Biosorption of malachite green from aqueous solutions by pine sawdust: equilibrium, kinetics and the effect of process parameters

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Received 25 November 2011; Accepted 24 October 2012

ABSTRACT

The study offers the use of Scots Pine (*Pinus silvestris*) sawdust as a biosorbent for the removal of cationic dye, malachite green, from aqueous solutions. The effects of process parameters, such as contact time, sorbent concentration, initial dye concentration, pH, temperature, salinity and surfactant addition, on the biosorption process were determined. The experimental biosorption kinetics and equilibrium results were described by a range of mathematical models. The equilibrium data were best described by the Langmuir-Freundlich model, while the kinetics was best described by the pseudo-second-order model. The maximum sorption capacity of sawdust was 71.67 mg/g. An increase in pH values results in the rise of biosorption degree, mostly below pH 5. Addition of inorganic salts results in a drop in sorption capacity, but for concentrations higher than 0.5% w/w, the uptake increases along with an increase in salt concentration. The presence of an ionic surfactant (sodium dodecyl benzene sulphonate) at concentrations below critical micelle concentration enhances the sorption, while higher concentrations lead to solubilisation of dye molecules within the micelles, thus reducing the sorption efficacy. Desorption study was carried out with four different eluents.

Keywords: Biosorption; Cationic dye; Sawdust; Isotherm; Kinetics; Effect of parameters; Desorption