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ADSORPTION PROPERTIES OF VERMICULITE FOR THE REMOVAL OF METHYLENE BLUE FROM AQUEOUS SOLUTION

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Abstract

Herein, vermiculite was used as an adsorbent to remove methylene blue dye from aqueous solutions. Vermiculite was characterized by SEM-EDX and FTIR analysis before and after adsorption. The formation of new bands (1342 , 1396 and 1600 cm^{-1}) after adsorption of methylene blue in FTIR analysis indicated a structural change in vermiculite. Experimental studies were carried out to examine the basic factors that are effective on adsorption such as contact time, temperature, initial pH, adsorbent dosage and initial dye concentration in the batch system. Results show that adsorption capacity increased with increase in the initial MB concentration. However, increasing the adsorbent dosage reduced the adsorption capacity. Additionally, temperature and initial pH parameters did not have much effect on adsorption capacity. Adsorption equilibrium of MB was reached within 180 minutes. Equilibrium data were tested by using Langmuir and Freundlich isotherm models. According to the results, Langmuir isotherm model had the best fit ($q_{max}=24.21\text{ mg/g}$ at 45°C). The pseudo-second-order model performed better in the kinetics studies than the pseudo-first-order model. Studies on the thermodynamics of the process demonstrated that MB adsorption on vermiculite is feasible, spontaneous and endothermic. The activation energy value was found to be 10.90 kJ/mol . Consequently, vermiculite, an inexpensive and readily accessible clay variety, was found to be highly effective in the removal of methylene blue from aqueous solutions.

Key words: adsorption, isotherms, kinetics, methylene blue, vermiculite

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