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Montmorillonite K10 : An Effective Adsorbent for Removal of a Toxic Reactive Mono-azo Dye, Procion Red MX 5B, from Water

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Abstract — Reactive dyes are widely used in industry to dye cellulosic fibres, nylon, silk and wool. Azo dyes and their precursors are generally considered as human carcinogens and their presence in water is also a known health risk. The present study investigates utilization of the commercially available clay mineral, montmorillonite K10, to remove Procion red MX5B from water. Adsorption was carried out in a batch process with pH, dye concentration, amount of clay mineral, interaction time and temperature as the process variables. Montmorillonite K10 was characterized with XRD, FT-IR and Surface area measurement. Adsorption was favourable in acidic pH and highest adsorption was observed at pH 2. First and second order kinetic models, intra-particle and liquid film diffusion models were applied to the rate processes that showed the second order model to have the highest applicability. The adsorption capacity of the clay mineral was found by applying Langmuir isotherm which showed that the dye uptake was 11.04 mg g⁻¹ at 303 K. The thermodynamic parameters of adsorption like enthalpy, entropy and Gibbs energy were also evaluated from experiments conducted over the temperature range, 293 to 323 K, and these were used to validate the observed endothermic interactions.

Keywords : *Adsorption, montmorillonite K10, procion red MX5B, isotherm, kinetics.*

INTRODUCTION

The growth of industries in the last few decades in Asian countries has significant impact on the economy of these countries while having serious consequences for the

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