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Peer-reviewed Journal Articles

DNR

Arsenic interaction with microplastics: Implications for soil-water-food nexus

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Abstract

Microplastics (MPs) interact with toxic trace elements available in the surrounding environment (water and soil). This review is focused on the possible impacts of As-bound MPs on soil, water, and food nexus. Arsenic sorption capacities of polystyrene and polytetrafluoroethylene MPs were 1.12 mg/g and 1.05 mg/g respectively. Sorption capacities depend on MPs size, surface properties, acidity or basicity of surrounding water or soil, temperature, and the presence or absence of organic matter. Arsenic bioavailability in soil, water, and inside organisms changed when present with MPs. Co-existence of MPs and As negatively influences plant growth, photosynthesis rate, and seed germination. However, the presence of both MPs and As has been found to decrease the intake of As by rice seedlings owing to the competition between MPs and As for adsorption sites on roots. Furthermore, the existence of both MPs and As shifts the bacterial community succession pattern via the enrichment of some microbes (*Proteobacteria* and *Bacteroidetes*), and inhibition of certain species (*Chloroflexi* and *Verrucomicrobia*), however, the exact mechanisms are not known yet. Although research on the combined impact of As and MPs is limited, the addition of MPs to the As contaminated environment may amplify the adverse impact of As on the soil and water food nexus. Hence, more attention should be given to understanding the As impact on soil and aquatic food nexus in presence of MPs for developing feasible solutions to resolve toxicity issues related to the co-occurrence of MPs and As.

About the Journal

Current Opinion in Environmental Science & Health

Impact Factor – 15.3

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DPST

Progress and Perspective toward Continuous-Wave Organic Solid-State Lasers

Xun Tang, Chathuranganie A. M. Senevirathne, Toshinori Matsushima, Atula S. D. Sandanayaka, Chihaya Adachi

Abstract

A continuous-wave (CW) organic solid-state laser is highly desirable for spectroscopy, sensing, and communications, but is a significant challenge in optoelectronics. The accumulation of long-lived triplet excitons and relevant excited-state absorptions, as well as singlet–triplet annihilation, are the main obstacles to CW lasing. Here, progress in singlet- and triplet-state utilizations in organic gain media is reviewed to reveal the issues in working with triplets. Then, exciton behaviors that inhibit light oscillations during long excitation pulses are discussed. Further, recent advances in increasing organic lasing pulse widths from microseconds toward the indication of CW operation are summarized with respect to molecular designs, advanced resonator architectures, triplet scavenging, and potential triplet contribution strategies. Finally, future directions and perspectives are proposed for achieving stable CW organic lasers with significant triplet contribution.

About the Journal

Advanced Materials

Impact Factor – 32.086

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Polymer-free gel electrolyte and its application in TiO_2-based electrochromic devices

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Abstract

Electrochromic devices based on polymer-free gel electrolytes (PFGEs) offer several advantages over polymer electrolytes. The preparation and characterization of a novel fumed silica-based PFGE and its applications in TiO_2 electrochromic devices (ECD) were the main aims of the present study. First, a series of liquid electrolytes were prepared by mixing lithium chloride (LiCl) and ethylene Glycol (EG) with different molar ratios and their ionic conductivities were measured to get an idea about the highest ionic conductivity composition. The total oxygen atoms of EG to lithium ions of LiCl molar ratio ($O:Li^+$) was altered from 5:1 to 80:1. The highest ionic conductivity was observed for 15: 1 molar ratio with the value being the 1.28×10^{-2} S cm^{-1}. This optimized composition was selected for preparing PFGE. In order to prepare PFGE, 10 wt% of fumed silica from the total weight of EG and LiCl were added to the optimized liquid electrolyte EG/LiCl as the polymer-free gelling agent. The maximum ionic conductivity was found in O:Li = 10: 1, with the value being 8.94×10^{-3} S cm^{-1}. ECDs were prepared by sandwiching this PFGE between TiO_2 electrochromic electrode and fluorine-doped tin oxide (FTO) counter-electrode with the configuration of FTO/TiO_2/PFGE/FTO. Notable electrochromic properties of TiO_2-coated FTO with higher optical modulation of 64% at 700 nm and 33% at 550 nm by applying 4.2 V and a switching speed of Tbleaching= 42.5 s and Tcoloring= 16.7 s were observed.

About the Journal

Journal of Applied Electrochemistry

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Book Chapters

DNR & DPST

Microplastics and Soil Nutrient Cycling

Madhuni Wijesooriya, Hasintha Wijesekara, Madushika Sewwandi, Sasimali Soysa, Anushka Upamali Rajapaksha, Meththika Vithanage, Nanthi Bolan

Abstract

In recent decades, microplastic contamination in the terrestrial environment has become an emerging environmental issue. Microplastic accumulation in terrestrial environments occurs through composting, mulching, irrigation water, biosolids application, and atmospheric fallout; microplastics are likely to interact with soil nutrients, influencing their biogeochemical cycling. The carbon, nitrogen, and phosphorous cycles are affected by microplastics-microbe interactions through the leaching of dissolved organic carbon and altered denitrification. The presence of microplastics in soil negatively affects its structural and functional aspects. Microplastics can decrease soil microbial enzyme activity, coding genes, microbial biomass carbon, and microbial carbon use efficiency, thereby indirectly affecting soil nutrient cycling. However, limited background knowledge is available on the influence of microplastics in soil nutrient cycling. This chapter focuses on factors affecting nutrient cycling in microplastic-contaminated soil. It also highlights the influence of microplastics on the redistribution of micronutrients and trace elements in soil and provides suggestions for future studies.

About the Book

Microplastics in the Ecosphere

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