Experimental design for modeling of Eriochrome Black T adsorption onto Oleaster core loaded by magnetic nanoparticles

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Abstract In this project, carbon prepared Oleaster stone was loaded by mgnetic nanoparticles to be used as adsorbent for removal of Eriochrome Black T (EBT) aqueous solutions. Optimization of adsorption process was performed by response surface method. The mgnetic adsorbent was synthesized by mixing carbon prepared Oleaster stone with a solution containing ferric and ferrous chlorides in highly basic media at 80oC under nitrogen atmosphere. Then, the adsorbent was characterized by scanning electron microscopy, Fourier transform infrared spectroscopy and X-ray diffraction spectrum. The dye removal experiments were carried out based on a Bax-Behnken design with four variables including adsorbent dosage (0.4-4 g/L), pH (3–9), contact time (30-50 minutes) and ionic strength (0.02-0.1 mol/L). Dye concentration of 50 mg/L was taken as a fixed input parameter. Experimental data of the efficiency of EBT removal by the magnetic adsorbent showed a good fit to a second-order polynomial model with coefficient of determination value of 0.970 and Fisher ratio of 19.99. The developed model predicted the optimum values of the experimental factors as: adsorbent dosage of 2.29 g/L, pH=3.39, contact time of 48.6 min and ionic strength of 0.1 mol/L. Experimental checking performed at the predicted optimum conditions resulted in the efficiency of 98.11% for EBT removal by the magnetic adsorbent. Study of Langmuir and Freundlich adsorption isotherms indicated that Langmuir equation had better fit to the equilibrium data of the dye-adsorbent system. Based on the kinetic studies, adsorption of EBT onto the magnetic adsorbent prepared Oleaster stone carbon followed the pseudo-second order model.

Keywords : Keywords: Adsorption, Oleaster stone, Mgnetic nanoparticles, Eriochorom Black T, Response surface modeling.