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MARA

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TITLE:

Parametric Study on Magnetic Iron Tea Waste Adsorbent for
Malachite Green Removal: Impact of Dye Concentration

SUPERVISOR:

MOHD SHAHRUL NIZAM SALLEH
NORTHAQIFAH HASNA MOHAMMED KHIR

**SCHOOL OF CHEMICAL ENGINEERING
COLLEGE OF ENGINEERING**

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AUTHOR'S DECLARATION

“ I hereby declare that this report is the resof my own work except for quotations and summaries which have been duly acknowledged.”

Name of Student : Amirul Ammar Bin Rosmini

Student I.D. No. : 2022857832

Programme : Diploma in Chemical Engineering

College/School : College of Engineering/School of Chemical Engineering

Signature of Student :

Date : 12/02/2025

ABSTRACT

This study investigates the use of magnetic iron tea waste biosorbents for the removal of Malachite Green (MG) dye from aqueous solutions. The research focuses on a parametric evaluation of key factors affecting adsorption efficiency, including dye concentration and contact time. Raw tea waste (RTW) and magnetically modified iron tea waste (FeTW) were prepared and characterized using FTIR spectroscopy to identify the functional groups responsible for adsorption. The incorporation of iron oxide onto tea waste was confirmed by Fe-O peaks in the FTIR spectra, enhancing adsorption capacity and facilitating separation using magnetic properties. Batch adsorption experiments demonstrated that FeTW exhibited superior adsorption performance compared to RTW, particularly at higher dye concentrations and longer contact times. Optimal removal efficiency was achieved at a dye concentration of 25 ppm. The study also highlighted challenges associated with adsorption time optimization and the variability in adsorption efficiency due to dye concentration fluctuations. Despite these challenges, the findings underscore the potential of magnetic iron tea waste as a cost-effective and environmentally friendly solution for dye removal in wastewater treatment. Recommendations for future work include scaling up the process, exploring the reusability of FeTW, and investigating its application for the removal of other pollutants. This research provides valuable insights into the development of sustainable adsorbent materials derived from agricultural waste, contributing to the advancement of green technologies for environmental remediation.

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