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ADSORPTION OF AN ANIONIC DYE ONTO NATIVE AND CHEMICALLY MODIFIED AGRICULTURAL WASTE

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Abstract

The native and surface modified adsorbents from agricultural waste, such as Psyllium stalks (PS) were investigated for their ability to remove the Coomassie Brilliant Blue (CBB) dye from aqueous media. The native and surface modified adsorbents were characterized by the Fourier Transform Infrared spectroscopy (FTIR). The results show that the Sodium Bicarbonate Treated Carbon (SBTC) has good surface properties for the removal of the CBB dye from aqueous media. The SBTC was analyzed by Scanning Electron Microscopy (SEM), Energy Dispersive X-ray spectrometry (EDX) and Brunauer, Emmett and Teller (BET) analysis. Batch adsorption experiments were carried out using all the adsorbents, by varying the adsorption parameters such as, solution pH, adsorbent dose, contact time, initial dye concentration, and temperature. The maximum percentage of dye removal was observed for the solution pH of 7.0 and an adsorbent dose of 0.4 g/L for SBTC. The adsorption kinetics for the SBTC reveals that the equilibrium was attained in 90 min. The kinetics of dye adsorption onto the adsorbents follows the pseudo-second order model. The external mass transfer controls the dye removal during the earlier stages of adsorption, and intraparticle diffusion during the later stages of adsorption. The percentage removal of the dye decreases with an increase in the dye concentration. The Langmuir maximum monolayer adsorption capacity value of SBTC for the CBB dye is found to be 237.2 mg/g. The thermodynamic study shows that the adsorption of the dye onto the adsorbents was spontaneous and exothermic in nature.

Key words: adsorption, adsorption isotherms, anionic dye, kinetics, thermodynamics

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