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Cost-effective Cu^{2+} and Pb^{2+} remediation using peanut shell-derived biosorbents: a physicochemical investigation

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ABSTRACT

Heavy metals in water bodies are caused chiefly by anthropogenic activities: industrial wastes, agricultural runoff, mining and hazardous waste disposal further the causes. They could enter the water body through varied processes, including those in direct contact with contaminated soils and sediments, along with atmospheric deposition. Recently, nanowaste biomass has been one of the avenues for heavy metal removal from water. The following figures show that these nanoparticles prepared from agricultural and industrial wastes can absorb heavy metal ions. This adsorption involves the complexation of biomass with heavy metal ions, which enhances the binding; thus, these metals can be recovered using different desorption methods. The innovative approach reduces the concentrations of heavy metals to acceptable levels as required by the regulatory guidelines. It also provides a cost-effective and environmentally benign alternative to conventional remediation methods. Various physical techniques then characterised the obtained nano waste materials. The crystal structure of the peanut shell (PS) and its nanoparticles (PSNP) were described by XRD, and the chemical composition was defined according to Raman Spectroscopy and FTIR. Present research identified a biosorbent nanoparticle powder made from peanut shells with 40 to 60 nm particle sizes, as confirmed by FESEM, HRTEM, BET and Zeta analysis. PSNP removal efficiencies achieved for Cu^{2+} and Pb^{2+} were 94% and 91%, respectively. Contact time and pH varied to determine the optimum conditions for removing heavy metal ions from contaminated water supplies.

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1. Introduction

Copper is potentially toxic, and lead represents toxic heavy metals in our surroundings and poses serious health and ecological hazards. Non-biodegradable metals accumulate in the environment and the living organism, causing liver damage, developmental disorders in the foetal brain, kidney diseases and sleep disorders [1,2]. The resultant processes all lead to the electroplating, milling and etching industries generating wastewater that contains hazardous substances and is considered serious ecological concerns, which stringent regulatory measures from the environmental agency shall be availed.

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