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Removal of lead, cadmium, copper, and arsenic ions using biosorption: equilibrium and kinetic studies

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ABSTRACT

Biosorption of lead, cadmium, copper, and arsenic ions by using native algae was investigated. Experiments were carried out in a batch reactor to obtain equilibrium and kinetic data. Experimental parameters affecting the biosorption process such as pH, shaking time, initial metal concentrations, and temperature were studied. The optimum pH for removal was found to be 3, 5, 4, and 5 for Pb^{2+}, Cd^{2+}, Cu^{2+}, and As^{3+}, respectively. Biosorption of these metals is based on ion-exchange mechanism accompanied by release of light metals such as calcium, magnesium, potassium, and sodium. Experimental isotherms data well fitted an ion-exchange model and the affinity constant was calculated for each metal. The results showed the ion-exchange model was found suitable for describing the biosorption process. Fourier Transformation Infrared Spectroscopy analysis was used to find the effects of functional groups of algae in biosorption process. The results showed that Pb^{2+} had a greater difference in the peak values of absorbance bands than As^{3+} and Cu^{2+}, while Cd^{2+} had the lowest. The experimental data showed that the kinetics of biosorption of four metals fitted well the pseudo-second-order model.

Keywords: Biosorption; Algae; Ion-exchange model; Affinity constant; Kinetics

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