Chemically modified natural cotton fiber: a low-cost biosorbent for the removal of the Cu(II), Zn(II), Cd(II), and Pb(II) from natural water

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ABSTRACT

In this work, the removal of Cu(II), Zn(II), Cd(II), and Pb(II) ions from aqueous solution by natural cotton fiber modified with citric acid (NCFCA) is reported, using both batch and continuous systems. Specifically, kinetics and adsorption isotherms have been determined considering the effect of contact time, pH, and heavy metals concentration. Adsorption isotherms show that the experimental maximum adsorption capacity of Cu(II), Zn(II), Cd(II), and Pb(II) were 6.12, 4.53, 8.22, and 21.62 mg g\(^{-1}\), respectively, at 25°C and pH 5. Furthermore, breakthrough curves were obtained for the adsorption of heavy metals using a fixed bed column packed with NCFCA at pH 5, flow rate = 2.5 mL min\(^{-1}\) and 1.0 \(\times\) 10\(^{-4}\) mol L\(^{-1}\) of metals concentration. The Thomas model has been used for data fitting of adsorption competitions of continuous experiments and for determining the design parameters that are useful to characterize the performance of the packed bed column. The natural water real samples were treated with the fixed bed column packed with NCFCA, and the results of the analyses of the percolated samples show that the biosorbent is efficient for the removal of heavy metals that are present in low concentrations in the samples.

Keywords: Cotton fiber; Adsorption; Heavy metals; Fixed-bed; Kinetics; Wastewater treatment

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