

Kinetics and equilibrium studies of the adsorption of Cu(II) from aqueous solution using *Acacia nilotica* seed pods on ZnCl₂ activation

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Abstract The present work investigates the removal of Cu(II) from aqueous solution by adsorption on to *Acacia nilotica* seed pods chemically activated using ZnCl₂ (ANZ). Batch mode experiments of Cu(II) ions (ANZC) as a function of pH (2.0–10.0), agitation time (0–120 m), adsorbent dosage (0.2–1.0 g/L), and initial concentration (25–200 mg/L) on the adsorption capacity have been studied at room temperature. Comparative adsorption of Cu(II) by the adsorbent ANZ in the binary system (70–44.44 % \approx Cu–Ni, 75–42.85 % \approx Cu–Cr) and ternary system (80–60 % \approx Cu–Ni–Cr) shows that the uptake of one metal ion was decreased by the presence of other metal ions. Analyses of SEM, XRD, and FTIR were carried out before and after adsorption to explore the number and position of the functional group available for copper binding on to the adsorbent, and the changes in surface morphology and elemental constitution of the adsorbent. The single component equilibrium data were analysed using various adsorption isotherms. Batch adsorption studies have been described by using kinetic equations.

Keywords Adsorption · Copper (II) removal · *Acacia nilotica* seed pods · Isotherm model and kinetic studies

Introduction

Pollution from heavy metals is a major concern in developing countries. The discharge of heavy metals into water is a serious pollution problem which may

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