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Characterisation of *Pometia Pinnata* Seed Carbon at Different Pyrolysis Temperatures for Removal of Methylene Blue

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CHARACTERISATION OF POMETIA PINNATA SEED CARBON AT DIFFERENT PYROLYSIS TEMPERATURES FOR REMOVAL OF METHYLENE BLUE

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ABSTRACT

CHARACTERISATION OF POMETIA PINNATA SEED BIOCHAR AT DIFFERENT PYROLYSIS TEMPERATURES FOR REMOVAL OF METHYLENE BLUE

The discharge of dye-containing wastewater from industrial activities poses a serious threat to water quality and aquatic ecosystems. Among synthetic dyes, Methylene Blue (MB) is widely used due to its strong color and chemical stability, yet it is resistant to conventional wastewater treatment processes. Therefore, it is necessary to explore the possibility of using a more inexpensive and sustainable method for the removal of the dye through some form of biosorption. In this study, biochar derived from *Pometia pinnata* seeds was prepared via pyrolysis at 350 °C and 400 °C to evaluate its potential for Methylene Blue removal from aqueous solution. The influence of pyrolysis temperature on biochar characteristics was investigated using Field Emission Scanning Electron Microscopy (FESEM), Fourier Transform Infrared Spectroscopy (FTIR), and Brunauer–Emmett–Teller (BET) surface area analysis. Batch adsorption experiments were conducted to assess the adsorption performance of the produced biochar. The characterisation results demonstrated that increasing pyrolysis temperature led to changes in surface morphology, a reduction in oxygen-containing functional groups, and enhanced aromaticity, which are known to influence adsorption behaviour. Adsorption studies indicated that biochar produced at higher pyrolysis temperature exhibited improved removal efficiency for Methylene Blue. The findings suggest that *Pometia pinnata* seed-derived biochar has potential as a low-cost adsorbent for dye removal, while also contributing to the valorisation of agricultural waste.

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