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OPTIMIZATION REMOVAL OF ERIOCHROME BLACK T BY COAGULATION-FLOCCULATION USING *Opuntia ficus-indica* MUCILAGE AS FLOCCULANT

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Abstract

Eriochrome Black T (EBT) is a potentially harmful substance known for its toxicity and negative impact on the environment. This study aimed to explore the coagulation-flocculation process as a means to treat EBT solutions, using mucilage extracted from cactus cladodes as a natural flocculant. The optimization of this treatment process was accomplished through the application of the Box-Behnken design and response surface methodology (RSM), incorporating three independent variables: EBT concentration (ranging from 20 to 100 mg L⁻¹), pH levels (ranging from 9 to 13), and flocculant volume (ranging from 1 to 4 mL). The coagulation-flocculation experiments were conducted using 1 g L⁻¹ of FeCl₃ as a coagulant and 20 g L⁻¹ of mucilage derived from cactus as a flocculant. Experimental decolorization yields varied from 6.04% to 55.3%, and a second-degree regression model was developed to predict the decolorization process. This model accurately illustrated the influence of each variable and their interactions, displaying a high correlation coefficient ($R^2 = 0.96$) and a low probability ($P < 0.05$). Furthermore, the lack of fit P-value (P-value = 0.0892) was determined to be statistically insignificant ($P > 0.05$). Through experimental optimization, it was determined that the most favorable conditions for the treatment process were as follows: an EBT concentration of 100 mg L⁻¹, a mucilage solution volume of 2 mL, and a pH level of 13, resulting in a decolorization rate of 55.87%. Fourier transform infrared spectroscopy (FTIR) was employed to characterize the mucilage derived from cactus cladodes, revealing the presence of carbohydrates that aid in the removal of EBT through the coagulation-flocculation process.

Key words: Box-Behnken design, cactus, coagulation-flocculation, Eriochrome Black T, mucilage

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