SYNTHESIS AND CHARACTERIZATION OF KAOLIN-BIOCHAR COMPOSITES FROM AGRICULTURAL WASTE FOR ENVIRONMENTAL REMEDIATION

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Abstract

The rising demand for environmentally friendly and economically viable adsorbents has increased interest in the valorization of waste-derived materials. A low-cost kaolin-biochar composite adsorbent was successfully developed by distributing clay particles on the carbon surfaces within the biochar matrix. Two locally sourced agricultural residues were pretreated with wet-beneficiated kaolin suspensions and subsequently pyrolyzed at 500 and 600°C for 2 hours under a nitrogen atmosphere. Scanning Electron Microscopy (SEM), FTIR, and XRD analyses confirmed the successful incorporation and uniform distribution of clay particles within the biochar matrix. XRD results further indicated that the purity of kaolin increased from 55% to 87%, while its surface area increased by over 200% following wet beneficiation. Modified clay-biochar composites showed higher surface area, proximate, and ultimate characteristics compared to unmodified biochar. The findings indicate that modified biochar prepared from clay and biochar is a promising adsorbent with significant potential for the removal of heavy metals from aqueous solutions.

Keywords: Kaolin, biomass, clay-biochar composite, pyrolysis, circular economy.