[Poster presentation]

Synergistic Effects of Mixing Activated Carbon on PFAS Adsorption

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ABSTRACT

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Contents

Per- and polyfluoroalkyl substances (PFASs) have been widely used across various industries due to their thermal and chemical stability. However, their resistance to degradation has led to their continuous accumulation in aquatic environments. Activated carbon (AC) is considered a practical alternative for removing PFAS. Nevertheless, coal-based activated carbon has been designated as a subject to emergency supply control, highlighting the need for the development and alternative of the materials. The key properties of PFAS adsorption using AC include electrostatic interactions, pore distribution, and surface areas. When it comes to PFAS, chain length, hydrophobicity, and functional groups are the primary factors affecting adsorption. In this study, different types of activated carbon were mixed to enhance the removal of short-chain PFASs. The initial concentration was set to 250 ng/L for each compound, reflecting the maximum concentration of individual PFAS in rivers. Three types of activated carbon—coal, coconut, and bamboo—were applied at dosage of 40 mg/L, with sufficient time of 24 hours. Binary mixtures of activated carbons (coal–coconut, coconut–bamboo, coal–bamboo) were evaluated at ratios of 1:4, 1:2, 1:1, 2:1, 4:1. Bamboo-based AC exhibited low removal efficiency about 50% for short-chains, due to strong electrostatic repulsion from its high negative zeta potential (–69.01 mV). Coconut-based AC, with a high surface area, showed PFAS removal above 85% for most PFASs. Coal-based AC demonstrated the highest adsorption capacity dominating the adsorption capacity when mixed. When only bamboo and coconut-based ACs were combined, the 1:2 ratio showed the best performance, achieving an adsorption capacity of 5.7–5.8 μg/g, comparable to that of coconut AC alone. Considering the rising demand and price of coconut AC as a substitute for coal-based AC, the combined use of bamboo and coconut AC offers a promising strategy. This approach can reduce unit costs of activated carbon and contribute to lowering operational expenses in water treatment plants.

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