



Chemically enhanced coffee husks as biosorbents for the removal of copper and nickel ions from aqueous solutions: study on kinetic parameters

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ABSTRACT

Biosorption of Cu and Ni ions onto low-cost coffee husk (CH) was investigated in this study. Adsorbent was activated using ZnCl_2 , and the desorption studies revealed the increase in adsorption with high regeneration capacity. Adsorbent was characterized by Fourier-transform infrared and its point of zero charge was determined using pH drift method. Effects of pH, reaction time, and adsorbent concentration on metal ions adsorption were studied. Physical modification of adsorbent at varying temperature 37°C to 90°C depicted that the temperature was inversely proportional to adsorption efficiency. Study parameters showed that pH 6, temperature 37°C, and reaction time 6th hour (for copper) and 10th hour (for nickel) exhibited maximum efficiency. The equilibrium adsorption data were analyzed using Langmuir, Freundlich, Redlich, and Sips adsorption isotherms with Langmuir providing a best fit ($R^2 > 0.96$). Immobilization studies were carried by encapsulating CHs in alginate beads, and the experiment was carried out for both batch and continuous modes, where the continuous modes were carried out using a column apparatus. Both batch and continuous studies showed 95% efficiency in removal of heavy metals. From these studies, it is clear that CHs are better low-cost adsorbents of heavy metals from aqueous solutions.

Keywords: Coffee husk; Copper; Nickel; FT-IR; Langmuir and Freundlich isotherm

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