Direct dye biosorption by immobilized barley husk

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ABSTRACT

The potential of low-cost adsorbent–barley husk to remove direct dye, namely Actarus Red BWS through biosorption process has been investigated in both continuous and batch modes. A series of experiments have been performed to evaluate the optimum biosorption conditions such as pH (2–5), biosorbent dosage (0.2–0.8 g), initial dye concentration (50–200 ppm), equilibrium time, and temperature (303–333 K). The adsorption efficiency decreased with increase in pH and increased with increase in biomass dose. Equilibrium isotherms have been developed by applying data to Langmuir, Freundlich, and Flory–Huggins models. The highest correlation coefficient ($R^2 = 0.99$) related to Langmuir isotherm indicated good fitness of this model, explaining the sorption as monolayer process. The process followed pseudo-second-order kinetic model. The negative $\Delta G^\circ$ and positive $\Delta H^\circ$ values indicated the spontaneous and endothermic nature of process. The continuous mode of biosorption has been tested as the function of flow rate and bed height too.

Keywords: Biosorption; Barley husk; Actarus Red BWS; Isotherm; Kinetics

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