CHEMWATCH

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CHEMICAL EFFECTS

Veterinary tetracycline residues: environmental occurrence, ecotoxicity, and degradation mechanism

2024-11-21

Tetracycline has been widely used in the intensive livestock and poultry breeding industry to prevent and treat infectious diseases or promote animal growth. Usually, about 40.0-90.0% of tetracycline is excreted in the form of original drugs or metabolites and finally enters the surrounding water and soil, causing a series of eco-toxic effects. In this review, the toxic effects on plants, soil animals, and microorganisms are systematically reviewed. The migration and degradation mechanisms of tetracycline are emphasized, which are closely related to the physical and chemical properties of soil. In addition, the residual tetracycline in soil and water can be efficiently degraded by "plant-microorganism". Based on summarizing the current research progress, this review puts forward some important problems to be solved in the study of tetracycline residue and looks forward to the future research direction.

Authors: Changning Li, Mukesh Kumar Awasthi, Jie Liu, Tuo Yao
Full Source: Environmental research 2024 Nov 21:120417. doi: 10.1016/j.envres.2024.120417.

Comparing conventional and phytoscreening methods to detect subsurface chemical contaminants: a test case of volatile organic compounds in an urban setting

2024-11-22

The nationwide prevalence of brownfields, with often unknown types and quantities of subsurface chemical contaminants, highlights the need for rapid, cost-effective, and noninvasive methods to reduce routes of exposure. In post-industrial cities such as Detroit, Michigan, anthropogenic volatile organic compounds (VOCs), known to negatively impact human health, are typically detected at brownfields through conventional methods, e.g. screening soil, and groundwater. Recently, the method of phytoscreening-the chemical analysis of plant tissues to provide evidence for belowground contamination-has become a viable alternative to conventional methods. However, few studies have been designed to directly compare conventional and plant-based methods of detecting VOCs. To fill this knowledge gap, we sampled and compared the concentration of six VOCs including BTEX, PCE, and TCE detected in conventional media (soil, soil vapor, groundwater, sewer vapor) and

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different plant tissue (tree core, leaf, root, shoot) at two brownfields sites in Detroit: an abandoned gas station with a leaking underground storage tank, and a former dry cleaning facility. Our results suggest that the concentrations of VOCs detected in plants are similar to or in some cases greater than conventional methods and can differ across the growing season. For example, leaves and roots detected, on average, a higher concentration of VOCs compared to shoots and tree cores, however, TCE and PCE were generally in higher concentrations in soil and soil vapor. Moreover, the frequency at which conventional versus phytoscreening methods failed to detect VOCs was similar at one site and higher at another, suggesting that phytoscreening may yield fewer non-detects at known sites of contamination. While additional work is needed to understand the relationship between concentrations of VOCs detected in soil versus co-located plant samples, our results suggest that phytoscreening may be a viable and reliable method to detect belowground chemical contaminants while reducing screening times and cost, and increasing access to private property.

Authors: Brendan F O'Leary, Carol J Miller, Kelvin Selegean, Glen Ray Hood
Full Source: Environmental pollution (Barking, Essex : 1987) 2024 Nov 22:125374. doi: 10.1016/j.envpol.2024.125374.

ENVIRONMENTAL RESEARCH

A systematic evidence map protocol for mapping global exposure to bisphenols and their alternatives and social and environmental justice implications

2024-10-22

Background: Bisphenol A (BPA) is one of the highest-volume chemicals produced worldwide, and human exposure to BPA is thought to be ubiquitous. Stricter regulations around the use of BPA have led many manufacturers to switch to other bisphenol chemicals with similar functions such as bisphenol S and F. Even though exposure to BPA, other bisphenol chemicals and bisphenol alternatives poses a health risk for humans, very little is known about the granular exposure levels of different populations around the world.

Aim: This systematic evidence map (SEM) will identify human studies reporting concentrations of bisphenols and their alternatives measured in human bio-samples with the aim to chart the global human exposure levels by country and population characteristics to identify research gaps and discuss any social and environmental injustice implications.

> Background: Bisphenol A (BPA) is one of the highest-volume chemicals produced worldwide, and human exposure to BPA is thought to be ubiquitous.

Search strategy and eligibility criteria: MEDLINE®, Embase and Web of Science (WoS) databases as well as grey literature sources will be searched using predefined search strings. The database search results will be supplemented by backward and forward citation tracking on included studies. A scoping exercise conducted during planning identified 90 bisphenol chemicals and alternatives used in plastics. These include BPA, other bisphenol chemicals with/without similar functions to BPA as well as alternatives with similar functions to bisphenol chemicals. Eligible studies must measure concentrations of at least one relevant bisphenol chemical/alternative in human bio-samples.

Study selection: Only primary studies published in English since 2010 will be considered. The title, abstract and keywords will be screened by the DistillerAI tool and two independent reviewers. Grey literature will be screened by two reviewers for inclusion and exclusion. The full text of the included studies will then be screened by two independent reviewers.

Study appraisal: Study quality will not be evaluated in this SEM.

Data extraction and coding: Data extraction and coding will be performed by two independent reviewers. Parameters of interest will include the following: study characteristics (e.g., year of publication, sampling timepoints and study design), population information (e.g., country, age, sex, ethnicity, number of participants) and exposure information (sources of exposure, bio-sample analyzed, chemical name, concentration, and detection frequencies).

Synthesis and visualization: The results will be presented using a narrative summary, tables, bar plots and color-coded maps. The interactive database will be available on a dedicated freely accessible website.

Systematic map protocol registry and registration number: This protocol has been registered on Open Science Framework (OSF) and is available at https://doi.org/10.17605/OSF.IO/MNWTD.

Authors: Bhedita J Seewoo, Enoch V S Wong, Yannick R Mulders, Aleksandra Gozt, Ahmed Elagali, Christos Symeonides, Sarah A Dunlop
Full Source: Environment international 2024 Oct 22:194:109091. doi: 10.1016/j.envint.2024.109091.

Carbon capture potential and environmental impact of concrete weathering in soil
2024-11-23

The enhanced weathering of concrete in soil has potential to capture atmospheric CO_2. The objective of this research was to conduct a laboratory experiment and evaluate the environmental impacts and carbon capture potential of concrete as an enhanced weathering material

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in soil. A column study was conducted with four treatments comprised of: 1) 100 % soil (S treatment), 2) 90 % soil and 10 % concrete by weight of 0.25-0.71 mm diameter fragments (S + Cfine treatment), 3) 90 % soil and 10 % concrete by weight of 8-25 mm diameter fragments (S + Ccoarse treatment), and 4) 100 % concrete composed of 8-25 mm diameter fragments (C treatment). Deionized water was added to the columns for 16 weeks. The S + Cfine treatment experienced a significant increase in soil pH (8.0 ± 0.07) compared to the S (6.9 ± 0.22) and S + Ccoarse (7.1 ± 0.08) treatments. The C treatment experienced a significant increase in leachate pH. Leachate NO_3^- concentrations in the S + Cfine (33 ± 18 mg L-1) samples were significantly greater than those in other treatments. Soil microbial community concentrations were significantly less in the S + Cfine treatment. The S + Cfine treatment had a calculated average HCO_3^- concentration of 350 ± 120 mg L-1 which was significantly greater than the S (230 ± 100 mg L-1), C (270 ± 170 mg L-1), and S + Ccoarse (260 ± 50 mg L-1) treatments. Increased concentrations of Ca^{2+}, SO_4^{2-}, H_4SiO_4, and HCO_3^- in the mixed concrete and soil samples are evidence that chemical reactions occurred due to the soil-concrete interaction and are likely capturing atmospheric CO_2.

Authors: Brittany Multer Hopkins, Rattan Lal, W Berry Lyons, Susan A Welch
Full Source: The Science of the total environment 2024 Nov 23:957:177692. doi: 10.1016/j.scitotenv.2024.177692.

Microplastics in the Eastern Arabian Sea: Decision support tools for monitoring and environmental risk reduction
2024-11-22

The study of microplastics (MP) in the Eastern Arabian Sea (EAS) offers globally relevant insights into the pressing issue of marine plastic pollution. Quantification results (mean concentration of 0.13 particles m-3 and range of 0.02-0.71 particles m-3) from the various sectors suggest that terrestrial activities are an important source of MP. By quantifying MP concentrations, identifying predominant polymers, and employing hydrodynamic and particle tracking models, the study provides model simulations that aid in tracking the fate and distribution of MP in coastal environments. Various indices developed in the study suggest significant land-based activity (LBA), low microplastic pollution impact (MPI), and waste management demand (WMD) at medium levels, wherein these indices are replicable and can be applied globally. The development of an Environmental Decision Support System (EDSS) by combining the above indices demonstrates the practical utility of our research in guiding policymakers. This tool can be adapted by governments and organisations

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worldwide to implement integrated coastal zone management (ICZM), emphasising key strategies like plastic source reduction, regulatory enforcement, and waste management. This study aligns with international goals, including the United Nations' Sustainable Development Goals (SDG 14) addressing plastic pollution from both land-based and marine sources. EDSS identifies regions of high-priority areas for intervention, showcasing that regional data can be scaled up to address global challenges. This research presents a blueprint for managing marine plastic pollution on a global scale, emphasising the importance of integrating scientific findings with innovative policy tools. It underscores the need for a coordinated, region-specific, and globally replicable approach to protect marine ecosystems and ensure sustainable coastal management practices.
Authors: M Mugilarasan, R S Robin, J Joyson Joe Jeevamani, R Karthik, A Nithin, G Hariharan, B Subbareddy, K K Idrees Babu, R Purvaja
Full Source: Journal of environmental management 2024 Nov 22:372:123160. doi: 10.1016/j.jenvman.2024.123160.

PHARMACEUTICAL/TOXICOLOGY

A review of enhanced adsorption removal of odor contaminants with low ppm concentration levels: the key to technological breakthrough as well as challenges
2024-11-14
The industrial production processes often produce different concentrations and types of odorous pollutants. Most odors have a low odor threshold, and the human sense of smell can still have a strong, unpleasant odor even at low ppb concentrations. The main challenges in low ppm concentration odor purification are short contact time, high air volume, low equilibrium adsorption capacity, and easy physical desorption. For the first time, this work reviews the technical paths how to purify four typical types of low concentrations of odors such as H2S, NH3, CH3SH, and CH3SCH3 from low ppm concentration levels to low ppb, with the view of the odor sources, the development of treatment technology, international permissible emission standards, and the recent status of adsorbent materials. To begin, Citespace software is employed to analyze the progress, hotspots, and technology trends in the field of odor pollutant research over the past 28 years and the factors that affect removal efficiency of low-concentration odorous pollutants are discussed in detail. Then, taking activated carbon, molecular sieve, and metal-organic frameworks as target adsorbents, how to strengthen

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the integrated ways of physical adsorption and chemical adsorption of these adsorbents are suggested starting from the synergistic effects of modifications for pore structure, surface chemical functional groups, and complexation and redox reactions of metal ions. As a practice, the application cases of purifying low-concentration odorous pollutants by the adsorption are briefly introduced. Finally, the challenges of developing novel adsorption materials and technologies to purify low-concentration odorous pollutants toward lower than odor threshold are presented.
Authors: Wenying Li, Jianing Lv, Yang Yue, Yao Wang, Jia Zhang, Guangren Qian
Full Source: Journal of hazardous materials 2024 Nov 14:482:136512. doi: 10.1016/j.jhazmat.2024.136512.

Changing the horizon of food frying from the use of liquid oil to semi-solid gel
2024-12
Deep fat frying is the most adopted process of producing fried food products; it involves mass and heat transfer to form fried products with good colour, crispiness, flavour, taste, and texture. However, frequent consumption of these products is a concern due to higher oil content that poses threats to human health. Hence, there is a need to find an alternative frying medium for deep fat frying of food products to obtain fried products having lower fat content. The structuring of liquid oil to convert it into semi-solid gel by the process of oleogelation forms oleogel. The use of oleogel as a frying medium gives fried products with good oxidative, textural, and sensory attributes. The Oleogelator used in the formulation of oleogel plays a significant role in maintaining the stability of oleogel. An increase in the oleo gelator concentration decreases the oil uptake in the fried product. The superior product quality and high consumer acceptance of oleogel fried products indicate that oleogel is a potential frying medium. The scope of the present review is to cover the heat and mass transfer perspective of the deep fat frying process, factors responsible for oil uptake in fried products, formulation and components of semi-solid system, discussion on various characteristics of semi-solid system as frying medium, comparative assessment of oil uptake in food fried in oleogel and conventional oil and finally covering specific examples showing the efficacy of liquid oil oleogel as a frying medium.
Authors: Harsh B Jadhav
Full Source: Food research international (Ottawa, Ont.) 2024 Dec;197(Pt 2):115290. doi: 10.1016/j.foodres.2024.115290.

> Deep fat frying is the most adopted process of producing fried food products; it involves mass and heat transfer to form fried products with good colour, crispiness, flavour, taste, and texture.

OCCUPATIONAL

Heavy metal exposure and its effects on APOC3, CFAI, and ZA2G

2024-11-20

Despite increasing heavy metal pollution, traditional epidemiology often fails to link exposure to health outcomes. This study used multi-omics to investigate associations between heavy metal exposure and health. Blood and urine samples from 294 participants in heavy metal-exposed and control areas were analyzed, revealing key biomarkers. Meta P analysis revealed consistent trends in apolipoprotein C3 (APOC3) expression, and mediation analysis showed significant effects of APOC3 and zinc-alpha-2-glycoprotein (ZA2G) on metabolites: the mediating effect of APOC3 from blood cadmium to serotonin was 0.023 (P < 0.001) and that to 3-phosphoglyceric acid (3PG) was 0.0125 (P = 0.002). Mendelian randomization confirmed the positive impact of APOC3 and Complement Factor I (CFAI) and the negative effect of ZA2G on metabolites, with apolipoprotein H (APOH) methylation significantly altering APOC3 (β = -0.22, P = 0.017), CFAI (β = 0.176, P = 0.035), and ZA2G (β = 0.139, P = 0.048) protein levels. Liver function variables, including albumin, total protein, calcium, and lactate dehydrogenase, correlated with 3PG and serotonin levels in the exposed areas. Sex-specific analysis showed that men exhibited stronger compensatory mechanisms via CFAI and myo-inositol, while women's greater vulnerability to heavy metal exposure highlighted the need for targeted interventions. These findings suggest APOH methylation affects APOC3, CFAI, and ZA2G levels, elevating 3PG, inosine monophosphate, and serotonin levels and harming liver function via lipolysis, supporting the use of these markers in health monitoring, therapies, and policies to limit heavy metal risks.

Authors: Nam-Eun Kim, Min Heo, Hyeongyu Shin, Ah Ra Do, Jeeyoung Kim, Hee-Gyoo Kang, Sora Mun, Hyun Ju Yoo, Mi Jeong Kim, Jung-Woong Kim, Chul-Hong Kim, Young-Seoub Hong, Yong Min Cho, Heejin Jin, Kyungtaek Park, Woo Jin Kim, Sungho Won

Full Source: Journal of hazardous materials 2024 Nov 20:482:136574. doi: 10.1016/j.jhazmat.2024.136574.

> Despite increasing heavy metal pollution, traditional epidemiology often fails to link exposure to health outcomes.

Impact of exposure to extremely low-frequency magnetic fields on blood pressure, heart rate variation and disturbance to quality of sleep on industrial workers in Korea

2024-11-23

Objectives: This study investigates the potential health risks associated with exposure to extremely low-frequency magnetic fields (ELF-MFs), focusing on the impact on sleep quality. The hypothesis is that increasing ELF-MF exposure will correlate with elevated blood pressure (BP), altered heart rate (HR) dynamics and poorer sleep quality among occupational workers in Korea.

Methods: The study involved 85 participants. Assessment of ELF-MF exposure was carried out continuously for 24 h in the two groups. Measurements of BP parameters, HR and sleep quality were conducted accordingly.

Results: The study found significant ELF-MF exposure levels in both working and sleeping times for industrial factory workers (0.19 ± 0.38 and 0.17 ± 0.23 µT, p < 0.05). Long-term exposure among industrial workers may contribute to a significant difference in systolic blood pressure (SBP) (125.61 ± 9.60 mm Hg, p < 0.05). Additionally, a significant difference in deep sleep analysis was observed between the high-exposure and low-exposure groups (67.13 ± 31.15 min, p < 0.05).

Conclusion: The hypothesis was confirmed, indicating possible effects of high ELF-MF exposure on SBP and deep sleep. However, further research on long-term exposure and its association with sleep quality disturbances is needed for validation.

Authors: S D N A M Amila Madhushanka Weerasinghe, Sanduni Liyanage, Mailan Arachchige Don Rajitha Kawshalya, Seung-Cheol Hong

Full Source: International journal of occupational safety and ergonomics : JOSE 2024 Nov 23:1-8. doi: 10.1080/10803548.2024.2413816.

Behavioral risk assessment of work-related musculoskeletal disorders among workers of petrochemical industries: protocol of a mixed method study

2024-11-23

Background: Musculoskeletal disorders (MSDs) are one of the most common occupational diseases and the main cause of disability worldwide. Work-related musculoskeletal disorders (WMSDs) are one of the common health risks and the most important cause of absenteeism due to disability in various industries, including the petrochemical

> Objectives: This study investigates the potential health risks associated with exposure to extremely low-frequency magnetic fields (ELF-MFs), focusing on the impact on sleep quality.

industry, in developed and developing countries. These disorders have important social economic, and significant financial consequences due to direct and hidden costs. Health behaviors play a role in both creating and preventing musculoskeletal disorders in employees. Therefore, by identifying the influencing factors on these behaviors, it is possible to strengthen and improve the preventive behaviors of musculoskeletal disorders through educational intervention programs. This study aims to assess the behavioral risk of work-related musculoskeletal disorders, and design and implement an educational intervention to teach effective behaviors in the prevention of musculoskeletal disorders in petrochemical industry workers.

Methods: This study is a mixed-method study implemented in four stages involving the qualitative study, the design and evaluation of an instrument, the design of an experimental randomized clinical trial, and the psychometric evaluation of the instrument and the evaluation of the program. The research community consists of employees working in the petrochemical industry. The volume of samples in the qualitative study with the purposeful sampling method, in the instrument design stage based on the available sampling method, and also in the experimental study, the samples are employees suffering from work-related musculoskeletal disorders, who were selected based on a simple random method from among the employees of the petrochemical industry. Then they will be divided into intervention and control groups. The instruments of this research include a demographic questionnaire, a researcher-made questionnaire for measuring behavior, and two auxiliary instruments including the visual analog scale (VAS) and the Quebec Disability Scale. Evaluation is done in 4 stages: pre-test, immediately, 3, and 6 months after the intervention of both groups. The obtained data will be analyzed using SPSS software.

Discussion: Musculoskeletal disorders related (WMSDs) to work can harm employees' health in various industries, including the petrochemical industry. This study attempts to evaluate the behavioral risk of work-related musculoskeletal disorders among petrochemical industry workers and design and implement an appropriate educational intervention program.

Trial registration: Iranian Registry of Clinical Trial (IRCT20240321061346N1). Registered on 2024-04-10. Ethics Status: Ethics code: IR.MODARES. REC.1402.251.

Authors: Zohreh Moradi, Sedigheh Sadat Tavafian, Fazlollah Ahmadi, Omran Ahmadi
Full Source: Trials 2024 Nov 23;25(1):790. doi: 10.1186/s13063-024-08622-8.