Box–Behnken design optimization for the removal of Direct Violet 51 dye from aqueous solution using lignocellulosic waste

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ABSTRACT

The present research work was designed to explore the biosorption efficiency of sugarcane bagasse (SB) biomass for the removal of Direct Violet 51 dye from aqueous solution. The modification of SB biomass was carried out by different physical and chemical treatments. HCl-treated SB biomass depicted maximum biosorption efficiency among all the modified SB biomasses. Box–Behnken experimental design was employed to illustrate the effect of three independent variables (initial dye concentration (A), biosorbent dose (B), and pH (C)) on the dye removal process. Maximum dye removal (63.0 mg g\(^{-1}\)) was achieved at pH 2 and 0.05 g biosorbent dose. Higher initial dye concentration was found to be favorable for the dye removal process. Desorption study was conducted using NaOH solution of different strengths, and it was observed that 61.58% dye can be desorbed from the loaded biosorbent using 1 M NaOH solution. Characterization of SB biomass was also carried out by FTIR, scanning electron microscope, and TGA analysis. The results indicated that SB biomass can be used as an efficient biosorbent for the treatment of dye containing wastewater.

Keywords: Direct Violet 51; Box–Behnken experimental design; FTIR analysis; TGA analysis; Desorption study

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