



Biosorption of Drimarine Blue HF-RL using raw, pretreated, and immobilized peanut hulls

Saima Noreen, Haq Nawaz Bhatti*, Sana Nausheen, Muhammad Zahid, Sadia Asim

Environmental Chemistry Laboratory, Department of Chemistry and Biochemistry, University of Agriculture, Faisalabad 38040, Pakistan

Tel. +92 41 9200161/3319; Fax: +92 41 9200764; email: haq_nawaz@uaf.edu.pk

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ABSTRACT

The aim of this study is to establish an economical and environment friendly method for the removal of reactive dye from wastewater. This study was carried out for the removal of Drimarine Blue HF-RL using raw, nitric acid treated, and immobilized peanut hulls in both batch and column modes. In batch study, different process parameters like pH, biosorbent dose, initial dye concentration, contact time, and temperature were optimized. The pH (2), biosorbent dose (0.05 g), initial dye concentration (400, 200, 200 mg/L), contact time (90, 120, 120 min), and temperature (30°C) were optimized for raw, nitric acid treated, and immobilized peanut hulls. The biosorption data have been analyzed using Langmuir, Freundlich, Temkin, Dubinin–Radushkevich, and Harkins–Jura isotherms. The isothermal data followed the Langmuir model. The biosorption processes conformed to the pseudo-second-order rate kinetics. Different thermodynamic parameters were estimated during thermodynamic study. The results showed the exothermic and spontaneous nature of biosorption process. The column study was also investigated for making the process more applicable on industrial scale. The optimum bed height (4.5 cm), flow rate (1.8 mL/min), and initial dye concentration (100 mg/L) were found in column study. Thomas and Bed depth service time models were fitted well to the experimental data in continuous process. The FTIR spectrum confirmed the presence of $-NH_2$ and $-C=O$ groups in the biomass structure responsible for interaction between biomass and dye molecules. The results proved that the peanut hulls in different forms behave as efficient and cost-effective biosorbent for the removal of reactive dyes.

Keywords: Biosorption; Peanut hulls; Pretreatments; Kinetics; Equilibrium isotherms; Thermodynamics

*Corresponding author.