

Abstract

The effective and economic removal of dyes from industrial effluents is difficult because of chemical stability of dye compounds. This study was undertaken to evaluate the adsorption potential of *Cassia fistula*, which is a natural, low-cost ornamental tree. Stem bark, branches and leaves were used as natural environmental friendly coagulant for the batch removal of Mordant Black 17 (MB 17) dye. The possible operating conditions for MB 17 removal are pH, initial dye concentration, adsorbent dose, temperature and time of contact are as follows:

Stem bark pH 4, 1.0g (amount of adsorbent), 50 mg/L (initial dye concentration), 308K (temperature) and 45 min (time of contact).

Branches pH 3, 0.6 g (amount of adsorbent), 60 mg/L (initial dye concentration), 313K (temperature) and 45 min (time of contact).

Stem bark pH 3, 0.8g (amount of adsorbent), 60mg/L (initial dye concentration), 303K (temperature) and 30 min (time of contact).

Freundlich and Langmuir isotherm models were applied on data. Langmuir models exhibited best fit ($R^2 > 0.99$) to the adsorption equilibrium data. The adsorption process was endothermic and spontaneous resulted from the thermodynamic analysis. Pseudo second-order best fits the kinetic data with higher correlation coefficient. Overall, branches and leaf sample can be a viable option for the commercial adsorbents to treat the industrial waste water. Different techniques such as scanning electron microscopy (SEM), Fourier transform spectroscopy (FTIR), X-ray diffraction (XRD) and UV-vis spectroscopy were employed to characterize the *Cassia fistula* biomass.