Removal of free cyanide from aqueous solutions by pine cone scale (PCS)

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ABSTRACT

The removal of free cyanide from aqueous solutions was studied by adsorption onto PCS. The chemical composition of PCS was determined to be 48.91% C, 6.12% H, 0.5% N and 44.47% O. The BET surface area, total pore volume and average pore diameter of the sample were determined to be 0.657 m^2/g, 0.020114 $cm^3 g^{-1}$ and 122.41 nm, respectively. The N_2 adsorption isotherm resembled to the Type III standard adsorption isotherms proposed by IUPAC. The SEM-WDX analysis indicates that PCS is a carbon based adsorbent and FTIR analysis confirmed the presence of acidic and basic surface functional groups on its surface. The equilibrium studies showed that the loading capacity of PCS towards CN^- increases from 1.16 to 6.64 mg/g and the removal percentage decreases from 87.5% to 25% by increasing initial CN^- concentration from 26 to 531 mg/L. The equilibrium and kinetic data were best modeled by Redlich-Peterson isotherm and Pseudo-second order kinetic models, respectively. The basic surface functional groups play the main role in the adsorption of CN^- onto the PCS and the rate limiting step was determined to be film diffusion. The study revealed that PCS can be an effective and economically feasible biosorbent for the removal of CN^-.

Keywords: Cyanide; Adsorption, Pine cone scale; Isotherm; Kinetics

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