

(189)

Removal of the Methylene Blue in an Aqueous Solution Using Raw Laterite: Adsorption Studies**Gunathilake B.M.* , Jayawardana D.T., Nayanthika I.V.K.**

*Department of Forestry and Environmental Science, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Nugegoda, Sri Lanka.
bhanukasjp@gmail.com

Abstract

Methylene blue is a cationic dye, identified as a one of the pollutants in many industrial waste water especially in textile industry. It also can be used to develop a model to study adsorption behavior of raw Laterite. Therefore, the study was mainly focused on removal of methylene blue in an aqueous solution using raw laterite as the adsorbent material. Natural raw Laterite was collected from South West region of Sri Lanka. Initially, physical and chemical properties were analyzed by using standard methods. In order to prepare powdered material, soil samples were crushed and sieved through 53 μm standard sieve. After that, 30 ppm methylene blue aqueous solution was prepared. Effect of adsorbent dose, operating pH, ionic strength and contact time on the removal of methylene blue process were examined by contacting raw laterite with methylene blue aqueous solution. All the experiments were carried out in batch experiment system. Equilibrium concentration of methylene blue aqueous solution was measured using UV-Visible spectrometer at 663 nm. Before and after the experiment, the laterite soil were characterized with X-Ray powder Diffraction (XRD), X-Ray Fluoresce (XRF), Fourier Transform Infrared Spectroscopy (FTIR), Scanned Electron Microscopy (SEM) and Energy-dispersive X-ray spectroscopy (EDS). The adsorption behavior of laterite was evaluated using Langmuir, Freundlich and Temkin isotherm models. For that, methylene blue solutions which contain 10,20,30,40 and 50 ppm concentration were used. In order to investigate the mechanism of methylene blue adsorption on to the laterite soil pseudo first order and pseudo second order kinetic models were used. The recorded optimum adsorption dosage was 2.0 g and contact time was 60 minute while the maximum removal efficiency was recorded in higher pH than 10. When increasing the ionic strength of the methylene blue aqueous solution, removal efficiencies were significantly decreased. The experimental adsorption isotherm complies with Freundlich isotherm model ($R^2=0.99$) and the maximum amount of adsorption (q_{max}) was recorded as 3.45 mg/g. The kinetic studies revealed that the adsorption of methylene blue is rapid and complies with the pseudo second-order kinetic model ($R^2=0.99$). Based on the obtained results from the study, it can be concluded that raw laterite is effective in removing methylene blue from aqueous solutions. Finally, raw laterite can be recommended as a cost effective alternative for commercially available expensive adsorbents to remove methylene blue.

Keywords: Methylene blue, Laterite, Adsorption, Isotherm, Kinetic studies