Optimization of biosorption parameters of Hg(II) from aqueous solutions by the buckwheat hulls using respond surface methodology

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ABSTRACT

The buckwheat hulls in the region of Jiaodong were used as the potential adsorbents for the removal of heavy metal ions from wastewater. The experimental results showed that the buckwheat hulls with 120 meshes had good adsorption capability for Hg(II) ions. Moreover, the adsorption process optimization of the buckwheat hulls for Hg(II) ions was performed through Central Composite Rotary Design using response surface methodology (RSM) by Design Expert Version 8.0.6.1 (Stat-Ease, Inc., Minneapolis, MN, USA). For the maximum biosorption of mercury ions from aqueous solutions by the buckwheat hulls, a total of 20 experimental runs were set and the experimental data fitted to the empirical second-order polynomial model of a suitable degree. The quantitative relationship between the mercury removal and different levels of the factors (initial pH, adsorbent dosage, and initial Hg(II) concentration) was used to work out optimized levels of these parameters by a full factorial design (2^3). The analysis of variance (ANOVA) of the quadratic model demonstrated that the model was highly significant, and initial pH of 4.0, initial Hg(II) concentration of 802.36 mg/L, and adsorbent dosage of 2.0 g/L were found to be the optimum conditions for the maximum uptake of mercury ions of 110.07 mg/g in batched mode.

Keywords: Biosorption; Mercury(II); Aqueous solutions; Buckwheat hulls; Optimization; Response surface methodology

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