

Special Issue

Advances in Biochar-Mediated Nitrogen and Phosphorus Removal from Water

Message from the Guest Editor

Biochar, a carbon-rich material derived from biomass pyrolysis, has emerged as a multifunctional agent for addressing nitrogen and phosphorus pollution in aquatic systems. This Special Issue synthesizes cutting-edge research on biochar-mediated N/P removal mechanisms, focusing on its dual role as an adsorbent, catalyst, and microbial habitat enhancer. Recent studies highlight biochar's capacity to immobilize ammonium and nitrate through electrostatic interactions, surface complexation, and pore confinement, while simultaneously trapping phosphate via ligand exchange and precipitation with embedded metal oxides.

Engineered biochars or modified biochars demonstrate enhanced selectivity and kinetics for nutrient recovery. Critically, biochar fosters microbial denitrification and dissimilatory nitrate reduction by serving as an electron shuttle or donor, significantly suppressing N_2O emissions. Synergistic coupling with phytoremediation or constructed wetlands further amplifies nutrient uptake efficiency in wastewater. This issue also explores lifecycle assessments analyses to evaluate the sustainability of biochar-based systems across water treatment.

Guest Editor

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Deadline for manuscript submissions

10 December 2025



Separations

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Impact Factor 2.7
CiteScore 4.5



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