Optimization of methyl orange bioremoval by *Prunus amygdalus* L. (almond) shell waste: Taguchi methodology approach and biosorption system design

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**ABSTRACT**

This study presents a systematic procedure to define optimal operational conditions for optimizing methyl orange biosorption by almond shell waste using the Taguchi method. Several biosorption experiments were conducted using the L9 orthogonal array with four factors in three levels. The optimum set of parameters was obtained as reaction time of 80 min, initial dye concentration of 100 mg L\(^{-1}\), pH of 3, and temperature of 20°C, considering the larger is better pattern. Analysis of variance displayed that the initial dye concentration was the dominant factor affecting the dye biosorption. Verification experiments were performed to confirm the optimized results. Further, a regression model was developed as a function of the process parameters mentioned. Finally, a single-stage batch biosorption process design was presented based on the Langmuir isotherm. Thus, the Taguchi statistical approach provided a pleasing success in specifying the optimum conditions for the dye removal process.

**Keywords:** Almond shell waste; Biosorption; Methyl orange; Optimization; System design; Taguchi method