World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:10, No:01, 2016

Removal of Rhodamine B from Aqueous Solution Using Natural Clay by Fixed Bed Column Method

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Abstract : The discharge of dye in industrial effluents is of great concern because their presence and accumulation have a toxic or carcinogenic effect on living species. The removal of such compounds at such low levels is a difficult problem. The adsorption process is an effective and attractive proposition for the treatment of dye contaminated wastewater. Activated carbon adsorption in fixed beds is a very common technology in the treatment of water and especially in processes of decolouration. However, it is expensive and the powdered one is difficult to be separated from aquatic system when it becomes exhausted or the effluent reaches the maximum allowable discharge level. The regeneration of exhausted activated carbon by chemical and thermal procedure is also expensive and results in loss of the sorbent. The focus of this research was to evaluate the adsorption potential of the raw clay in removing rhodamine B from aqueous solutions using a laboratory fixed-bed column. The continuous sorption process was conducted in this study in order to simulate industrial conditions. The effect of process parameters, such as inlet flow rate, adsorbent bed height, and initial adsorbate concentration on the shape of breakthrough curves was investigated. A glass column with an internal diameter of 1.5 cm and height of 30 cm was used as a fixed-bed column. The pH of feed solution was set at 8.5. Experiments were carried out at different bed heights (5 - 20 cm), influent flow rates (1.6- 8 mL/min) and influent rhodamine B concentrations (20 - 80 mg/L). The obtained results showed that the adsorption capacity increases with the bed depth and the initial concentration and it decreases at higher flow rate. The column regeneration was possible for four adsorption–desorption cycles. The clay column study states the value of the excellent adsorption capacity for the removal of rhodamine B from aqueous solution. Uptake of rhodamine B through a fixed-bed column was dependent on the bed depth, influent rhodamine B concentration, and flow rate.

Keywords : adsorption, breakthrough curve, clay, fixed bed column, rhodamine b, regeneration
Conference Title : ICCBEE 2016 : International Conference on Chemical, Biological and Environmental Engineering
Conference Location : Paris, France
Conference Dates : January 21-22, 2016