Environmental Engineering and Management Journal

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ASSESSMENT OF A NATURAL LAYERED CLAY MINERALS FOR REMOVAL OF VAT BLEU CLF DYE FROM WATER: KINETIC, ISOTHERM AND THERMODYNAMIC STUDIES

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Abstract

This study investigates the potential of Natural Layered Clay Mineral as an adsorbent for the removal of Vat Bleu CLF dye from textile wastewater. The effects of operational parameters, including temperature, adsorbent dosage, initial dye concentration, contact time, and pH, were systematically examined to determine their influence on removal efficiency. The highest efficiency was obtained at pH 3, with a marked reduction occurring within the first 5 min of contact. Adsorption isotherm analysis indicated that the Langmuir model provided the best fit to the experimental data, describing monolayer adsorption with a maximum capacity of 714.29 mg/g. Kinetic studies revealed that the process followed a pseudo-second-order model. The intraparticle diffusion model was also applied to evaluate the contribution of internal diffusion to the overall mechanism. Thermodynamic parameters confirmed that the adsorption was physical, spontaneous, and endothermic. These findings highlight Natural Layered Clay Mineral as a promising, low-cost, and efficient material for treating dye-contaminated industrial wastewater, providing a practical solution to mitigate environmental pollution and support sustainable water management.

Key words: Freundlich, Langmuir, pollution, sorption, water treatment

Received: April, 2025; Revised final: October, 2025; Accepted: October, 2025

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