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SUSTAINABLE CARBON-BASED ADSORBENT FOR TEXTILE DYE REMOVAL: VALORIZATION OF COCOA HUSK WASTE

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The extensive use of synthetic dyes in the textile industry represents a major environmental concern. These compounds are often toxic, resistant to biodegradation, and capable of persisting in aquatic ecosystems, where they reduce light penetration, disrupt microbial balance, and may accumulate in the food chain. Developing effective and sustainable wastewater treatment technologies is therefore an urgent scientific and engineering challenge.

A promising strategy involves the design of efficient sorbents derived from inexpensive and readily available raw materials. Natural products are particularly attractive due to their biodegradability, environmental compatibility, and low cost. In this study, a carbon-based material was synthesized via thermochemical treatment of cocoa husks. Its morphological and surface characteristics were analyzed using BET, SEM-EDS, and Raman spectroscopy. SEM images revealed a heterogeneous surface with irregularly distributed pores, resulting from thermochemical activation, while Raman spectra indicated a high degree of oxidation and an amorphous structure.

The obtained carbon sorbent exhibited a well-developed porous network dominated by mesopores and a high specific surface area (1661 m^2/g, determined by the BET method). Importantly, adsorption experiments demonstrated its high efficiency toward reactive dyes, achieving over 90% removal of Drimaren Red from contaminated water. These results highlight the material's strong potential as an eco-friendly adsorbent for wastewater purification and its applicability in the remediation of dye-polluted effluents from the textile industry.

Keywords: *textile dyes, Drimaren Red, activated carbon; cocoa husks, adsorption, wastewater treatment*

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