Abstract

In this study, discussed the removal of methylene blue from aqueous solution using fixed-bed columns filled with geopolymer mortar grannies and its mathematical modeling. In addition, preliminary studies were conducted to identify factors affecting adsorption, such as the pH of the solution and contact time. Laboratory-scale fixed-bed experiments were performed using a tube having (internal diameter of 2.5 cm and a height of 30 cm). Repeated the experiment for different flow rates (10, 15 and 20mL min−1), fixed bed height (15, 20,25cm) and initial MB concentrations (50, 100 and 150mg L−1). Breakthrough curves were constructed for each of the experiments.

Shape of breakthrough curves depended upon various operating parameters such as initial MB concentrations, bed depth, and flow rate. Therefore fixed bed adsorption experiments were performed by changing these operating parameters. The breakthrough curves obtained from the fixed-bed adsorption experiment was used to find parameters like breakthrough time (t_b), exhaustion time (t_e), length of mass transfer zone (h_0), equilibrium dynamic adsorption capacity (q_e) and adsorption efficiency (R). These dynamic adsorption parameters gave the clear idea of the optimum operating condition of this fixed bed adsorption column.

pH point of zero charge (pHpzc)is an important factor affecting the adsorption efficiency ,found to be 12.56. It has been found that absorption is more effective in alkaline solusion. It was also found that 45% of the adsorption occurs within the first 50 minutes. It was found that adsorption capacity increases when initial MB concentration decreases, flow rate reduces and depth of bed increases. The operating conditions C_O= 50 mg/L, Q= 10ml/min and h=25cm were found to provide maximum adsorption efficiency

Kinetic modeling of fixed-bed column is an important part of this study. Thomas, BDST and Yoon-Nelson kinetic models selected for this purpose. (K_{TH}) and (q_e) are the Thomas model parameters (K_A) and (N_0) are the BDST model parameters and (K_{YN}) and (τ) are the Yoon-Nelson model parameters. The values of these parameters were obtained using linear regression analysis of experimental data. These model parameters can also be used for future scale-up studies