Hydrothermally Carbonised Biomass: Applications to Water Decontamination

Najma Memon

National Centre of Excellence in Analytical Chemistry, University of Sindh, Jamshoro, Pakistan.

* Corresponding author E-mail: najma.memon@usindh.edu.pk

Thematic Area: Applications of agricultural biomass/waste materials in the remediation of environmental pollutants

Abstract

Hydrothermally carbonised (HTC) biomass has emerged as a sustainable and versatile material for addressing the global water crisis through effective decontamination. Derived from agro-wastes and organic residues, HTC biomass possesses unique physicochemical properties including high porosity, tunable surface functionality, and chemical stability, making it ideal for adsorption-based purification. This work underscores the transformation of natural and waste biomass into functional carbonaceous adsorbents—particularly sawdust, keratin, and cellulose—enhanced via thermal and chemical modification. These materials demonstrate exceptional performance in removing heavy metals (e.g., cadmium, chromium, thallium), pharmaceutical residues, and synthetic dyes from aqueous media. Optimized through techniques like response surface methodology (RSM) and functional group engineering, HTC-derived sorbents not only offer high adsorption capacities but also support circular economy principles by repurposing industrial by-products. This work involves integration of green chemistry with waste valorisation, making HTC biomass a promising frontier for scalable and eco-efficient water treatment technologies.

Keywords: Hydrothermal carbonization, Sustainable water purification, Carbonaceous adsorbents from waste, Agro-waste derived sorbents, Green chemistry in wastewater treatment

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