

A study of the removal characteristics of Cu(II) ions from aqueous solutions by a low-cost adsorbent.

Abstract

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Heavy metal pollution has become one of the most critical environmental problems throughout the world today, since they persist in the environment without degradation. Present study explored the feasibility of using Jack wood sawdust as a low cost adsorbent, for the removal of Cu(II) ions from aqueous solutions. Batch mode process was carried out to investigate the effect of contact time, initial metal concentration, particle size, pH and temperature with the dosage of 0.500 g sawdust treated with 0.1%V/V sodium hydroxide. Maximum adsorption for Cu(II) was observed at a pH range of 6-7 having the particle size 107-150 μm . Percentage removal of Cu(II) increased when temperature was varied from 20 $^{\circ}\text{C}$ to 70 $^{\circ}\text{C}$. Langmuir, Freundlich and D-R isotherms were obtained at 30 ± 0.2 $^{\circ}\text{C}$. Applicability of pseudo-first order, pseudo-second order, intra-particle diffusion and liquid-film diffusion kinetic models were investigated at 30 ± 0.2 $^{\circ}\text{C}$. Cu(II) removal by Jackwood sawdust obeyed pseudo-second order kinetic model, Langmuir and D-R isotherms. Maximum removal capacity obtained from Langmuir and D-R isotherms are 6.26 and 5.51 mg g^{-1} respectively. Thermodynamic parameters ΔG , ΔS and ΔH obtained for the removal were -8, 52 kJ mol^{-1} and 0.2 $\text{kJ mol}^{-1} \text{K}^{-1}$ respectively indicating the removal process is favourable and spontaneous. IR analysis of sawdust before and after the removal of Cu(II) was carried out to identify the possible functional groups responsible for the removal and significant changes in the intensities of functional groups of metal loaded sawdust was observed with shifts in positions of some peaks. Ultimately this research can be considered as a demonstration of using a waste material (sawdust) having low economic value to solve an environmental problem such as decontamination of industrial effluents.

Keywords: Jack wood sawdust; Heavy metals.