

# Bulletin Board

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## CHEMICAL EFFECTS

**Micron-size tire tread particles leach organic compounds at higher rates than centimeter-size particles: Compound identification and profile comparison**

2023-06-30

Tire tread particles (TTP) are environmentally prevalent microplastics and generate toxic aqueous leachate. We determined the total carbon and nitrogen leachate concentrations and chemical profiles from micron (32 μm) and centimeter (1 cm) TTP leachate over 12 days. Dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) were used to measure the concentration of leached compounds. Nontargeted chemical analysis by comprehensive two-dimensional gas chromatography coupled to time-of-flight mass spectrometry (GC × GC/TOF-MS) was used to compare the chemical profiles of leachates. After leaching for 12 days, DOC was 4.0 times higher in the micron TTP leachate than in the centimeter TTP leachate, and TDN was 2.6 times higher. The total GC × GC/TOF-MS chromatographic feature peak area was 2.9 times greater in the micron TTP leachate than the centimeter TTP leachate, and similarly, the total relative abundance of 54 tentatively identified compounds was 3.3 times greater. We identified frequently measured tire-related chemicals, such as 6PPD, N-cyclohexyl-N'-phenylurea (CPU), and hexa(methoxymethyl) melamine (HMMM), but nearly 50% of detected chemical were not previously reported in tire literature or lacked toxicity information. Overall, the results demonstrate that smaller TTP have a greater potential to leach chemicals into aquatic systems, but a significant portion of these chemicals are not well-studied and require further risk assessment.

Authors: M E Stack, K Hollman, N Mladenov, B Harper, F Pinongcos, K E Sant, C M Rochman, W Richardot, N G Dodder, E Hoh

Full Source: Environmental pollution (Barking, Essex: 1987) 2023 Jun 30;122116. doi: 10.1016/j.envpol.2023.122116.

**Source apportionment of heavy metal(loid)s in sediments of a typical karst mountain drinking-water reservoir and the associated risk assessment based on chemical speciations**

2023-07-02

As important place for water storage and supply, drinking-water reservoirs in karst mountain areas play a key role in ensuring human well-being, and its water quality safety has attracted much attention. Source apportionment and ecological risks of heavy metal(loid)s in

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sediments of drinking-water reservoir are important for water security, public health, and regional water resources management, especially in karst mountain areas where water resources are scarce. To expound the accumulation, potential ecological risks, and sources of heavy metal(loid)s in a drinking-water reservoir in Northwest Guizhou, China, the surface sediments were collected and analyzed based on the combined use of the geo-accumulation index (Igeo), sequential extraction (BCR), ratios of secondary phase and primary phase (RSP), risk assessment code (RAC), modified potential ecological risk index (MRI), as well as the positive matrix factorization methods. The results indicated that the accumulation of Cd in sediments was obvious, with approximately 61.9% of the samples showing moderate to high accumulation levels, followed by Pb, Cu, Ni, and Zn, whereas the As and Cr were at low levels. A large proportion of BCR-extracted acid extractable and reducible fraction were found in Cd (72.5%) and Pb (40.3%), suggesting high bioavailability. The combined results of RSP, RAC, and MRI showed that Cd was the major pollutant in sediments with high potential ecological risk, while the risk of other elements was low. Source apportionment results of heavy metal(loid)s indicated that Cd (75.76%) and Zn (23.1%) mainly originated from agricultural activities; As (69.82%), Cr (50.05%), Cu (33.47%), and Ni (31.87%) were associated with domestic sources related to residents' lives; Cu (52.36%), Ni (44.57%), Cr (34.33%), As (26.51%), Pb (24.77%), and Zn (23.80%) primarily came from natural geological sources; and Pb (47.56%), Zn (22.46%) and Cr (13.92%) might be introduced by mixed sources of traffic and domestic. The contribution ratios of the four sources were 18.41%, 36.67%, 29.48%, and 15.44%, respectively. Overall, priority control factors for pollution in relation to agricultural sources included Cd, while domestic sources are primarily associated with As. It is crucial to place special emphasis on the impacts of human activities when formulating pollution prevention and control measures. The results of this study can provide valuable reference and insights for water resources management and pollution prevention and control strategies in karst mountainous areas.

Authors: Xue Chen, Pan Wu, Xue Chen, Hongyan Liu, Xuexian Li

Full Source: Environmental geochemistry and health 2023 Jul 2. doi: 10.1007/s10653-023-01676-8.

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## ENVIRONMENTAL RESEARCH

## The dark side of artificial greening: Plastic turfs as widespread pollutants of aquatic environments

2023-06-09

Artificial turf (AT) is a surfacing material that simulates natural grass by using synthetic, mainly plastic, fibers in different shapes, sizes and properties. AT has spread beyond sports facilities and today shapes many urban landscapes, from private lawns to rooftops and public venues. Despite concerns regarding the impacts of AT, little is known about the release of AT fibers into natural environment. Here, for the first time, we specifically investigate the presence of AT fibers in river and ocean waters as major conduits and final destination of plastic debris transported by water runoff. Our sampling survey showed that, AT fibers - composed mainly of polyethylene and polypropylene - can constitute over 15% of the mesoplastics and macroplastics content, suggesting that AT fibers may contribute significantly to plastic pollution. Up to 20,000 fibers a day flowed down through the river, and up to 213,200 fibers per km<sup>2</sup> were found floating on the sea surface of nearshore areas. AT, apart from impacting on urban biodiversity, urban runoff, heat island formation, and hazardous chemical leaching, is a major source of plastic pollution to natural aquatic environments.

Authors: William P de Haan, Rocío Quintana, César Vilas, Andrés Cózar, Miquel Canals, Oriol Uviedo, Anna Sanchez-Vidal  
Full Source: Environmental pollution (Barking, Essex: 1987) 2023 Jun 29;122094. doi: 10.1016/j.envpol.2023.122094.

## Electrochemical oxidation technique to pharmaceutical pollutants removal

2023-06-28

Human progress in medical science and drug production has improved the growth process and increased human lifespan. Most of the drugs used are to control or prevent common human diseases. These drugs can be produced in different ways such as synthetic, chemical, biological, etc. On the other hand, pharmaceutical companies have a large volume of pharmaceutical effluents and wastewater that enters the environment and harms nature and human life. The main problems of entering the pharmaceutical effluent into the environmental cycle are the creation of drug resistance against the active substance of the drugs and the occurrence of abnormalities in the next generations. Therefore, the

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process of pharmaceutical wastewater treatment is used to reduce the level of pharmaceutical pollutants in order to enter the pharmaceutical wastewater into the environmental cycle. Until recently, filtration, passing through reverse osmosis and ion exchange resins, cleaning facilities, etc., have been various methods to remove pharmaceutical pollutants. Due to the low efficiency of the usual and old systems, the use of new methods has attracted more attention. In this article, the aim is to investigate the electrochemical oxidation method in order to remove the active ingredient of some commonly used drugs (aspirin, atorvastatin, metformin, metronidazole and ibuprofen) from the wastewater of pharmaceuticals. Therefore, in order to observe the initial conditions of the samples, a cyclic voltammetry diagram with a scanning rate of 100 mV/s has been performed. Next, by using the chronoamperometry process and applying a constant potential, the desired drugs were subjected to the electrochemical process of oxidation. As a result, the re-examined samples were subjected to cyclic voltammetry test to determine the conditions of sample oxidation peaks as well as the removal efficiency of the samples by examining the surface under the initial and final voltammetry graph. The results indicate that this method for removing selected drugs has a high removal efficiency of about 70% and 100% for atorvastatin samples. Therefore, this method is accurate, reproducible (RSD 2%), efficient, easy and economical and can be used in drug manufacturing industries. This method is used in a wide range of drug concentration. This means that by increasing the concentration of the drug, without the need to change the equipment used and the applied potential, by spending more time in the oxidation process, it is possible to remove very high amounts of the drug (more than 1000 ppm).

Authors: Chunying Wu, Ji Ge, Feng Gu, Lu Bai

Full Source: Chemosphere 2023 Jun 28;139373. doi: 10.1016/j.chemosphere.2023.139373.

## Advances in the application of metallic isotopes to the identification of contaminant sources in environmental geochemistry

2023-06-22

The development of the economy and society makes heavy metals (HMs) pollution more and more serious. And, pollution source identification is the primary work of environmental pollution control and land planning. Notably, stable isotope technology has a high ability to distinguish pollution sources, and can better reflect the migration behavior and contribution of HMs from diverse sources, which has become a hot

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research tool for pollution source identification of HMs. Currently, the rapid development of isotope analysis technology provides a relatively reliable reference for pollution tracking. Based on this background, the fractionation mechanism of stable isotopes and the influence of environmental processes on isotope fractionation are reviewed. Furthermore, the processes and requirements for the measurement of metal stable isotope ratios are summarized, and the calibration methods and detection accuracy of sample measurement are evaluated. Besides, the current commonly used binary model and multi-mixed models in the identification of contaminant sources are also concluded. Moreover, the isotopic changes of different metallic elements under natural and anthropogenic conditions are discussed in detail, and the application prospects of multi-isotope coupling in the traceability of environmental geochemistry are evaluated. This work has some guidance for the application of stable isotopes in the source identification of environmental pollution.

Authors: Peng Wang, Jian Hu, Tingyi Liu, Jinke Liu, Shunrong Ma, Wenmin Ma, Jun Li, Houyi Zheng, Ran Lu  
Full Source: Journal of hazardous materials 2023 Jun 22;458:131913. doi: 10.1016/j.jhazmat.2023.131913.

## PHARMACEUTICAL/TOXICOLOGY

## One-step simultaneous biomass synthesis of iron nanoparticles using tea extracts for the removal of metal(loid)s in acid mine drainage

2023-06-28

Acid Mine Drainage (AMD) contains various metal/metalloid ions such as Fe, Cu, and As, which all impact seriously on mine ecosystems. Currently, the commonly used chemical methods for treating AMD may cause secondary pollution to appear in the environment. In this study, one-step simultaneous biomass synthesis of iron nanoparticles (Fe NPs) using tea extracts for the removal of heavy metals/metalloids in AMD is proposed. Characterizations revealed that the Fe NPs presented severely agglomerated particles with an average particle size of  $119.80 \pm 4.94$  nm, on which various AMD-derived metal(loid)s, including As, Cu, and Ni, were uniformly dispersed. The biomolecules participating in the reaction in the tea extract were identified as polyphenols, organic acids, and sugars, which acted as complexing agents, reducing agents, covering/stabilizing agents, and promoted electron transfer. Meanwhile, the best

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reaction conditions (reaction time = 3.0 h, volume ratio of AMD and tea extract = 1.0:1.5, concentration of extract = 60 g/L, and T = 303 K) were obtained. Finally, the simultaneous formation of Fe NPs and their removal of heavy metals/metalloids from AMD was proposed, mainly involving the formation of Fe NPs and adsorption, co-precipitation, and reduction processes of heavy metals/metalloids.

Authors: Zibin Pan, Rongrong Xie, Zuliang Chen  
Full Source: Chemosphere 2023 Jun 28;139366. doi: 10.1016/j.chemosphere.2023.139366.

## Are nanoplastics potentially toxic for plants and rhizobiota? Current knowledge and recommendations

2023-06-229

Soil is now becoming a reservoir of plastics in response to global production, use/disposal patterns and low recovery rates. Their degradation is caused by numerous processes, and this degradation leads to the formation and release of plastic nanoparticles, i.e., nanoplastics. The occurrence of nanoplastics in the soil is expected to both directly and indirectly impact its properties and functioning. Nanoplastics may directly impact the physiology and development of living organisms, especially plants, e.g., by modifying their production yield. Nanoplastics can also indirectly modify the physicochemical properties of the soil and, as a result, favour the release of related contaminants (organic or inorganic) and have an impact on soil biota, and therefore have a negative effect on the functioning of rhizospheres. However, all these results have to be taken carefully since performed with polymer nanobead not representative of the nanoplastics observed in the environment. This review highlights thus the current knowledge on the interactions between plants, rhizosphere and nanoplastics, their consequences on plant physiology and development in order to identify gaps and propose scientific recommendations.

Authors: Delphine Masson, Mathieu Pédrot, Mélanie Davranche, Francisco Cabello-Hurtado, Nataliia Ryzhenko, Abdelhak El Amrani, Aurélie Wahl, Julien Gigault  
Full Source: NanoImpact 2023 Jun 29;100473. doi: 10.1016/j.impact.2023.100473.

Soil is now becoming a reservoir of plastics in response to global production, use/disposal patterns and low recovery rates.

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### Summer and winter variations of BTEX concentrations in an oil refinery complex and health risk assessment based on Monte-Carlo simulations

2023-07-01

The summer and winter concentrations of BTEX pollutants were investigated in various workplaces of an oil Refinery, Iran. In total 252 air samples from the breathing zones of the following employees were collected: supervisors, safety men, repairmen, site men, and all workers. Carcinogenic and non-carcinogenic risk values were calculated based on the USEPA methodology using Monte Carlo simulations. BTEX concentrations were higher in the summer than in the winter season for all workstations, especially for toluene and ethylbenzene. The mean values of exposure to benzene for repairmen and site men were higher than threshold limit value of 1.60 mg/m<sup>3</sup> for both seasons. Non-carcinogenic risk (HQ) values calculated for summer season for benzene, ethylbenzene, and xylene in all workstations, as well as for toluene for repairmen and site men exceeded acceptable level of 1. In winter season the mean HQ values for benzene and xylene in all workstations, for toluene for repairmen and site men, and for ethylbenzene for supervisors, repairmen, and site men were also > 1. For all workstations definite carcinogenic risk was indicated as calculated LCR values for benzene and ethylbenzene exposure were higher than 1 × 10<sup>-4</sup> in both summer and winter seasons.

Authors: Amir Hossein Khoshakhlagh, Saeid Yazdanirad, Mahdi Mousavi, Agnieszka Gruszecka-Kosowska, Mehran Shahriyari, Hassan Rajabi-Vardanjani

Full Source: Scientific reports 2023 Jul 1;13(1):10670. doi: 10.1038/s41598-023-37647-3.

The summer and winter concentrations of BTEX pollutants were investigated in various workplaces of an oil Refinery, Iran.

## OCCUPATIONAL

### Comparison of bioaerosol release characteristics between windrow and trough sludge composting plants: Concentration distribution, community evolution, aerosolization behaviour, and exposure risk

2023-06-29

Windrow and trough composting are two mainstream composting methods, but the effect of composting methods on bioaerosol release from sludge composting plants is unclear. In this study, the bioaerosol concentration release characteristics and exposure risks were compared

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between the two composting methods. The results showed that the bacterial aerosol concentrations in the windrow composting plant ranged from 14,196 to 24,549 CFU/m<sup>3</sup>, while the fungal aerosol concentrations in the trough composting plant reached 5874 to 9284 CFU/m<sup>3</sup>; there were differences in the microbial community structures between the two sludge composting plants, and the composting method had a greater effect on bacterial community evolution than on fungal community evolution. The biochemical phase was the primary emission source of the bioaerosolization behaviour of the microbial bioaerosols. In the windrow and trough composting plants, the bacterial bioaerosolization index ranged from 1.00 to 999.28 and from 1.44 to 24.57, and the fungal bioaerosolization index ranged from 1.38 to 1.59 and 0.34 to 7.72, respectively. The same microbial aerosolization distribution behaviour was observed in the two sludge composting plants; bacteria preferentially aerosolized mainly in the mesophilic phase, while the peak of the fungal bioaerosolization index occurred in the thermophilic phase. The total non-carcinogenic risks for bacterial aerosols were 3.4 and 2.4, while those for fungi were 1.0 and 3.2 in the trough sludge composting plant and windrow sludge composting plant, respectively. Respiration is the main exposure pathway for bioaerosols. Therefore, it is necessary to develop different bioaerosol protection measures for sludge composting facilities with different composting methods. The results of this study provided basic data and theoretical guidance for reducing the potential risk of bioaerosols in sludge composting plants.

Authors: Jianwei Liu, Xinyu Ai, Chen Lu, Hongyu Tian

Full Source: The Science of the total environment 2023 Jun 29;164925. doi: 10.1016/j.scitotenv.2023.164925.

Background: Occupational noise exposure is a significant health problem.

### Investigating the effect of workplace noise exposure on cardiovascular disease risk factors in a power plant: A case-control study

2023-06-24

Background: Occupational noise exposure is a significant health problem. In addition to hearing impairments, noise as a stressor may cause cardiovascular problems.

Objective: This study aimed to investigate the effect of exposure to workplace noise on cardiovascular disease risk factors.

Methods: This case-control study was conducted in 2021 in a power plant in Iran. In this study, the health status of 406 employees in both exposed (n = 203) and non-exposed (n = 203) to noise groups was examined for cardiovascular disease risk factors. Also, the trend of changes in the

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studied variables from 2012 to 2020 in exposed employees was examined. Data were collected from participants' annual physical examinations and occupational noise exposure measurements. To measure the noise in the present study, the KIMO-DB300 noise level meter was used. Data were analyzed in SPSS-26 software.

**Results:** The results revealed that mean fasting blood sugar (FBS), triglyceride, liver enzyme (SGOT), blood pressure, and body mass index were significantly different in the two groups ( $p$ -value $<0.05$ ). There was no significant difference in the mean of creatinine, cholesterol, and liver enzyme (SGPT) between the two groups ( $p$ -value $>0.05$ ). In the exposed group, the mean of all studied variables except diastolic blood pressure was statistically different during the study years ( $p$ -value $<0.05$ ).

**Conclusion:** This study demonstrates that exposure to noise above the permissible level can affect the cardiovascular disease risk factors, so it is recommended to apply engineering and management measures like using Hearing Conservation Programme (HCP) to reduce the risk of these diseases with periodically assessing the health status of employees and timely diagnosis.

**Authors:** Mostafa Mohammad-Ghasemi, Sedighe Dehghani-Bidgoli, Thelma Ahmadi, Neda Nikbakht, Shima Heidarifar, Mohsen Sadeghi-Yarandi

**Full Source:** Work (Reading, Mass.) 2023 Jun 24. doi: 10.3233/WOR-220396.