Combating "Forever Chemicals": Efficient PFAS Removal via Microbially Enhanced Biochar Sorption

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Per- and polyfluoroalkyl substances (PFAS) are a class of environmentally persistent contaminants widely detected in soil and water systems and associated with adverse human health effects. Certain microbes have demonstrated the ability to incorporate short- and intermediate-chain PFAS into their lipid bilayer, and biochar's high porosity and abundance in polar functional groups make it a favorable environment for microbial proliferation. The extent to which microbial association can enhance the sorptive limitations of biochar for these transformation products remains unknown. Batch sorption experiments were designed to compare sterile biochar systems with biochar combined with Pseudomonas sp. strain 273. Biochar is incubated with bacterial cultures to allow microbial association, and known concentrations of 7:3 FTCA were then introduced to each static system. Following incubation, liquid samples were collected for quantitative analysis of residual 7:3 FTCA concentrations. Here we showed that Pseudomonas sp strain. 273 enhances the sorption capabilities of biochar. Inoculated biochar achieved an adsorption capacity of 0.012 mg 7:3 FTCA per gram, a 65% increase over sterile biochar (0.0066 mg/g). This study demonstrated that incorporation of PFAS into bacterial cellular membranes may alter PFAS partitioning behavior and increase association with biochar surfaces. By integrating biological and adsorptive processes, this experiment addresses a key limitation of biochar-based remediation and provides a low-cost combined strategy for improving removal of PFAS in environmental treatment systems.

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