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CHEMICAL EFFECTS

Insight into the mechanisms of combined toxicity of cadmium and flotation agents in luminescent bacteria: Role of micro/nano particles

2024-05-30

Currently, risk assessment and pollution management in mines primarily focus on toxic metals, with the flotation agents being overlooked. However, the combined effects of metals and flotation agents in mines remain largely unknown. Therefore, this study aimed to evaluate the combined effects of Cd and two organic flotation agents (ethyl xanthate (EX) and diethyldithiocarbamate (DDTC)), and the associated mechanisms. The results showed that Cd + EX and Cd + DDTC exhibited synergistic toxicity. The EC50 values for luminescent bacteria were 1.6 mg/L and 1.0 mg/L at toxicity unit ratios of 0.3 and 1, respectively. The synergistic effects were closely related with the formation of Cd(EX)2 and Cd(DDTC)2 micro/nano particles, with nano-particles exhibiting higher toxicity. We observed severe cell membrane damage and cell shrinkage of the luminescent bacteria, which were probably caused by secondary harm to cells through the released CS2 during their decomposition inside cells. In addition, these particles induced toxicity by altering cellular levels of biochemical markers and the transcriptional levels of transport proteins and lipoproteins, leading to cell membrane impairment and DNA damage. This study has demonstrated that particulates formed by Cd and flotation agents contribute to the majority of the toxicity of the binary mixture. This study helps to better understand the complex ecological risk of inorganic metals and organic flotation agents in realistic mining environments.

Authors: Jiacheng Sun, Bo Yan, Hongxing Chen, Shuchen Tu, Junhao Zhang, Tao Chen, Qinzi Huang, Yuting Zhang, Lingtian Xie

Full Source: The Science of the total environment 2024 May 30:173588. doi: 10.1016/j.scitotenv.2024.173588.

Currently, risk assessment and pollution management in mines primarily focus on toxic metals, with the flotation agents being overlooked.

Indigo dyes: Toxicity, teratogenicity, and genotoxicity studies in zebrafish embryos

2024-05

Wastewater released by textile dyeing industries is a major source of pollution. Untreated wastewater released from indigo dyeing operations affects aquatic ecosystems and threatens their biodiversity. We have assessed the toxicity of natural and synthetic indigo dye in zebrafish embryos, using the endpoints of teratogenicity, genotoxicity, and

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histopathology. The zebrafish embryo toxicity test (ZFET) was conducted, exposing embryos to ten concentrations of natural and synthetic indigo dyes; the 96-hour LC50 values were approximately 350 and 300 mg/L, respectively. Both dyes were teratogenic, causing egg coagulation, tail detachment, yolk sac edema, pericardial edema, and tail bend, with no significant difference in effects between the natural and synthetic dyes. Both dyes were genotoxic (using comet assay for DNA damage). Real-time RT-PCR studies showed upregulation of the DNA-repair genes FEN1 and ERCC1. Severe histological changes were seen in zebrafish larvae following exposure to the dyes. Our results show that indigo dyes may be teratogenic and genotoxic to aquatic organisms, underscoring the need for development of sustainable practices and policies for mitigating the environmental impacts of textile dyeing.

Authors: M Porkodi, Manoj P Brahmane, Mujahidkhan A Pathan, Nalini Poojary, Shubra Singh, M Harshavarthini, N S Nagpure

Full Source: Mutation research. Genetic toxicology and environmental mutagenesis 2024 May-Jun:896:503752. doi: 10.1016/j.mrgentox.2024.503752.

Occurrence and dissipation mechanisms of organic contaminants during sewage sludge anaerobic digestion: A critical review

2024-05-29

Sewage sludge, a complex mixture of contaminants and pathogenic agents, necessitates treatment or stabilization like anaerobic digestion (AD) before safe disposal. AD-derived products (solid digestate and liquid fraction) can be used as fertilizers. During AD, biogas is also produced, and used for energy purposes. All these fractions can be contaminated with various compounds, whose amount depends on the feedstocks used in AD (and their mutual proportions). This paper reviews studies on the distribution of organic contaminants across AD fractions (solid digestate, liquid fraction, and biogas), delving into the mechanisms behind contaminant dissipation and proposing future research directions. AD proves to be a relatively effective method for removing polychlorinated biphenyls, polycyclic aromatic hydrocarbons, pharmaceuticals, antibiotic resistance genes and hydrocarbons. Contaminants are predominantly removed through biodegradation, but many compounds, especially hydrophobic (e.g. per- and polyfluoroalkyl substances), are also sorbed onto digestate particles. The process of sorption is suggested to reduce the bioavailability of contaminants. As a result of sorption, contaminants accumulate in the largest amount in the solid digestate, whereas in smaller

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amounts in the other AD products. Polar pharmaceuticals (e.g. metformin) are particularly leached, while volatile methylsiloxanes and polycyclic aromatic hydrocarbons, characterized by a high Henry's law constant, are volatilized into the biogas. The removal of compounds can be affected by AD operational parameters, the type of sludge, physicochemical properties of contaminants, and the sludge pretreatment used.
Authors: Wiktoria Błaszczyk, Anna Siatecka, Pavel Tlustoš, Patryk Oleszczuk
Full Source: The Science of the total environment 2024 May 29:173517. doi: 10.1016/j.scitotenv.2024.173517.

ENVIRONMENTAL RESEARCH

Emerging contaminants in water environments: progress, evolution, and prospects

2024-05
This article employs bibliometric tools like VOSviewer, Bibliometrix, and CiteSpace for a comprehensive visual analysis of 1,612 documents on Emerging Contaminants in Waters from the Web of Science database. The objective is to elucidate the historical development, research hotspots, and trends in international studies of this field, offering valuable insights and guidance for future research directions. The analysis reveals a consistent increase in publications from 2003 to 2023, with the United States, China, and Spain being the most prolific contributors. A detailed examination of keyword co-occurrence and cluster analysis shows a predominant focus on themes such as pollutant detection, risk assessment, and biogeochemical cycling. Furthermore, the study underscores the significance of forming interdisciplinary networks among authors and institutions, highlighting its critical role in enhancing the quality and innovation of scientific research. The findings of this study not only chart the progression and focal points of research in this domain but also underscore the pivotal role of international collaboration, serving as an indispensable reference for shaping future research trajectories and fostering global cooperation.
Authors: Ruiqi Wang, Huanchen Tang, Ruitao Yang, Jingduo Zhang
Full Source: Water science and technology : a journal of the International Association on Water Pollution Research 2024 May;89(10):2763-2782. doi: 10.2166/wst.2024.151.

This article employs bibliometric tools like VOSviewer, Bibliometrix, and CiteSpace for a comprehensive visual analysis of 1,612 documents on Emerging Contaminants in Waters from the Web of Science database.

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Ultrafine CuO/graphene oxide cellulose nanocomposites with complementary framework for polycyclic aromatic hydrocarbon pollutants removal

2024-05-21
Efficient and sustainable methods for eliminating polycyclic aromatic hydrocarbon pollutants (PAHPs) are in highly desired. Proven technologies involve physical and chemical reactions that absorb PAHPs, however they encounter formidable challenges. Here, a bottom-up refining-grain strategy is proposed to rationally design ultrafine CuO/graphene oxide-cellulose nanocomposites (LCelCCu) with a mirror-like for tetracycline (TC) to substantially improve the efficient of the purification process by active integrated-sorption. The LCelCCu captures TC with a higher affinity and lower energy demand, as determined by sorption kinetic, isotherms, thermodynamics, and infrared and X-ray Photoelectron Spectroscopy. The resulting material could achieve ultra-high sorption capacity (2775.23 mg/g), kinetic (1.2499 L g-1 h-1) and high selectivity (up to 99.9 %) for TC, nearly surpassing all recent adsorbents. This study simultaneously unveils the pioneering role of simultaneous multi-site match sorption and subsequent advanced oxidation synergistically, fundamentally enhancing understanding of the structure-activity-selectivity relationship and inspires more sustainable water purification applications and broader material design considerations.
Authors: Mengbo Cao, Hanmin Zhang, Xingyue Wei, Yu Tian
Full Source: Water research 2024 May 21:258:121816. doi: 10.1016/j.watres.2024.121816.

Efficient and sustainable methods for eliminating polycyclic aromatic hydrocarbon pollutants (PAHPs) are in highly desired.

Sixty years of research on bracken fern (Pteridium spp.) toxins: environmental exposure, health risks and recommendations for bracken fern control

2024-05-29
Bracken fern (Pteridium spp.) is a highly problematic plant worldwide due to its toxicity in combination with invasive properties on former farmland, in deforested areas and on disturbed natural habitats. The carcinogenic potential of bracken ferns has caused scientific and public concern for six decades. Its genotoxic effects are linked to illudane-type glycosides (ITGs), their aglycons and derivatives. Ptaquiloside is considered the dominating ITG, but with significant contributions from other ITGs. The present review aims to compile evidence regarding environmental pollution by bracken fern ITGs, in the context of their human and animal health implications. The ITG content in bracken fern exhibits substantial spatial, temporal,

and chemotaxonomic variation. Consumption of bracken fern as food is linked to human gastric cancer but also causes urinary bladder cancers in bovines browsing on bracken. Genotoxic metabolites are found in milk and meat from bracken fed animals. ITG exposure may also take place via contaminated water with recent data pointing to concentrations at microgram/L-level following rain events. Airborne ITG-exposure from spores and dust has also been documented. ITGs may synergize with major biological and environmental carcinogens like papillomaviruses and Helicobacter pylori to induce cancer, revealing novel instances of chemical and biological co-carcinogenesis. Thus, the emerging landscape from six decades of bracken research points towards a global environmental problem with increasingly complex health implications.

Authors: Rui M Gil da Costa, Andrew Povey, Beatriz Medeiros-Fonseca, Carmel Ramwell, Connie O'Driscoll, David Williams, Hans Chr B Hansen, Lars Holm Rasmussen, Mary T Fletcher, Peter O'Connor, Richard H W Bradshaw, Roderick Robinson, James Mason

Full Source: Environmental research 2024 May 29:119274. doi: 10.1016/j.envres.2024.119274.

PHARMACEUTICAL/TOXICOLOGY

Hazard identification of endocrine-disrupting carcinogens (EDCs) in relation to cancers in humans

2024-05-31

Endocrine disrupting chemicals or carcinogens have been known for decades for their endocrine signal disruption. Endocrine disrupting chemicals are a serious concern and they have been included in the top priority toxicants and persistent organic pollutants. Therefore, researchers have been working for a long time to understand their mechanisms of interaction in different human organs. Several reports are available about the carcinogen potential of these chemicals. The presented review is an endeavor to understand the hazard identification associated with endocrine disrupting carcinogens in relation to the human body. The paper discusses the major endocrine disrupting carcinogens and their potency for carcinogenesis. It discusses human exposure, route of entry, carcinogenicity and mechanisms. In addition, the paper discusses the research gaps and bottlenecks associated with the research. Moreover,

Endocrine disrupting chemicals or carcinogens have been known for decades for their endocrine signal disruption.

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it discusses the limitations associated with the analytical techniques for detection of endocrine disrupting carcinogens.

Authors: Neha Sharma, Vinay Kumar, Vimal Sugumar, Mridul Umesh, Preeti Sharma, Basheer Thazeem, Komalpreet Kaur, Jithin Thomas, Ritu Pasrija, Divya Utreja

Full Source: Environmental toxicology and pharmacology 2024 May 31:104480. doi: 10.1016/j.etap.2024.104480.

Children's exposure to halogenated flame retardants and organophosphate esters through dermal absorption and hand-to-mouth ingestion in Swedish preschools

2024-05-29

Children are exposed to endocrine disrupting chemicals (EDCs) through inhalation and ingestion, as well as through dermal contact in their everyday indoor environments. The dermal loadings of EDCs may contribute significantly to children's total EDC exposure due to dermal absorption as well as hand-to-mouth behaviors. The aim of this study was to measure potential EDCs, specifically halogenated flame retardants (HFRs) and organophosphate esters (OPEs), on children's hands during preschool attendance and to assess possible determinants of exposure in preschool indoor environments in Sweden. For this, 115 handwipe samples were collected in winter and spring from 60 participating children (arithmetic mean age 4.5 years, standard deviation 1.0) and analyzed for 50 compounds. Out of these, 31 compounds were identified in the majority of samples. Levels were generally several orders of magnitude higher for OPEs than HFRs, and 2-ethylhexyl diphenyl phosphate (EHDPP) and tris(2-butoxyethyl) phosphate (TBOEP) were detected in the highest median masses, 61 and 56 ng/wipe, respectively. Of the HFRs, bis(2-ethyl-1-hexyl)-2,3,4,5-tetrabromobenzoate (BEH-TEBP) and 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether (BDE-209) were detected in the highest median masses, 2.8 and 1.8 ng/wipe, respectively. HFR and/or OPE levels were found to be affected by the number of plastic toys, and electrical and electronic devices, season, municipality, as well as building and/or renovation before/after 2004. Yet, the calculated health risks for single compounds were below available reference dose values for exposure through dermal uptake as well as for ingestion using mean hand-to-mouth contact rate. However, assuming a high hand-to-mouth contact rate, at the 95th percentile, the calculated hazard quotient was above 1 for the maximum handwipe mass of TBOEP found in this study, suggesting a risk of negative health effects. Furthermore, considering

Children are exposed to endocrine disrupting chemicals (EDCs) through inhalation and ingestion, as well as through dermal contact in their everyday indoor environments.

additive effects from similar compounds, the results of this study indicate potential concern if additional exposure from other routes is as high.
Authors: Ylva Sjöström, Fang Tao, Niklas Ricklund, Cynthia A de Wit, Katja Hagström, Jessika Hagberg
Full Source: The Science of the total environment 2024 May 29:173635. doi: 10.1016/j.scitotenv.2024.173635.

OCCUPATIONAL

Letter re: Regulatory toxicology approaches in workplaces of Iran

2024-05-31
The objective of establishing occupational exposure limits (OELs) is to utilize them as a risk management tool, ensuring the protection of workers' health and well-being from hazardous substances present in the workplace. To regulate and develop an OEL, it is essential to conduct toxicological studies on both animals and humans, to determine the dose-response relationship for each chemical compound, and to determine whether the dose-response relationship is linear or non-linear. Because the OELs suggested by different organizations or countries are just the result of their scientific methods, knowledge, and judgment, this does not confirm the applicability in other countries. Therefore, it is not scientific and logical to imitate the permissible limits recommended in Western countries. In most Western Asian nations, there is a significant difference in the suggested OEL levels between the reference organizations, and in assessing and managing a specific situation's risk, using any of the proposed OELs can lead to contradictory results. Suggestions for the development and improvement of the basics of determining the OELs for chemical pollution in West Asian countries have been made.
Authors: Seyed Mohammad Ebrahimi, Mansur Rezazadeh Azari, Razzagh Rahimpoor
Full Source: Toxicology and industrial health 2024 May 31:7482337241258664. doi: 10.1177/07482337241258664.

Reduced protein levels in latex gloves may play an alternative approach to lowering latex sensitization risks among health workers; a cross-sectional analytical study

2024-06-03
Background: Latex gloves are essential for protecting healthcare workers from biological hazards but pose a risk of latex allergy, particularly due to powdered, protein, and allergen content. Recent advancements in latex glove manufacturing have led to reduced levels of extractable proteins, a known factor triggering allergenic reaction. This study aimed to compare latex sensitization between nursing staff using low-protein and high-protein latex gloves at a tertiary university hospital in Thailand.
Methods: A cross-sectional analytical study categorized participants into two groups based on glove exposure: the low extractable protein group (only exposed to non-powdered latex gloves with extractable protein levels below 50 µg/g) and the high extractable protein group (exposed to powdered latex gloves with levels above 50 µg/g). The sample size comprised 163 individuals in the low protein group and 318 in the high protein group (1:2). Latex allergy symptoms and sensitization were assessed using a self-administered questionnaire and latex-specific IgE measurement (ImmunoCAP), respectively. Data analysis involved descriptive and inferential statistics, including odds ratios and 95%CI.
Results: Demographic data was mostly similar in both exposure groups except for age. No significant differences in latex sensitization between the low and high protein groups were found via latex-specific IgE measurement (crude OR 1.90, 95%CI: 0.5, 7.18), potentially attributed to lower extractable protein levels in powdered latex gloves compared to previous studies. In contrast, the low protein group exhibited significantly fewer current latex allergy symptoms in both bivariate (crude OR 0.24, 95%CI: 0.06, 0.74) and multiple variable analysis (adjusted OR 0.18, 95%CI: 0.04, 0.86). Moreover, there was a significant reduction in latex allergy symptoms among the low protein group, decreasing from 9.8% who reported experiencing symptoms (when powdered latex gloves were used) to 1.2% who still reported current symptoms (OR 0.11, 95%CI: 0.02, 0.44).
Conclusions: This study underscores the importance of using non-powdered and low-protein latex gloves to reduce latex allergy symptoms while emphasizing the need for further investigation into the relationship between extractable protein levels in addition to the attempt of the major allergen removal and latex sensitization amid evolving glove manufacturing practices.
Authors: Chatpong Ngamchokwathana, Naesinee Chaiear, Jitladda Sakdapipanich, Sumalai Dechyotin, Somsamai Sripramai, Prapassorn Khajornpipat
Full Source: Journal of occupational medicine and toxicology (London, England) 2024 Jun 3;19(1):21. doi: 10.1186/s12995-024-00420-x.

The objective of establishing occupational exposure limits (OELs) is to utilize them as a risk management tool, ensuring the protection of workers' health and well-being from hazardous substances present in the workplace.