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Biosorption of toxic congo red dye from aqueous solution by eco-friendly biosorbent *Saccharum bengalense*: kinetics and thermodynamics

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ABSTRACT

In the present study, *Saccharum bengalense* (SB), a potential biosorbent, was investigated for the removal of toxic Congo red (CR) dye. The effect of various operating variables, viz. adsorbent dosage, pH, contact time, and temperature on the removal of dye has been studied. Almost 94% removal of dye is possible after 50 min at pH 2.0 under batch test conditions. It was found that a pseudo-second-order mechanism was predominant and the overall rate of the dye adsorption process appears to be controlled by more than one step. The intraparticle diffusion model was applied to investigate the rate determining step. Langmuir, Freundlich, and Dubinin–Radushkevich adsorption isotherm models were applied to describe the biosorption isotherm. The biosorption data were better represented by the Langmuir model and the biosorption capacity (q_{max}) of SB for CR was achieved at 125 mg/g. Thermodynamic parameters such as standard free energy change (ΔG°), standard enthalpy change (ΔH°), and standard entropy change (ΔS°) were calculated and revealed the spontaneous, endothermic, and feasible nature of the adsorption process. Biomass derived from the pulp of SB was evaluated as an effective biosorbent for removal of CR dye.

Keywords: Biosorbent; *Saccharum bengalense*; Congo red; Kinetics

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