عنوان مقاله:

Combination of Experimental Design and Desirability Function as a Genuine Method to Achieve Common Optimal Conditions for the Adsorption of Pb(II) and Cu(II) onto the Poplar Tree Leaves: Equilibrium, Kinetic and Thermodynamic Studies

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خلاصه مقاله:

In this study, the ashes of poplar tree leaves are applied as an efficient, accessible and inexpensive biosorbent for the removal of heavy metals Pb۲+ and Cu+۲ in aqueous solutions. In the adsorption processes, the success of the ions removal highly depends on the level of several experimental factors such as pH, contact time, adsorbent dosage and temperature. Therefore, a genuine statistical experiment design method is required to achieve a common experimental conditions where both ions have been removed from aqueous solutions to a great degree. Here, this common optimal conditions are obtained by the combination of experimental design and desirability function methods. For a mixture of Pb۲+ and Cu+۲, the following optimal conditions were achieved: pH of ۵.۴, contact time of ۲۳ min, adsorbent dosage of ۰.۱۴ g, and temperature of ۲۸۰C; at ۱۵۰ mg L-۱ of Pb۲+ and ۱۲۰ mg L-۱ Cu۲+. The removal efficiencies of Pb۲+ and Cu+۲ were ۹۲.۸% and ۹۴.۹%, respectively, which verified the applicability of this biosorbent for the ions removal. Moreover, the equilibrium and kinetic behavior of the adsorption processes are investigated and then thermodynamic parameters, $\Delta G \circ (Kj\ mol-۱)$, $\Delta H(Kj\ mol-۱) \circ$, and $\Delta S \circ (Kj\ mol-۱)$, are evaluated which reveal that both processes are endothermic and spontaneous.

کلمات کلیدی:

Desirability function, Biosorption, heavy metals, Kinetic, thermodynamic parameters