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Desalination and Water Treatment

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Biosorption of Pb and Cu from aqueous solution using banana peel powder (Article)Mohd Salim, R.^a, Khan Chowdhury, A.J.^c, Rayathulhan, R.^b, Yunus, K.^b, Sarkar, M.Z.I.^d^a Department of Chemistry, Kulliyah of Science, International Islamic University of Malaysia (IIUM), Kuantan, Pahang, Malaysia^b Department of Biotechnology, Kulliyah of Science, International Islamic University of Malaysia (IIUM), Kuantan, Pahang, Malaysia^c Department of Marine Science, Kulliyah of Science, International Islamic University of Malaysia (IIUM), Kuantan, Pahang, Malaysia[View additional affiliations](#)[View references \(35\)](#)

Abstract

Banana peel is considered as a dominant agricultural waste which causes more disposal problem everywhere. This disposal problem could be handled by changing it into an advantage whereby utilizing banana peel to be used as an adsorbent to remove heavy metals from water. Based on the above perspectives, an adsorption capability of banana peel was evaluated in removing toxic heavy metals Pb and Cu from aqueous solution. The banana peel was chemically modified (BPPT) by treating it with 0.1 M sodium hydroxide to examine the improvement in the adsorption capacity compared to the untreated form (BPPU). The parameters such as adsorbent mass, initial pH, initial concentration and contact time were tested accordingly. The adsorbent mass with the highest adsorption capacity for both Pb and Cu were 0.9 g. As for the effect of pH, adsorption of Pb and Cu was favourable at pH 7 and pH 9, respectively. The effects of concentration and contact time on peel extract, the maximum adsorption for Pb has shown at 4 mg/L at 120 min for BPPU and was 6 mg/L at 150 min for BPPT. As for Cu, both untreated and treated adsorbent achieved the highest adsorption rate at concentration of 2 mg/L with contact time at 120 min. Atomic absorption spectrophotometer (AAS) was used to measure the concentration of toxic metals. Scanning electron microscope was used to observe the differences in morphology of the peel between BPPT and BPPU before and after adsorption. Fourier transform infrared spectroscopy was used to determine the functional groups present in it which was responsible for the adsorption process. Equilibrium data of both metals were well fitted with the Langmuir and Freundlich isotherm models with ($R^2 \approx 0.99$). R_L values for both Pb and Cu also ranged in between 0 and 1 indicating a favourable adsorption process based on the Langmuir isotherm. Overall BPPT proved to have higher adsorption capacity than BPPU. BPPT gives the highest maximum coverage capacity (Q_0) for Pb adsorption with 89.286 and 5.720 mg/g for Cu in a favourable condition. Therefore, it could be concluded that banana peel could be recognized as potential and environmentally friendly agro-based waste material which could be utilized as low-cost adsorbents to remove toxic metal from industrial wastewater. © 2015 Balaban Desalination Publications. All rights reserved.

Author keywords

Adsorption; Banana Peel; Heavy Metals; Isotherm; Kinetics

Indexed keywords

GEOBASE Subject Index: adsorption; aqueous solution; copper; desalination; heavy metal; isotherm; kinetics; lead; water treatment

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