behavior through either direct or cumulative effects during childhood; these associations may persist until early adolescence, especially among girls.
Authors: Hélène Tillaut, Nathalie Costet, Christine Monfort, Rémi Béranger, Ronan Garlantézec, Florence Rouget, Sylvaine Cordier, Dave Saint-Amour, Cécile Chevrier
Full Source: Environmental health : a global access science source 2024 Oct 4;23(1):79. doi: 10.1186/s12940-024-01120-z.

ENVIRONMENTAL RESEARCH

Microplastic biofilms promote the horizontal transfer of antibiotic resistance genes in estuarine environments

2024-10-03
As emerging pollutants, microplastics can aggregate microorganisms on their surfaces and form biofilms, enriching antibiotic-resistant bacteria (ARB) and antibiotic resistance genes (ARGs). Consequently, microplastic biofilms have become a focal point of research. Horizontal gene transfer is one of the primary mechanisms by which bacteria acquire antibiotic resistance, with much of the research focusing on suspended bacteria. However, microplastic biofilms, as hotspots for horizontal gene transfer, also merit significant investigation. This study primarily explored and compared the frequency of ARG conjugative transfer between suspended bacteria and microplastic biofilms. The results demonstrated that,

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compared to suspended bacteria, microplastic biofilms enhanced the frequency of ARG conjugative transfer by 7.2-19.6 times. Among them, biofilms on polyethylene microplastics showed the strongest promotion of conjugation. After the formation of microplastic biofilms, there was a significant increase in bacterial density within the biofilms, which raised the collision frequency of donor and recipient bacteria. Then microplastic biofilms facilitated the gene expression levels of outer membrane proteins, enhanced bacterial gene transfer capabilities, promoted the synthesis of conjugative pili, accelerated the formation of conjugative pairing systems, and elevated the expression levels of genes related to DNA replication and transfer systems, thereby enhancing the conjugative transfer of ARGs within microplastic biofilms. Among different types of microplastic biofilms, polyethylene biofilms exhibited the highest bacterial density, thus showing the highest frequency of ARG conjugation. This study highlights the risks associated with ARG conjugative transfer following the formation of microplastic biofilms and provides insights into the risks of microplastic and antibiotic resistance propagation in estuarine environments.
Authors: Yangyuan Zhou, Guosheng Zhang, Dawei Zhang, Ningzheng Zhu, Jinpei Bo, Xiangzhou Meng, Yao Chen, Yu Qin, Huajie Liu, Weiying Li
Full Source: Marine environmental research 2024 Oct 3:202:106777. doi: 10.1016/j.marenvres.2024.106777.

Short- and medium-term cumulative effects of traffic-related air pollution on resting heart rate in the elderly: A wearable device study

2024-10-04
Background: Epidemiological evidence regarding the association between air pollution and resting heart rate (RHR), a predictor of cardiovascular disease and mortality, is limited and inconsistent.

Objectives: We used wearable devices and time-series analysis to assess the exposure-response relationship over an extended lag period.
Methods: Ninety-seven elderly individuals (>65 years) from the Taipei Basin participated from May to November 2020 and wore Garmin® smartwatches continuously until the end of 2021 for heart rate monitoring. RHR was defined as the daily average of the lowest 30-min heart rate. Air pollution exposure data, covering lag periods from 0 to 60 days, were obtained from nearby monitoring stations. We used distributed lag non-linear models and linear mixed-effect models to assess cumulative effects of air pollution. Principal component analysis

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was utilized to explore underlying patterns in air pollution exposure, and subgroup analyses with interaction terms were conducted to explore the modification effects of individual factors.
Results: After adjusting for co-pollutants in the models, an interquartile range increase of 0.18 ppm in carbon monoxide (CO) was consistently associated with increased RHR across lag periods of 0-1 day (0.31, 95 % confidence interval [CI]: 0.24-0.38), 0-7 days (0.68, 95 % CI: 0.57-0.79), and 0-50 days (1.02, 95 % CI: 0.82-1.21). Principal component analysis identified two factors, one primarily influenced by CO and nitrogen dioxide (NO2), indicative of traffic sources. Increases in the varimax-rotated traffic-related score were correlated with higher RHR over 0-1 day (0.36, 95 % CI: 0.25-0.47), 0-7 days (0.62, 95 % CI: 0.46-0.77), and 0-50 days (1.27, 95 % CI: 0.87-1.67) lag periods. Over a 0-7 day lag, RHR responses to traffic pollution were intensified by higher temperatures (β = 0.80 vs. 0.29; interaction p-value [P_int] = 0.011). Males (β = 0.66 vs. 0.60; P_int < 0.0001), hypertensive individuals (β = 0.85 vs. 0.45; P_int = 0.028), diabetics (β = 0.96 vs. 0.52; P_int = 0.042), and those with lower physical activity (β = 0.70 vs. 0.54; P_int < 0.0001) also exhibited stronger responses. Over a 0-50 day lag, males (β = 0.99 vs. 0.96; P_int < 0.0001), diabetics (β = 1.66 vs. 0.69; P_int < 0.0001), individuals with lower physical activity (β = 1.49 vs. 0.47; P_int = 0.0006), and those with fewer steps on lag day 1 (β = 1.17 vs. 0.71; P_int = 0.029) showed amplified responses.
Conclusions: Prolonged exposure to traffic-related air pollution results in cumulative cardiovascular risks, persisting for up to 50 days. These effects are more pronounced on warmer days and in individuals with chronic conditions or inactive lifestyles.
Authors: Chi-Hsien Chen, Feipei Lai, Li-Ying Huang, Yue-Liang Leon Guo
Full Source: Ecotoxicology and environmental safety 2024 Oct 4:285:117140. doi: 10.1016/j.ecoenv.2024.117140.

Optimized pyrolytic synthesis and physicochemical characterization of date palm seed biochar: unveiling a sustainable adsorbent for environmental remediation applications

2024-10-05
This study focuses on the optimization and comprehensive characterization of biochar synthesized from date palm seeds (DPS), a prevalent agricultural waste in arid regions. Using response surface methodology (RSM) with a central composite design (CCD), we optimized the pyrolysis process by investigating the effects of time (1-3 h) and temperature (600-900 °C) on critical properties such as specific surface

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area, pore volume, and yield. The optimized biochar, produced at 828 °C for 1.7 h, demonstrated a high specific surface area of 654.8 m2/g and well-developed microporosity. Characterization techniques, including XRD, FTIR, SEM-EDS, and BET analyses, revealed an amorphous carbon structure with graphitic domains, diverse surface functionalities, and a heterogeneous porous microstructure. The biochar's point of zero charge at pH 7.58 indicates its potential for selective adsorption of charged contaminants. The close agreement between RSM-predicted and experimental values for specific surface area (652.1 m2/g vs. 654.8 m2/g) and micropore volume (0.191 cm3/g vs. 0.190 cm3/g) validates the effectiveness of the model in optimizing biochar properties. This research highlights the potential of DPS-derived biochar as a sustainable adsorbent for environmental remediation, opening avenues for valorizing agricultural wastes and contributing to circular economy principles.
Authors: Rania Remmani, Murat Yılmaz, Saliha Benaoune, Luca Di Palma
Full Source: Environmental science and pollution research international 2024 Oct 5. doi: 10.1007/s11356-024-35218-1.

PHARMACEUTICAL/TOXICOLOGY

Effect of physicochemical parameters on the occurrence of per- and polyfluoroalkyl substances (PFAS) in aquatic environment

2024-10-03
Perfluoroalkyl substances (PFAS) and their distribution in aquatic environments have been studied extensively, but more information is needed to link these occurrences to their physicochemical characteristics. Understanding how these parameters influence PFAS can help predict their fate, mobility, and occurrences in water. This study reviewed the influence of physicochemical parameters on the occurrences of PFAS in aquatic environment using the relevant keywords to retrieve articles from databases spanning mostly between 2017 and 2024. The result suggests that high pH, turbidity, and dissolved oxygen, give high concentration of PFAS, while high electrical conductivity, temperature and salinity give low PFAS concentration in the water. Therefore, monitoring and safeguarding the aquatic bodies for human and environmental safety is imperative. Future studies should include the effects of the physicochemical properties on PFAS occurrences in the natural environment and focus on an organism's distinctive characteristics to

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comprehend the bioaccumulation and biomagnification of PFAS in them and environmental matrices.
Authors: Chinemerem Ruth Ohoro, James F Amaku, Jeanet Conradie, Chijioke Olisah, Kovo G Akpomie, Alhadji Malloum, Samson O Akpotu, Kayode A Adegoke, Emmanuel Sunday Okeke, Elizabeth O Omotola
Full Source: Marine pollution bulletin 2024 Oct 3:208:117040. doi: 10.1016/j.marpolbul.2024.117040.

OCCUPATIONAL

Mixed contaminant exposure in tapwater and the potential implications for human-health in disadvantaged communities in California

2024-09-25
Water is an increasingly precious resource in California as years of drought, climate change, pollution, as well as an expanding population have all stressed the state's drinking water supplies. Currently, there are increasing concerns about whether regulated and unregulated contaminants in drinking water are linked to a variety of human-health outcomes particularly in socially disadvantaged communities with a history of health risks. To begin to address this data gap by broadly assessing contaminant mixture exposures, the current study was designed to collect tapwater samples from communities in Gold Country, the San Francisco Bay Area, two regions of the Central Valley (Merced/Fresno and Kern counties), and southeast Los Angeles for 251 organic chemicals and 32 inorganic constituents. Sampling prioritized low-income areas with suspected water quality challenges and elevated breast cancer rates. Results indicated that mixtures of regulated and unregulated contaminants were observed frequently in tapwater throughout the areas studied and the types and concentrations of detected contaminants varied by region, drinking-water source, and size of the public water system. Multiple exceedances of enforceable maximum contaminant level(s) (MCL), non-enforceable MCL goal(s) (MCLG), and other health advisories combined with frequent exceedances of benchmark-based hazard indices were also observed in samples collected in all five of the study regions. Given the current focus on improving water quality in socially disadvantaged communities, our study highlights the importance of assessing mixed-contaminant exposures in drinking water at the point of consumption to adequately address human-health concerns (e.g., breast cancer risk). Data from this pilot study provide a foundation for future studies across a greater number

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of communities in California to assess potential linkages between breast cancer rates and tapwater contaminants.
Authors: Kelly L Smalling, Kristin M Romanok, Paul M Bradley, Michelle L Hladik, James L Gray, Leslie K Kanagy, R Blaine McCleskey, Diana A Stavreva, Annika K Alexander-Ozinskas, Jesus Alonso, Wendy Avila, Sara E Breitmeyer, Roberto Bustillo, Stephanie E Gordon, Gordon L Hager, Rena R Jones, Dana W Kolpin, Seth Newton, Peggy Reynolds, John Sloop, Andria Ventura, Julie Von Behren, Mary H Ward, Gina M Solomon
Full Source: Water research 2024 Sep 25:267:122485. doi: 10.1016/j.watres.2024.122485.

In silico occupational exposure banding framework for data poor compounds in biotechnology

2024-10-06
Occupational exposure limits (OELs) and occupational exposure bands (OEBs) provide quantitative benchmarks for worker health protection. If empirical toxicology data are insufficient to derive an OEL, an OEB is often assigned using partial toxicology data along with other relevant hazard information. There is no consensus methodology to assign OEBs for chemicals lacking any empirical toxicology data. Thus, this study developed an in silico framework for OEB assignment of data poor compounds. It relies upon computational tools to evaluate standard toxicological end points and to assign reliability ratings, which are then used to assign Global Harmonization System (GHS) hazard categories. Subsequently, the hazard categories are entered into the National Institute for Occupational Safety and Health (NIOSH) occupational exposure banding tool to assign bands for individual end points as well as an overall OEB. As a proof-of-concept, five compounds with established OELs (i.e., "knowns") were evaluated. The knowns were assigned to overall OEBs C, D, or E, four of which were equal to or lower than the OEBs based on actual harmonized GHS categories as well as established OELs, indicating that the OEBs assigned using this framework are likely to be protective. Subsequently, five compounds with little to no experimental data and no established OELs from any U.S. agency or consensus OEL-setting organizations were evaluated (i.e., "unknowns"). The unknowns were assigned to overall OEBs D or E. It was concluded that the proposed framework can be used to assign protective OEBs to compounds with little to no toxicology testing data. As additional data become available, the compound may be de-risked, and a precautionary OEB (or an OEL) can be assigned. The proposed framework provides an example of a practical

Occupational exposure limits (OELs) and occupational exposure bands (OEBs) provide quantitative benchmarks for worker health protection.

methodology to evaluate data poor compounds and shows that the output of this framework is expected to be protective of worker health.
Authors: Andrey Massarsky, Ernest S Fung, Veneese Jb Evans, Andrew Maier
Full Source: Toxicology and industrial health 2024 Oct 6:7482337241289184. doi: 10.1177/07482337241289184.

Occupational and industry prevalence of new long-term symptoms within American Red Cross blood donors with and without history of SARS-CoV-2 infection

2024-10-05
Purpose: Limited information is known about the burden of Long COVID by occupation and industry. This study compares the occurrence of self-reported new long-term symptoms lasting 4 weeks or longer among blood donors with and without prior SARS-CoV-2 infection by occupation and industry.
Methods: The American Red Cross invited blood donors 18 years and older who donated during May 4-December 31, 2021 to participate in online surveys. New long-term symptoms lasting 4 weeks or longer were assessed by self-reported occurrence of any of 35 symptoms since March 2020. SARS-CoV-2 infection status was determined by serological testing and self-report. We describe the prevalence of new long-term symptoms by SARS-CoV-2 infection status. We calculate the difference in reported new long-term symptoms by SARS-CoV-2 infection status within occupation and industry categories.
Results: Data were collected from 27,907 employed adults - 9763 were previously infected and 18,234 were never infected with SARS-CoV-2. New long-term symptoms were more prevalent among those previously infected compared to the never-infected respondents (45% vs 24%, $p < 0.05$). Among all respondents, new long-term symptoms by occupation ranged from 26% (installation, maintenance, and repair) to 41% (healthcare support) and by industry ranged from 26% (mining) to 55% (accommodation and food services). New long-term neurological and other symptoms were commonly reported by those previously infected with SARS-CoV-2.
Discussion: New long-term symptoms are more prevalent among certain occupation and industry groups, which likely reflects differential exposure to SARS-CoV-2. These findings highlight potential need for workplace

Purpose: Limited information is known about the burden of Long COVID by occupation and industry.

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accommodations in a variety of occupational settings to address new long-term symptoms.
Authors: Deja L Edwards, Melisa M Shah, Dallas S Shi, Nicole D Ford, Jessica L Rinsky, Jefferson M Jones, Bryan Spencer, James Haynes, Sharon H Saydah
Full Source: American journal of industrial medicine 2024 Oct 5. doi: 10.1002/ajim.23670.

Associations between multi-metal joint exposure and decreased estimated glomerular filtration rate (eGFR) in solar greenhouse workers: a study of a unique farmer group

2024-10-03
Background: Solar greenhouse workers, a unique farmer group, have been reported to have a higher risk of chronic kidney disease (CKD) compared to the general population, possible due to exposure to multiple metals.
Objective: This study aimed to investigate the associations between exposure to multiple metals and the estimated glomerular filtration rate (eGFR).
Methods: A cross-sectional study was conducted in the Northwest China. Urine samples were tested for concentration of 14 metals, including chromium, manganese, iron, et al. Blood creatinine was measured to calculate eGFR, which was to evaluate the kidney function. Linear model and the Bayesian Kernel Machine Regression (BKMR) models were used to evaluate the associations between metals exposure and eGFR.
Result: The study included 281 solar greenhouse workers, with 128 (45.6%) males and 153 (54.4%) females. The highest median concentrations of metals were zinc (418.55 μg/L), strontium (368.77 μg/L), and iron (55.73 μg/L), respectively. The linear model analysis showed that urinary levels of copper and zinc were negatively associated with eGFR [$\beta = -0.021$, 95% CI (-0.048, -0.007); $\beta = -0.018$, 95% CI (-0.068, -0.005)] considering a false discovery rate. BKMR results indicated a significant overall negative effect of 14 metals exposure on the eGFR when all metal levels were above the 50th percentile compared to the median value.
Conclusions: The decrease in eGFR among solar greenhouse workers was related to mixed metal exposure. Reducing exposure to the metals of copper, zinc, and lead could effectively protects kidney function.

Background: Solar greenhouse workers, a unique farmer group, have been reported to have a higher risk of chronic kidney disease (CKD) compared to the general population, possible due to exposure to multiple metals.
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Further prospective studies are needed to resolve concerns about reverse causality.

Authors: Tenglong Yan, Yetong Ma, Xin Song, Binshuo Hu, Wu Liu, Yonglan Chen, Xiaodong Liu, Chunguang Ding, Zhenxia Kou, Xiaowen Ding, Tian Chen, Xiaojun Zhu

Full Source: Chemosphere 2024 Oct 3:143467. doi: 10.1016/j.chemosphere.2024.143467.