

Bio-Remediation of Lead-Contaminated Water Using Adsorbent Derived from Papaya Peel

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Abstract : Toxic heavy metal discharges into environment due to rapid industrialization is a serious pollution problem that has drawn global attention towards their adverse impacts on both the structure of ecological systems as well as human health. Lead as toxic and bio-accumulating elements through the food chain, is regularly entering to water bodies from discharges of industries such as plating, mining activities, battery manufacture, paint manufacture, etc. The application of conventional methods to degrease and remove Pb(II) ion from wastewater is often restricted due to technical and economic constrains. Therefore, the use of various agro-wastes as low-cost bioadsorbent is found to be attractive since they are abundantly available and cheap. In this study, activated carbon of papaya peel (AC-PP) (as locally available agricultural waste) was employed to evaluate its Pb(II) uptake capacity from single-solute solutions in sets of batch mode experiments. To assess the surface characteristics of the adsorbents, the scanning electron microscope (SEM) coupled with energy disperse X-ray (EDX), and Fourier transform infrared spectroscopy (FT-IR) analysis were utilized. The removal amount of Pb(II) was determined by atomic adsorption spectrometry (AAS). The effects of pH, contact time, the initial concentration of Pb(II) and adsorbent dosage were investigated. The pH value = 5 was observed as optimum solution pH. The optimum initial concentration of Pb(II) in the solution for AC-PP was found to be 200 mg/l where the amount of Pb(II) removed was 36.42 mg/g. At the agitating time of 2 h, the adsorption processes using 100 mg dosage of AC-PP reached equilibrium. The experimental results exhibit high capability and metal affinity of modified papaya peel waste with removal efficiency of 93.22 %. The evaluation results show that the equilibrium adsorption of Pb(II) was best expressed by Freundlich isotherm model ($R^2 > 0.93$). The experimental results confirmed that AC-PP potentially can be employed as an alternative adsorbent for Pb(II) uptake from industrial wastewater for the design of an environmentally friendly yet economical wastewater treatment process.

Keywords : activated carbon, bioadsorption, lead removal, papaya peel, wastewater treatment

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