Removal of basic yellow dye from aqueous solutions by sorption onto reed as an adsorbent

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ABSTRACT

This work investigates the possibility to use the reed as an adsorbent for removal of basic yellow 28 (BY28), an industrial textile dye from aqueous solution. Batch adsorption experiments at 25 °C and agitation speed of 400 rpm were carried out and the effects of operational parameters including contact time, initial dye concentration, adsorbent dose, as well as solution pH on sorbed amount were investigated and discussed. The maximum uptake of BY28 was about 140 mg/g of adsorbent and it was obtained at pH6, initial dye concentration of 100 mg/L, and adsorbent dose of 0.5 g/L. It was also established that almost 15 min are sufficient to attain equilibrium sorption. Results of batch experiments showed that this adsorbent exhibited high sorption capacities toward BY28. Experimental data were analyzed using pseudo-first-order and pseudo-second-order kinetics and it was found that kinetic followed a pseudo-second-order equation. The equilibrium results have been modeled and evaluated using Langmuir, Freundlich, Sips, and Generalized model isotherms. The Langmuir model provides the best fit of equilibrium data of BY28 and according to this model, the maximum sorption capacity was estimated to181 mg/g of reed. FTIR spectrum of reed confirms the existence of various functional groups such as carboxyl, phenolic, hydroxyl, and amine groups on their surface and these functional groups have always been considered to effectively form some physicochemical interactions, e.g. ion exchange or inner-sphere complex formation, with BY28. Results from this study suggest that reed is an effective adsorbent for the removal of BY28 from aqueous solutions.

Keywords: Reed; Sorption; Basic yellow 28; Batch experiments; Langmuir isotherm; Pseudo-second-order model