CHARACTERIZATION OF COCKLE SHELLS DERIVED CHITOSAN MODIFIED WITH KAPOK BIOCHAR

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ABSTRACT

CHARACTERIZATION OF COCKLE SHELLS DERIVED CHITOSAN MODIFIED WITH KAPOK BIOCHAR

This research aim to extract and characterize chitosan from cockle shells (CS) and modify it with kapok biochar (BC) to enhance its physicochemical properties. The physicochemical properties of chitosan derived from cockle shells have not been thoroughly explored. Furthermore, while kapok biochar possesses a high surface area, its integration with chitosan has been limited, despite the recognized effectiveness of chitosan-biochar composites in environmental applications. Chitosan was extracted via deproteinization, demineralization, and deacetylation, while biochar was produced through pyrolysis. The resulting chitosan-biochar composite (CSBC) was characterized using Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffractometry (XRD), Scanning Electron Microscopy with Energy Dispersive X-ray Analysis (SEM-EDX), CHNS elemental analysis, and proximate analysis. Chitosan extraction yielded 45.3% with a degree of deacetylation (DDA) of 95.66%, while biochar production from kapok fiber yielded 20%. Proximate analysis showed that the chitosan-biochar composite (CSBC) had a fixed carbon content of 35.51%, higher than CS (23.89%) and BC (19.14%), indicating improved carbon retention. Fourier Transform Infrared Spectroscopy (FTIR) confirmed the successful incorporation of biochar, with shifts in O–H, N–H, and C–H stretching bands. X-ray Diffractometry (XRD) analysis revealed reduced crystallinity in CSBC, while Scanning Electron Microscopy with Energy Dispersive X-ray Analysis (SEM-EDX) showed a uniform structure with high carbon content (73.56%), though sodium contamination (1.52%) was detected. CHNS elemental analysis showed anomalies in carbon (144.28%) and hydrogen (5.21%) content, suggesting possible experimental errors. These findings indicate that CSBC possesses enhanced adsorption potential and improved physicochemical properties, making it a promising material for environmental remediation. However, further optimization is necessary to address residual contaminants and ensure reproducibility for real-world applications.