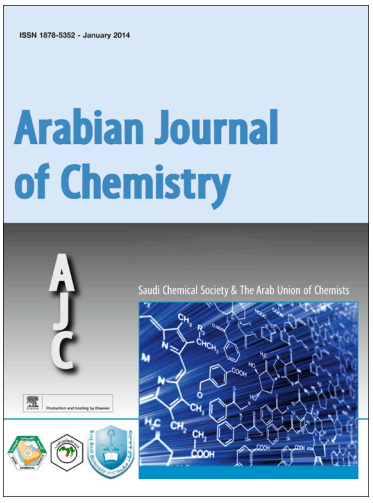

Original article

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Adsorption thermodynamics of cationic dyes (methylene blue and crystal violet) to a natural clay mineral from aqueous solution between 293.15 and 323.15 K

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Abstract

Wastewater from dyestuff production is one of the main water pollutants. Several methods have been applied for the remediation of contaminated water. Currently, adsorption using a cheap, abundant, and environmental-friendly adsorbent such as natural clay is the simplest and most useful method. This study aimed to determine the enthalpies of adsorption of the organic cationic dyes, methylene blue (MB) and crystal violet (CV), from polluted water onto a natural clay mineral. Early on, we performed mineralogical and textural analyses of a clay sample using various techniques, namely X-ray diffraction, scanning electron microscopy/energy dispersive X-ray spectroscopy, Brunauer-Emmett-Teller analysis, Fourier-transform infrared spectroscopy, and differential scanning calorimetry, before and after adsorption. The experimental results showed that this adsorbent is a mesoporous and non-swelling clay with illite and kaolinite as the major components. The effects of various parameters such as contact time, pH, and temperature were examined. The experimental data were analyzed using the linear forms of the Langmuir and Freundlich isotherm models and showed a good fit with the Langmuir equation for MB adsorption. Thermodynamic parameters such as the changes in Gibbs free energy, enthalpy, and entropy were determined from batch experiments. Results revealed that the adsorption of MB onto illitic clay was endothermic, while that of CV was an exothermic and spontaneous process.

***Key words*:** adsorption, cationic dyes, illitic clay, temperature effect, enthalpies of adsorption.

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