Preparation, Characterization and Evaluation of Lead Adsorption Efficiency of Chitosan Coated Activated Carbon

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Heavy metal contamination in various water resources is of great concern because of the toxic effect on human beings and other animals and plants in the environment. Lead is a major element which is released to the environment including water bodies by many industries and it is well known that the presence of Pb(II) in water, even at very low concentrations, is extremely harmful to the human. Therefore, the aim of the present study was to investigate the Pb adsorption potential of chitosan coated activated carbon derived from rice husk (CCAC) in aqueous media. First, chitin was extracted from shrimp shell wastes by following a standard procedure and it was deacetylated to obtain chitosan (deacetylation percentage = 82%). In the preparation of activated carbon from rice husk, HCl acid (5 % v/v) was used as the activating agent. The adsorbent of the study, CCAC was then prepared by coating activated carbon derived from rice husk (20.00 g) with chitosan (3.00 g dissolved in 1% v/v acetic acid) to improve the stability and mechanical strength of chitosan. The surface morphology and the elemental composition of CCAC was examined by Scanning Electron Microscopy & Energy Dispersive Spectroscopy (SEM/EDAX). The novel adsorbent was further characterized by Fourier Transform Infrared Spectroscopy (FT-IR). In order to determine the Pb adsorption potential of CCAC, batch adsorption studies were conducted at room temperature at pH 7. The effects of various experimental parameters such as initial Pb (II) concentration, dose of adsorbent and shaking time on Pb adsorption to CCAC were evaluated. According to the results, the maximum lead removal percentage (89%) was observed at initial Pb (II) concentration of 2 ppm, adsorbent dosage of 1 g/L and 120 minutes of shaking time. Further, the equilibrium adsorption data were analyzed by the Langmuir isotherm model and the Freundlich isotherm model for Pb adsorption onto CCAC. Among the two models, Langmuir isotherm best fitted with the equilibrium data (R2= 0.9916) with a maximum adsorption capacity (q0) of 24.39 mg/g. Based on the results, it can be concluded that CCAC can be considered as an efficient and cost-effective adsorbent for the removal of heavy metals such as Pb from industrial wastewater.

Keywords: "Pb (II) removal ; Chitosan ; Actiavted carbon ; wastewater"

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