Removal of Methyl Orange and Mythelene Blue Dyes from Aqueous Solution Using Low Cost Adsorbent Zeolite Synthesized from Fly Ash

SHAKTI DAS, SANGHAMITRA BARMAN* AND RUCHIKA THAKUR

The zeolite ZX₁ synthesized from fly ash was employed as effective adsorbent for removal of methylene blue and methyl orange, from its aqueous solution. In the present study, X-type and A-type zeolite were synthesized by alkali fusion, followed by hydrothermal treatment. The synthesized zeolite was then characterized using various techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM). Solution pH has an important role in the adsorption behavior of ZX₁. Higher solution pH results in higher adsorption capacity. The equilibrium results were well described by Freundlich isotherm model. Physical regeneration at high temperature showed that the adsorbent exhibits somehow lower adsorption capacity as compared to the fresh sample. The values of changes in enthalpy (ΔH°) and entropy (ΔS°) during the adsorption process were found to be -20.85 kJ/mol and -90.61 J/mol K⁻¹. Adsorption of methyl orange over Zeolite ZX₁ is much higher than ZA₁. Correlation coefficient was found to be 0.998.

Key words: Adsorption, zeolite, fly ash, methyl orange, methylene blue, kinetics

1. Introduction

Fly ash derived from coal residues has a tremendous potential for conversion to zeolites. The present environmental concerns over fly ash disposal have sparked a resurgent interest in its conversion to zeolites. Activated carbon is most widely used adsorbent due to its excellent adsorption capacity. However its use is often limited due to high cost, making this method unfavorable. Dyes or pigments are widely used in textile industries to color some products creating environmentally hazardous waste. Wastewater from process or waste effluents. Activated carbon is most widely used adsorbent due to its excellent adsorption capacity. However its use is often limited due to high cost, making this method unfavorable. Dyes or pigments are widely used in textile industries to color some products creating environmentally hazardous waste.