

Bulletin Board

Contents

JUL. 28, 2023

(click on page numbers for links)

CHEMICAL EFFECTS

- Probiotics ameliorate benzene-induced systemic inflammation and hematopoietic toxicity by inhibiting Bacteroidaceae-mediated ferroptosis 3
- Biofouling mechanism and cleaning procedures for *Spirulina platensis* as an organic fertilizer draw solution 4
- Synthesis of propenone-linked covalent organic frameworks via Claisen-Schmidt reaction for photocatalytic removal of uranium 4

ENVIRONMENTAL RESEARCH

- Advances in gum-based hydrogels and their environmental applications. 5
- Environmental exposures in early-life and general health in childhood 5

PHARMACEUTICAL/TOXICOLOGY

- Integrating In Vitro Data and Physiologically Based Kinetic Modeling to Predict and Compare Acute Neurotoxic Doses of Saxitoxin in Rats, Mice, and Humans 7
- Per- and polyfluoroalkyl substances (PFAS) measured in seafood from a cross-section of retail stores in the United States 7
- The combined effect of essential oils on wood physico-chemical properties and their antiadhesive activity against mold fungi: application of mixture design methodology 8

OCCUPATIONAL

- Incident risk and burden of cardiovascular diseases attributable to long-term NO₂ exposure in Chinese adults 9
- The effectiveness of implementing the Guideline for the Prevention of Mental Ill-health Problems at the Workplace on health-outcomes, organizational and social risk factors: a cluster-randomized controlled trial in Swedish schools 10

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Bulletin Board

Technical

JUL. 28, 2023

CHEMICAL EFFECTS

Probiotics ameliorate benzene-induced systemic inflammation and hematopoietic toxicity by inhibiting Bacteroidaceae-mediated ferroptosis

2023-07-19

The intestinal microbiota is associated with the development of benzene-induced hematopoietic toxicity. Modulation of intestinal homeostasis by probiotic supplementation has been considered an effective strategy to prevent adverse health effects. However, the role and mechanism of probiotics in benzene-induced hematopoietic toxicity are unclear. After 45 days of exposure, benzene caused bone marrow hematopoietic toxicity in mice. Furthermore, we found that benzene altered the intestinal barrier in mice, leading to an increase in the abundance of Bacteroidaceae and the activation of systemic inflammation. Interestingly, Fe²⁺ accumulation, lipid peroxidation, and differential expression of ferroptosis proteins were observed in the intestinal tissues of benzene-exposed mice. After fecal microbiota transplantation, stool microbes from benzene-exposed mice led to the development of intestinal ferroptosis in recipient mice. In particular, oral probiotics significantly reversed elevated Bacteroidaceae and intestinal ferroptosis, ultimately improving benzene-induced hematopoietic damage. We further used the benzene metabolite 1,4-BQ to treat human normal colonic epithelial cells (NCM460) and intervened with the ferroptosis inhibitor liproxstatin-1 (Lip-1) to validate the relationship between intestinal ferroptosis and inflammation. The results showed that 1,4-BQ treatment resulted in increased intracellular ROS levels and abnormal expression of ferroptosis proteins and the inflammatory factors IL-5 and IL-13. However, the use of Lip-1 significantly inhibited oxidative stress, ferroptosis, and inflammation in NCM460 cells. This result suggested that ferroptosis might be involved in benzene-induced hematopoietic toxicity by mediating Th2-type systemic inflammation. Overall, these findings revealed a role for Bacteroidaceae-intestinal ferroptosis-inflammation in benzene-induced hematopoietic toxicity and highlighted that probiotics could be a promising strategy to prevent adverse hematologic outcomes.

Authors: Lei Zhang, Huiwen Kang, Wei Zhang, JingYu Wang, Ziyang Liu, Jiayu Jing, Lin Han, Ai Gao

Full Source: The Science of the total environment 2023 Jul 19;899:165678. doi: 10.1016/j.scitotenv.2023.165678.

The intestinal microbiota is associated with the development of benzene-induced hematopoietic toxicity.

Bulletin Board

Technical

JUL. 28, 2023

Biofouling mechanism and cleaning procedures for *Spirulina platensis* as an organic fertilizer draw solution

2023-07-21

The forward osmosis (FO) desalination process has recently acknowledged a lot of attention as a promising solution for reducing the disadvantages of existing desalination systems. This work aimed to investigate the effect of a selected liquid organic fertilizer a novel draw solution produced from "microalgae *Spirulina platensis*" on the biofouling mechanism of FO membrane. Different draw solution (DS) concentrations ranging 240-480 g/L were examined, obtained water flux ranging from 6.5 to 3.4 Lm²h⁻¹. A high flux decline was observed when using higher DS concentrations due to fouling layer accumulated throughout the membrane area which lowers the effective osmotic pressure difference. Different cleaning strategies were examined. The biofouled membrane was cleaned on-line with deionized water (DI) and externally using ultrasound (US) and HCl. Baseline experiments were done to investigate the efficiency of the cleaning strategies. After cleaning using the deionized water (DI) water, it was found that the water flux progressed from 3.4 to 7 Lm²h⁻¹, while when using acid cleaning the flux recovered to 15 Lm²h⁻¹. The efficacy and amount of foulant removed by each cleaning stage were assessed using scanning electron microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX).

Authors: Ghada Al Bazed, Noha Soliman, Hani Sewilam

Full Source: Environmental science and pollution research international 2023 Jul 21. doi: 10.1007/s11356-023-28694-4.

Synthesis of propenone-linked covalent organic frameworks via Claisen-Schmidt reaction for photocatalytic removal of uranium

2023-07-21

The type of reactions and the availability of monomers for the synthesis of sp²-c linked covalent organic frameworks (COFs) are considerably limited by the irreversibility of the C=C bond. Herein, inspired by the Claisen-Schmidt condensation reaction, two propenone-linked (C=C-C=O) COFs (named Py-DAB and PyN-DAB) are developed based on the base-catalyzed nucleophilic addition reaction of ketone-activated α-H with aromatic aldehydes. The introduction of propenone structure endows COFs with high crystallinity, excellent physicochemical stability, and intriguing optoelectronic properties. Benefitting from the rational design on the COFs skeleton, Py-DAB and PyN-DAB are applied to the extraction

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Bulletin Board

Technical

JUL. 28, 2023

of radionuclide uranium. In particular, PyN-DAB shows excellent removal rates (>98%) in four uranium mine wastewater samples. We highlight that such a general strategy can provide a valuable avenue toward various functional porous crystalline materials.

Authors: Cheng-Peng Niu, Cheng-Rong Zhang, Xin Liu, Ru-Ping Liang, Jian-Ding Qiu

Full Source: Nature communications 2023 Jul 21;14(1):4420. doi: 10.1038/s41467-023-40169-1.

ENVIRONMENTAL RESEARCH

Advances in gum-based hydrogels and their environmental applications

2023-10-15

Gum-based hydrogels (GBHs) have been widely employed in diverse water purification processes due to their environmental properties, and high absorption capacity. More desired properties of GBHs such as biodegradability, biocompatibility, material cost, simplicity of manufacture, and wide range of uses have converted them into promising materials in water treatment processes. In this review, we explored the application of GBHs to remove pollutants from contaminated waters. Water resources are constantly being contaminated by a variety of harmful effluents such as heavy metals, dyes, and other dangerous substances. A practical way to remove chemical waste from water as a vital component is surface adsorption. Currently, hydrogels, three-dimensional polymeric networks, are quite popular for adsorption. They have more extensive uses in several industries, including biomedicine, water purification, agriculture, sanitary products, and biosensors. This review will help the researcher to understand the research gaps and drawbacks in this field, which will lead to further developments in the future.

Authors: Yingji Wu, Ahmad Parandoust, Reza Sheibani, Farshad Kargaran, Zahra Khorsandi, Yunyi Liang, Changlei Xia, Quyet Van Le

Full Source: Carbohydrate polymers 2023 Oct 15;318:121102. doi: 10.1016/j.carbpol.2023.121102.

Environmental exposures in early-life and general health in childhood

2023-07-21

Background: Early-life environmental exposures are suspected to be involved in the development of chronic diseases later in life. Most studies

Bulletin Board

Technical

JUL. 28, 2023

conducted so far considered single or few exposures and single-health parameter. Our study aimed to identify a childhood general health score and assess its association with a wide range of pre- and post-natal environmental exposures.

Methods: The analysis is based on 870 children (6-12 years) from six European birth cohorts participating in the Human Early-Life Exposome project. A total of 53 prenatal and 105 childhood environmental factors were considered, including lifestyle, social, urban and chemical exposures. We built a general health score by averaging three sub-scores (cardiometabolic, respiratory/allergy and mental) built from 15 health parameters. By construct, a child with a low score has a low general health status. Penalized multivariable regression through Least Absolute Shrinkage and Selection Operator (LASSO) was fitted in order to identify exposures associated with the general health score.

Findings: The results of LASSO show that a lower general health score was associated with maternal passive and active smoking during pregnancy and postnatal exposure to methylparaben, copper, indoor air pollutants, high intake of caffeinated drinks and few contacts with friends and family. Higher child's general health score was associated with prenatal exposure to a bluespace near residency and postnatal exposures to pets, cobalt, high intakes of vegetables and more physical activity. Against our hypotheses, postnatal exposure to organochlorine compounds and perfluorooctanoate were associated with a higher child's general health score.

Conclusion: By using a general health score summarizing the child cardiometabolic, respiratory/allergy and mental health, this study reinforced previously suspected environmental factors associated with various child health parameters (e.g. tobacco, air pollutants) and identified new factors (e.g. pets, bluespace) warranting further investigations.

Authors: Ines Amine, Alicia Guillien, Claire Philippat, Augusto Anguita-Ruiz, Maribel Casas, Montserrat de Castro, Audrius Dedele, Judith Garcia-Aymerich, Berit Granum, Regina Grazuleviciene, Barbara Heude, Line Småstuen Haug, Jordi Julvez, Mónica López-Vicente, Léa Maitre, Rosemary McEachan, Mark Nieuwenhuijsen, Nikos Stratakis, Marina Vafeiadi, John Wright, Tiffany Yang, Wen Lun Yuan, Xavier Basagaña, Rémy Slama, Martine Vrijheid, Valérie Siroux

Full Source: Environmental health: a global access science source 2023 Jul 21;22(1):53. doi: 10.1186/s12940-023-01001-x.

Gum-based hydrogels (GBHs) have been widely employed in diverse water purification processes due to their environmental properties, and high absorption capacity.

Bulletin Board

Technical

JUL. 28, 2023

PHARMACEUTICAL/TOXICOLOGY

Integrating In Vitro Data and Physiologically Based Kinetic Modeling to Predict and Compare Acute Neurotoxic Doses of Saxitoxin in Rats, Mice, and Humans

2023-07-21

Current climate trends are likely to expand the geographic distribution of the toxigenic microalgae and concomitant phycotoxins, making intoxications by such toxins a global phenomenon. Among various phycotoxins, saxitoxin (STX) acts as a neurotoxin that might cause severe neurological symptoms in mammals following consumptions of contaminated seafood. To derive a point of departure (POD) for human health risk assessment upon acute neurotoxicity induced by oral STX exposure, a physiologically based kinetic (PBK) modeling-facilitated quantitative in vitro to in vivo extrapolation (QIVIVE) approach was employed. The PBK models for rats, mice, and humans were built using parameters from the literature, in vitro experiments, and in silico predictions. Available in vitro toxicity data for STX were converted to in vivo dose-response curves via the PBK models established for these three species, and POD values were derived from the predicted curves and compared to reported in vivo toxicity data. Interspecies differences in acute STX toxicity between rodents and humans were found, and they appeared to be mainly due to differences in toxicokinetics. The described approach resulted in adequate predictions for acute oral STX exposure, indicating that new approach methodologies, when appropriately integrated, can be used in a 3R-based chemical risk assessment paradigm.

Authors: Jiaqi Chen, Annelies Noorlander, Sebastiaan Wesseling, Hans Bouwmeester, Nynke I Kramer, Ivonne M C M Rietjens
Full Source: Environmental science & technology 2023 Jul 21. doi: 10.1021/acs.est.3c01987.

Per- and polyfluoroalkyl substances (PFAS) measured in seafood from a cross-section of retail stores in the United States

2023-07-13

Seafood is a dominant source of human exposure to per- and polyfluoroalkyl substances (PFAS). Existing studies on foodborne PFAS exposure have focused on only a subset of these compounds. Here, we conducted a pilot study to screen 33 PFAS in 46 seafood samples from a cross-section of national and local stores in the US. Low levels of 8

Bulletin Board

Technical

JUL. 28, 2023

PFAS were measured in 74% of the samples, predominated by PFHxS (59%). Total PFAS ranged between 0.12 and 20 ng/g; highest levels were measured in Estonia-sourced smelt. The highest median levels were of PFOA (0.84 ng/g) with elevated concentrations found in Chinese clams (2.4 ng/g), which exceeds the EU established maximum limits (MLs). Measured levels of PFHxS, PFOA, and PFNA also exceeded MLs in 24%, 7%, and 5% of the samples, respectively. For average consumption levels, exposures were below the EU established tolerable weekly intakes (TWIs). However, for more frequent consumption of flounder, catfish, and cod, exposures exceeded regulations, which warrants identifying vulnerable high seafood consuming populations. Accidental PFBS cross contamination from sample storage bags resulted in 100% detection in samples, highlighting the problem with post-purchase food handling practices such as storage and cooking that could also have a substantial impact on human exposure, potentially in larger amounts than the (sea)food itself.

Authors: Megha Bedi, Yelena Sapozhnikova, Raegyn B Taylor, Carla Ng
Full Source: Journal of hazardous materials 2023 Jul 13;459:132062. doi: 10.1016/j.jhazmat.2023.132062.

The combined effect of essential oils on wood physico-chemical properties and their antiadhesive activity against mold fungi: application of mixture design methodology

2023-07-21

In the heritage field, the microbial adhesion on wood, and consequently the formation of biofilm led to inestimable losses of historical and cultural monuments. Thereby, this study aimed to examine the combined effect of *Thymus vulgaris*, *Myrtus communis*, and *Mentha pulegium* essential oils on wood surface physico-chemical properties, and to elaborate the optimal mixture using the mixture design approach coupled to the contact angle method. It was found that both wood hydrophobicity and electron donor character increased significantly after treatment using an optimal mixture containing 57% and 43% of *M. pulegium* and *M. communis* essential oils, respectively. The theoretical and experimental fungal adhesion on untreated and treated wood were also investigated. The results showed that the adhesion was favorable on untreated wood and reduced using the optimal mixture. Moreover, the experimental data

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Bulletin Board

Technical

JUL. 28, 2023

demonstrated that the same mixture exhibited an antiadhesive efficacy effect with a reduction of 36-75% in adhesion.

Authors: Moulay Sadiki, Mounyr Balouiri, Soumya Elabed, Fadoua Bennouna, Mohammed Lachkar, Saad Ibensouda Koraihi

Full Source: Biofouling 2023 Jul 21;1-18. doi: 10.1080/08927014.2023.2236029.

OCCUPATIONAL

Incident risk and burden of cardiovascular diseases attributable to long-term NO₂ exposure in Chinese adults

2023-06-23

Background: A number of studies suggested a nexus between long-term exposure to nitrogen dioxide (NO₂) and the incidence of cardiovascular disease (CVD), while population-based cohort evidence in low- and middle-income countries was extensively sparse.

Methods: We carried out an 8-year longitudinal study (2010-2018) in a nationwide dynamic cohort of 36,948 Chinese adult participants, who were free of CVD at baseline. Annual average estimates of NO₂ exposure were predicted using a well-validated spatiotemporal model and assigned to study participants based on their residential counties. Considering death as a competing risk event, Fine-Gray competing risk models with time-varying exposures at an annual scale were used to quantify incident risks of overall CVD, hypertension, and stroke associated with a 10- $\mu\text{g}/\text{m}^3$ rise in NO₂ exposure. Using the meta-analysis approach, we performed a pooled analysis of hazard ratio (HR) drawn from this and prior multinational cohort studies for the assessment of attributable burden. NO₂-attributable overall CVD incidents in China were evaluated by city and province for years 2010 and 2018, referring to a counterfactual exposure level of 10 $\mu\text{g}/\text{m}^3$ (2021 World Health Organization [WHO] air quality guidelines). A decomposition method was used to decompose net change in NO₂-attributable CVD incidents during 2010 and 2018 into 3 primary contributions of driving factors (i.e., changes in NO₂ exposure, population size, and incidence rate).

Results: A total of 4428 overall CVD events (hypertension 2448, stroke 1044) occurred during a median follow-up period of 6.1 years. Annual mean NO₂ concentration from 2010 to 2018 was 20.0 $\mu\text{g}/\text{m}^3$ (range: 6.9-57.4 $\mu\text{g}/\text{m}^3$). An increase of 10- $\mu\text{g}/\text{m}^3$ in NO₂ was associated with an HR of 1.558 (95% confidence interval [CI]: 1.477, 1.642) for overall CVD, 1.521 (95% CI: 1.419, 1.631) for hypertension, and 1.664 (95% CI: 1.485, 1.865) for stroke. Longitudinal associations of NO₂ exposure with incident CVD

Background: A number of studies suggested a nexus between long-term exposure to nitrogen dioxide (NO₂) and the incidence of cardiovascular disease (CVD), while population-based cohort evidence in low- and middle-income countries was extensively sparse.

Bulletin Board

Technical

JUL. 28, 2023

were nearly linear over the exposure range, suggesting no discernible thresholds. Subgroup analyses indicated significantly higher NO₂-associated risks of incident CVD among urban residents and overweight/obese individuals. According to pooled HR of NO₂-CVD association (1.108, 95% CI: [1.007, 1.219]) from 10 multinational cohort studies, we estimated totally 1.44 million incident CVD cases attributable to NO₂ exposure in 2018, representing a substantial decrease of 0.41 million compared to the estimate in 2010 (1.85 million) in mainland of China. Nationally, from 2010 to 2018, the attributable incident cases greatly dropped by 22.4%, which was dominantly driven by declined NO₂ concentration (-47.1%) that had offset far from the rise of CVD incidence rate (+19.6%) and population growth (+5.1%).

Conclusions: This study provided nationwide cohort evidence for elevated risks of CVD incidence associated with long-term ambient NO₂ exposure among Chinese adults, particularly in urban areas and among overweight/obese individuals. Our findings highlighted that reducing NO₂ exposure below 2021 WHO guideline could help prevent a substantial portion of incident CVD cases in China.

Authors: Kai Wang, Yang Yuan, Qun Wang, Zhiming Yang, Yu Zhan, Yaqi Wang, Fang Wang, Yunquan Zhang

Full Source: Environment international 2023 Jun 23;178:108060. doi: 10.1016/j.envint.2023.108060.

The effectiveness of implementing the Guideline for the Prevention of Mental Ill-health Problems at the Workplace on health-outcomes, organizational and social risk factors: a cluster-randomized controlled trial in Swedish schools

2023-07-23

Objectives: This study aimed to compare the effectiveness of the multifaceted implementation strategy (multifaceted group) versus a discrete implementation strategy (discrete group) for implementing the Swedish Guideline for the Prevention of Mental Ill-health Problems at the Workplace on the primary intervention outcome - exhaustion - and secondary outcomes of stress, health, recovery, psychosocial safety climate, and social and organizational risk factors. Another aim was to examine whether the primary and secondary outcomes differed on the basis of guideline adherence levels, irrespective of the group.

Methods: A cluster-randomized waiting-list controlled trial with 6- and 12-months follow-up was conducted among 19 Swedish public schools. Primary and secondary outcomes as well as guideline adherence were assessed by self-reported questionnaire. Linear mixed modeling was used

Objectives: This study aimed to compare the effectiveness of the multifaceted implementation strategy (multifaceted group) versus a discrete implementation strategy (discrete group) for implementing the Swedish Guideline for the Prevention of Mental Ill-health Problems at the Workplace on the primary intervention outcome - exhaustion - and secondary outcomes of stress, health, recovery, psychosocial safety climate, and social and organizational risk factors.

Bulletin Board

Technical

JUL. 28, 2023

to compare differences in outcomes between the groups from baseline to 6 and 12 months, and in relation to different adherence levels.

Results: The trial comprised 698 employees (83.1%) participated. There were no differences between groups in the primary and secondary outcomes at 6 months, while at 12 months differences were observed for some outcomes to the advantage of the discrete group. Better guideline adherence was associated with improvements in exhaustion at 12 months and the secondary outcomes of psychosocial safety climate, work organization and job content, interpersonal relations and leadership, and recovery over 6 and 12 months.

Conclusion: The multifaceted implementation strategy was no more effective than the discrete strategy in improving health outcomes or organizational and social work environment. However, higher adherence to the guideline was associated with larger improvements in health outcomes and organizational and social work environment, irrespective of the implementation strategy used.

Authors: Anna Toropova, Andreas Rödlund, Christina Björklund, Liselotte Schäfer Elinder, Irene Jensen, Lydia Kwak

Full Source: Scandinavian journal of work, environment & health 2023 Jul 23;4108. doi: 10.5271/sjweh.4108.