Desalination and Water Treatment
www.deswater.com
37 (2012) 169–177
January

doi: 10/5004/dwt.2012.2928
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Removal of textile dyes from aqueous solutions with eco-friendly biosorbent

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Received 19 April 2011; Accepted 4 July 2011

ABSTRACT

Inexpensive and eco-friendly biosorbent wheat bran has been successfully utilized for the removal of textile dyes from aqueous solutions. Remazol Red F3B (Reactive red 180) was initially used as a model textile dye. The effects of contact time, pH, initial dye concentration, biosorbent dose and temperature were investigated. The optimum biosorption conditions were found as following: contact time 4 h, initial pH 2.0, initial dye concentration 200 mg/l, biosorbent dose 0.25 g and temperature 20°C. The results indicate that acidic pH supported the biosorption of dyes on the wheat bran. The biosorption capacity was 39.42 mg/g for this dye. Using optimum biosorption conditions, five other dye types with reactive, direct and acidic structures were also investigated for biosorption capacity. The Langmuir and Freundlich models were evaluated using the experimental data and the experimental results showed that the Langmuir equation fit better than the Freundlich equation. Different thermodynamic parameters i.e., changes in standard free energy, enthalpy and entropy have also been evaluated and it has been found that the reaction was spontaneous and exothermic in nature. Finally, the effect of biosorbent surface was analyzed by scanning electron microscope (SEM). SEM images showed reasonable agreement with adsorption measurements.

Keywords: Wheat bran; Biosorption; Kinetic study; Reactive dye; Direct dye; Acidic dye

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