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CHEMICAL EFFECTS

Ecotoxicological hazards of sea star-derived asterosaponins: mechanistic insights into embryotoxicity and cardiotoxicity in marine medaka

2025-08-23

Outbreaks of the sea star in northern China Sea, supported by its robust chemical and physical defenses, have disrupted marine ecological balance and caused substantial economic losses to aquaculture. To investigate the compounds responsible for its chemical defense, three asterosaponins (SP1-SP3) and their shared aglycone (AG) were isolated and identified. The embryotoxicity of these compounds was evaluated using marine medaka embryos (Oryzias melastigma), with 96 h-LC50 values determined as 76.05, 2.84, 1.35, and 4.08 μM for AG, SP1, SP2, and SP3, respectively. The structure-toxicity relationship revealed that steroidal glycosides exhibited higher toxicity than their aglycone counterparts. Additionally, the composition and linkage patterns of the saccharide chains significantly influenced embryotoxicity. Transcriptomic analysis uncovered pronounced activation in pathways, including those involved in adrenergic signaling within cardiomyocytes, cardiac muscle contraction, calcium-mediated signaling, and neuroactive ligand-receptor interactions. Biochemical assays demonstrated decreased Na+ /K+-ATPase activity and reduced myosin light chain kinase (MLCK) levels in treated groups, aligning with the down-regulation of the atp1b4 and mylkb genes. These findings indicate that asterosaponins and their aglycone induce cardiotoxicity in marine medaka embryos, contributing to the foundation for further chemical ecological research and acute environmental hazard assessment.

Authors: Ranran Zhang, Zhen Lu, Derui Wang, Zhi Yan, Xueting Sun, Xiaodong Li, Xiuli Yin, Ke Li

Full Source: Ecotoxicology and environmental safety 2025 Aug 23:303:118908. doi: 10.1016/j.ecoenv.2025.118908.

Size-segregated emission characteristics and associated toxicity of polycyclic aromatic compounds from agricultural machinery

2025-08-21

Non-road agricultural machinery (AM) emissions now exceed road vehicles as major atmospheric particulate contributors in China. Though recent changes to fuels and emission standards have been implemented, their effects on particle size-resolved chemical compositions and public health impacts remain poorly understood. This study systematically analyzed the particle size-resolved polycyclic aromatic compounds (PACs) chemical composition from 5 AM, evaluating the impacts of fuel type (diesel B0, biodiesel B5/B20), emission standards (stage II/III), and working status (idling, moving, working) on emission characteristics and health risks. Key findings include: (1) Average emission factors for PPAHs, OPAHs, and SPAHs were 1.1 ± 1.6, 0.7 ± 0.7, and 0.03 ± 0.04 mg/kg, respectively. Compared with diesel B0, B5 reduced PAC emissions while B20 increased emissions by 34.8 %. (2) PAC emissions primarily concentrated in PM0.1-0.5 (>80 % mass fraction). Size distribution showed stronger dependence on emission standards and operating modes than fuel types. Stricter standards reduced total emissions by 80 % but boosted ultrafine particle emissions, particularly raising ultrafine oxygenated-PAHs 2.6-fold. (3) Carcinogenic risk assessment demonstrated 41.4 % toxicity reduction with B5 but increased risk with B20. While new standards reduced overall toxicity, the carcinogenic contribution from ultrafine particles quadrupled. These findings provide scientific basis for evaluating real-world AM emissions and formulating health-oriented control strategies under evolving regulatory frameworks.

Authors: Yishun Zhang, Zeyu Liu, Yingjun Chen, Yanli Feng, Min Cui, Xinxin Feng, Yu Peng, Junjie Cai, Tian Chen

Full Source: Journal of hazardous materials 2025 Aug 21:497:139627. doi: 10.1016/j.jhazmat.2025.139627.

Stirring speed optimization for improved microalgal-bacterial granular sludge morphology and performance in complex organic wastewater treatment

2025-08-22

This study investigated the morphology regulation and pollutant removal performance of microalgal-bacterial granular sludge (MBGS) under different organic carbon conditions, specifically comparing simple and complex organics. Results showed that MBGS proliferated faster due to filamentous cyanobacteria dominance in conditions of complex organics, requiring higher stirring speeds (300 rpm, 0.128 Pa) to inhibit excessive growth and maintain stability. Optimizing the stirring speed improved granule morphology in the complex group, reducing size and increasing density, which significantly enhanced pollutant removal efficiencies to 90.2 % for chemical oxygen demand, 86.2 % for total nitrogen, and 82.9 % for total phosphorus. Microbial community analysis further revealed that dominant phyla (Bacteroidota, Planctomycetota, Actinobacteriota) contributed significantly to the abundance of key carbon, nitrogen, and

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phosphorus metabolic genes (mqo, GLT1, ppk) under complex organic conditions. This study highlights the need for higher stirring speed to regulate MBGS in complex wastewater, providing practical strategies for optimizing treatment performance.
Authors: Chenyu Wang, Anjie Li, Bin Ji
Full Source: Bioresource technology 2025 Aug 22:133187. doi: 10.1016/j.biortech.2025.133187.

ENVIRONMENTAL RESEARCH

Mineralogical insights into the potentially toxic elements and health risks in lacustrine environments in the Lower Doce River, Southeastern Brazil

2025-08-24
The collapse of the Fundão tailings dam in 2015 triggered widespread contamination across the Doce River basin, yet its long-term effects on lacustrine environments remain poorly understood. This study investigates how sediment mineralogy influences the retention and mobility of potentially toxic elements (PTEs) in shallow and deep lakes of the Lower Doce River. Between 2018 and 2019, bottom sediment samples (0-5 cm) were collected from three deep lakes (Limão, Nova, and Juparanã) and three shallow lakes (Areão, Areal, and Monsarás). Twenty-four sediment samples were analyzed for mineralogy (X-ray diffraction and Fourier-transform infrared spectroscopy) and PTE concentrations using sequential extraction followed by ICP-MS/MS. PTEs were fractionated through a six-step sequential chemical extraction designed to isolate soluble/exchangeable, carbonate-bound, Fe oxide-bound (including poorly crystalline and crystalline phases), and pyrite-associated fractions. The results show that goethite and hematite are the main Fe oxyhydroxides in lake sediments, suggesting the legacy of deposited tailings. Deep lakes contain well-crystallized, Al-substituted goethites that enhance the retention of As, Cr, and V in more stable geochemical fractions. In contrast, shallow lakes, especially Areal and Monsarás, exhibit slightly higher hematite content and goethites with lower Al substitution and specific surface area, indicating reduced stability and greater susceptibility to redox-driven dissolution. Additionally, PTEs such as Co, Cu, Ni, Pb, and Zn are primarily associated with poorly crystalline Fe phases like ferrihydrite and lepidocrocite, which are prone to dissolution under anoxic conditions.

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Risk assessments indicate higher carcinogenic risks from As, Cr, and Ni exposure in shallow lakes, especially for children.
Authors: David Lukas de Arruda, Luiz Aníbal da Silva Filho, Sara Ramos Dos Santos, Gilberto Fonseca Barroso, Marcelo Metri Corrêa, Paulo Jorge Sanches Barbeira, Danniel Brandão Mendes, Vânya Márcia Duarte Pasa, Danilo de Lima Camêlo
Full Source: Environmental geochemistry and health 2025 Aug 24;47(10):410. doi: 10.1007/s10653-025-02712-5.

The fate, impacts and potential risks of photoaging process of the microplastics in the aqueous environment

2025-08-20
Microplastics are ubiquitous in various environments with a wide distribution. When exposed to the natural environment, microplastics undergo photoaging under ultraviolet irradiation, accompanied by a series of physicochemical property changes such as bond breakage and oxygen addition. It is of great significance to understand the physical and chemical properties of photoaged microplastics and their potential environmental risks, but information is limited and lacking in summary to date. This paper summarizes the properties of photoaged microplastics, the factors influencing their aging, and the increased environmental risks following microplastics exposure to ultraviolet radiation in aquatic environments. Firstly, the apparent changes in photoaging behavior on microplastics' physical and chemical properties were outlined, including morphological characteristics, chemical structure, crystallinity, hydrophobicity, Zeta potential and leaching behavior. Then, the factors affecting the photoaging process were discussed comprehensively, including microplastic properties, environmental media, dissolved organic matter (DOM), clay minerals and inorganic anions. In addition, the environmental risks of photoaged microplastics as pollutant transport vectors and disruption of elemental cycles were analyzed. Notably, photoaged microplastics may enhance the induction of biological toxicity and human exposure risks. Finally, knowing the summarized above, some issues that deserve more attention for future research are forecasted. Since the UV-induced weathering of microplastics is a widespread phenomenon with implications for humans, society and the environment, this review could

offer valuable insights for future research directions and environmental risk assessments of microplastics.
Authors: Jing Tong, Siying He, Xiaoming Huang, Xin Li, Xiaodong Nie, Zhengyang Li, Zhongwu Li, Weiping Xiong
Full Source: Journal of contaminant hydrology 2025 Aug 20:275:104699. doi: 10.1016/j.jconhyd.2025.104699.

PHARMACEUTICAL/TOXICOLOGY

Preparation of baicalin nano prodrug and its effect on inhibiting metastasis of triple-negative breast cancer

2025-08-18
Background: Triple-negative breast cancer (TNBC) faces great challenges in clinical treatment, owing to the lack of specific therapeutic targets and easy metastasis. The natural component baicalin can effectively inhibit the growth and metastasis of TNBC; however, it has some limitations, such as poor targeting and side effects. Nano targeted delivery systems can improve drug efficacy by enhancing drug accumulation and controlling drug release.
Objective: Trop-2 transmembrane glycoprotein expression is high in TNBC cells, suggesting that it can serve as a specific active targeting molecular-modified nano drug delivery system for TNBC to overcome non-specific distribution. Based on the characteristics of high-concentration glutathione in the tumor microenvironment, redox-sensitive nano-prodrugs (Trop2-BA-ss-PPEP) have been designed to achieve intelligent slow control and release of drugs.
Methods: The chemical structure of the Trop2-BA-ss-PPEP, and its stability, reductive response to drug release behavior, and targeting ability in vitro were characterized. Cell experiments and a transplanted tumor model verified the anti-tumor effect and biosafety.
Results: Trop2-BA-ss-PPEP was stable in a physiological environment and rapidly released the drug under reducing conditions. The experiments showed that Trop2-BA-ss-PPEP significantly promoted cellular uptake, and drug accumulation and maintenance time at the tumor site were increased. It enhanced the inhibitory effect on metastasis in vivo and in vitro, and no obvious toxicity or side effects were observed.
Conclusion: Trop2-BA-ss-PPEP was successfully constructed. The targeting ability, microenvironment responsiveness, and anti-tumor metastatic

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effects of Trop2-BA-ss-PPEP provide a new strategy for TNBC therapy, which has good application and transformation potential.
Authors: Meng Lan, Fansu Meng, Lanwen Gao, Anil K Giri, Makiya Nishikawa, Kosuke Kusamori, Jaiwoo Lee, Mulazim Hussain Asim, Shumaila Arshad, Honghui Gu, Qi Li, Lina Yang, Zhong Chen, Zhenjiang Yang, Jiajia Qin, Yu Cai
Full Source: Biomaterials advances 2025 Aug 18:178:214464. doi: 10.1016/j.bioadv.2025.214464.\

Associations between chronic exposure to bisphenols and parabens and gut microbiota in children

2025-08-21
Bisphenols and parabens are endocrine-disrupting chemicals widely used in food packaging and personal care products. Early-life exposure to these compounds has been associated with adverse health effects, but their potential role in modulating the gut microbiota during childhood remains poorly understood. The objective of this study was to investigate the association between chronic exposure to bisphenols and parabens and gut microbiota diversity, composition, and function in children.
A cross-sectional study in 97 Spanish children aged 4-12 year was conducted. Bisphenols and parabens in hair were quantified using ultra-high performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). Gut microbiota composition was assessed via 16S rRNA gene sequencing, and functional potential was inferred using PICRUSt2. Associations were explored using linear regression and random forest models, adjusting for age and sex. Total bisphenols and parabens were detected in 100 % of the children, with median concentrations of 311.33 ng/g and 1904.11 ng/g, respectively. No significant differences in overall gut microbiota diversity were observed between children with low and high exposure levels to bisphenols and parabens. However, regression models revealed associations between specific microbial genera and individual compounds. Additionally, bisphenol S was negatively associated with a predicted microbial pathway involved in methionine metabolism. Notably, Lachnospiraceae_UCG-001 emerged as a predictive genus for propylparaben exposure. Although gut microbiota composition was similar across exposure levels, specific taxa and functional pathways were linked to chronic bisphenol and paraben exposure. These findings support

the need for further research on the health implications of early-life exposure to these endocrine-disrupting chemicals.
Authors: Lourdes Rodrigo, Carlo Bressa, Mar Larrosa, Viviana Ramírez, Ángel Gil-Izquierdo, Cristóbal Sánchez-Muñoz, María Alba Martínez-Burgos, Alberto Zafra-Gómez, Ana Rivas
Full Source: Environmental research 2025 Aug 21;285(Pt 5):122643. doi: 10.1016/j.envres.2025.122643.

Cadmium-induced gut dysbiosis precedes the onset of hippocampus-dependent learning and memory deficits in mice

2025-08-22
Cadmium (Cd) is a heavy metal recognized as a neurotoxicant, but the detailed mechanisms contributing to its neurotoxicity remain to be fully elucidated. The gut-brain axis-a bidirectional communication pathway between the gut microbiome and the central nervous system-has been implicated in various neurological disorders. Since Cd targets the gut microbiome, it is important to investigate whether this axis contributes to Cd-induced neurotoxicity. In this study, adult male mice were exposed to environmentally relevant levels of Cd (3mg/L) via drinking water for nine weeks. Cognitive function was assessed throughout the exposure period, and fecal samples were collected biweekly to track changes in the gut microbiome. We found that Cd exposure caused gut dysbiosis before the onset of cognitive deficits, with specific bacterial species correlating with impaired cognition. RNA sequencing revealed alterations in the expression of genes involved in cognition and neuroinflammation in the hippocampus. Additionally, Cd exposure reduced the expression of genes related to intestinal barrier integrity, increased levels of inflammatory cytokines, and altered the levels of neuroactive microbial metabolites. These findings suggest a critical role for the gut-brain axis in mediating Cd neurotoxicity and highlight the gut microbiome as a potential target for therapeutic strategies to prevent or mitigate Cd-induced cognitive decline.
Authors: Hao Wang, Joe Jongpyo Lim, Haiwei Gu, Zhengui Xia, Julia Yue Cui
Full Source: Toxicology 2025 Aug 22:154265. doi: 10.1016/j.tox.2025.154265.

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OCCUPATIONAL

Deciphering the enzymatic responses, composition, network complexity, and functional degraders of the marine sediment bacterial community in response to 2-methyl-4-isothiazoline-3-one exposure

2025-08-20
2-Methyl-4-isothiazoline-3-one (MIT) is a widely employed antimicrobial agent frequently detected in environments; however, current documentation regarding its impacts on microbial communities and biodegradation processes remains limited. Herein, marine sediment systems were established to investigate the MIT impacts under tiered concentrations (CK, 0 μg/L; LC, 5 μg/L; MC, 50 μg/L; HC 5 mg/L). The extracellular polymeric substance contents increased in the LC and MC groups, but not in the HC group, after one day of exposure. MIT inhibited the protease, dehydrogenase, and catalase activities in the HC group after 14 days of exposure. Bacterial community structure was altered in response to high concentrations of MIT. Lutibacter (44.59 %) and Flavobacterium (7.90 %) were the predominant genera that maintained its stability. Cognatiyoonia and Pseudorhodobacter decreased on Day 1, while Rhodoferax and Pseudorhodobacter increased on Day 14. Network analysis demonstrated reduced bacterial community interactions. Functional prediction indicated that MIT inhibited carbon metabolism and citrate cycle process in the HC group. These results suggested the potential ecotoxicological risks of MIT to marine systems under prolonged exposure conditions. Furthermore, three novel bacterial strains, i.e., Brevibacterium sp., Microbacterium sp., and Epilithonimonas sp., were isolated with demonstrated MIT biodegradation capacity for the first time. This study advances our comprehension of the impacts of MIT on the marine environment and provides valuable bacterial resources for bioremediation.
Authors: Jingwei Wang, Jiaxin Wang, Pan Zhao, Shuzhen Li, Xuwang Zhang, Dan Xu, Qiao Ma
Full Source: Marine environmental research 2025 Aug 20:211:107469. doi: 10.1016/j.marenvres.2025.107469.

A case of leptospirosis contracted through occupational exposure in the Tokyo metropolitan area

2025-08-22

Leptospirosis is a zoonotic disease caused by direct or indirect contact with rodent reservoirs. Although it is widely known to be endemic in tropical countries, several cases have been reported even in metropolitan areas of non-tropical countries. Herein, we report a case of leptospirosis caused by occupational exposure in the Tokyo metropolitan area. A 24-year-old man presented with fever, headache, and systemic arthralgia. Laboratory tests revealed thrombocytopenia, abnormal liver function, and impaired renal function. Although he denied any direct contact with rats, his workplace was contaminated with them, which was key to the diagnosis. Leptospira interrogans serogroup Icterohaemorrhagiae ST17 was identified as the causative agent based on multilocus sequence typing of the urine sample and the microscopic agglutination test of the paired serum samples. Subsequent epidemiological investigation revealed that L. interrogans serogroup Icterohaemorrhagiae ST17 was isolated from rats captured in the vicinity of the patient's workplace. To the best of our knowledge, this is the first case of leptospirosis in Japan in which the same Leptospira genotype was identified in both the patients and the rats trapped around the patient's workplace. Although there is a widespread misconception that leptospirosis is a tropical disease, several cases are reported annually even in non-tropical industrialized cities, such as Tokyo, where rodents play a significant role in human infection. Diagnosis of leptospirosis is sometimes challenging for clinicians, but the first step in diagnosis is to recognize that there is always a risk of infection with Leptospira spp. in any environment potentially contaminated by rats.

Authors: Kyoko Yoshida, Kazuaki Fukushima, Yukari Nishikawa, Seowoong Jung, Masaru Tanaka, Taiichiro Kobayashi, Atsushi Ajisawa, Nobuo Koizumi, Yukihiro Akeda, Akifumi Imamura

Full Source: Journal of infection and chemotherapy: official journal of the Japan Society of Chemotherapy 2025 Aug 22:102799. doi: 10.1016/j.jiac.2025.102799.