

Kinetic and equilibrium studies of the biosorption of sunset yellow dye by alligator weed activated carbon

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ABSTRACT

Alligator weed activated carbon (AWAC) was prepared by phosphoric acid activation. The AWAC features a high surface area (736.3 m²/g) and has an abundant array of microvoids and mesopores with an average pore size of 4.05 nm. A 0.8 g/L dose of AWAC adsorbed about 96% of sunset yellow dye (SYD) at a concentration of 150 mg/L. The maximum adsorption was approximately 271 mg/g at 308 K. Orthogonal experiments for the %Removal and amount of SYD adsorbed at equilibrium revealed that the optimal conditions were pH = 3, T = 298 K, initial SYD concentration = 250 mg/L, and AWAC dose = 1.2 g/L. The kinetics and equilibrium data agreed well with the pseudo-second-order model and Freundlich isotherm equation for the adsorbent. Functional groups that may increase the adsorption capacity were detected on the surface of AWAC, such as –OH, C=C and C–O–C. Electrostatic interactions are important in the adsorption process along with chemical bond formation and hydrophobic interaction. Thermodynamic analysis illustrated that the adsorption process is spontaneous and endothermic. AWAC is a promising low-cost adsorbent for the removal of SYD from aqueous effluent.

Keywords: Activated carbon; Adsorption; Alligator weed; Sunset yellow dye

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