

## Adsorption of Congo Red from Aqueous Solution by Raw Clay: A Fixed Bed Column Study

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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 removals of such compounds at such low levels are a difficult problem. Physicochemical technique such as coagulation, flocculation, ozonation, reverse osmosis and adsorption on activated carbon, manganese oxide, silica gel and clay are among the methods employed. 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. Dye molecules also have very high affinity for clay surfaces and are readily adsorbed when added to clay suspension. The elimination of the organic dye by clay was studied by several researchers. The focus of this research was to evaluate the adsorption potential of the raw clay in removing congo red 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 7. Experiments were carried out at different bed heights (5-20 cm), influent flow rates (1.6- 8 mL/min) and influent congo red concentrations (10-50 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 congo red from aqueous solution. Uptake of congo red through a fixed-bed column was dependent on the bed depth, influent congo red concentration and flow rate.

**Keywords :** adsorption, breakthrough curve, clay, congo red, fixed bed column, regeneration

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