ENHANCED REMOVAL OF ANTIBIOTICS FROM WASTEWATER USING ACTIVATED HEMP SEED SHELL ACTIVE CARBON: A SUSTAINABLE APPROACH TO WATER PURIFICATION

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Abstract

This study examines the potential of hemp seed shell active carbon as an innovative solution for removing antibiotics from contaminated water sources. The process involved the thermal conversion of hemp seed shell waste into biochar, followed by its activation to enhance porosity and surface functionality suitable for adsorption applications. The biochar was produced through a controlled pyrolysis process, which optimized the yield and quality of the carbon-rich product. Subsequent chemical activation using phosphoric acid (H_3PO_4) and heat treatment was employed to increase the biochar's surface area and introduce functional groups that facilitate the adsorption of antibiotic molecules. Comprehensive characterization of the activated carbon was conducted using Scanning Electron Microscopy (SEM) to visualize the surface morphology and Brunauer-Emmett-Teller (BET) analysis to quantify the surface area and pore volume. These analyses confirmed the creation of a predominantly microporous structure, which is ideal for the adsorption of small molecular contaminants such as antibiotics. The efficacy of the hemp seed shell active carbon in removing various antibiotics was evaluated through batch adsorption experiments. These experiments targeted common antibiotics found in wastewater, such as tetracycline and sulfonamide. The results showed a significant reduction in antibiotic concentration, demonstrating the active carbon's capability as an effective adsorbent. The transformation of hemp seed shell waste into a functional biochar aligns with sustainable waste management practices and contributes to environmental preservation by addressing the pressing issue of antibiotic contamination in water bodies. This study highlights the role of agricultural waste active carbon in water treatment applications and supports the adoption of green technologies in pollution control.

These findings advocate for broader research into the utilization of different agricultural waste materials for environmental remediation purposes, offering a path towards sustainable management of both agricultural waste and water pollution.

Keywords: *Hemp seed shell, biochar, antibiotics removal, water purification, active carbon.*