



Removal of heavy-metal ions from wastewater samples using magnetic nanoparticles modified with ethylenediaminetetraacetic acid

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ABSTRACT

A study on the application of magnetic nanoparticles (MNPs) prepared from Fe_3O_4 and functionalized with ethylenediaminetetraacetic acid (FF-NH₂/EDTA) is reported. Based on the formation of the metal-EDTA complex, EDTA immobilized nanoparticles were used to extract Cd(II) and Pb(II) ions from aqueous solutions at pH 4. The magnetic nanomaterial can be readily separated from an aqueous solution by applying an external magnetic field. The extraction of Cd(II) and Pb(II) ions by these MNPs was studied and the effect of different parameters (amount of magnetic material, solution pH value and contact time) on the extraction of Cd(II) and Pb(II) ions was investigated. The concentration of Cd(II) and Pb(II) ions was determined using a bismuth film microelectrode by square wave anodic stripping voltammetry before and after the removal process. The results revealed that the magnetic nanomaterial has greater extraction capacity for Pb(II) ions than Cd(II) ions and indicated that 98.8% of Pb(II) could be removed from aqueous solutions at pH 4. FF-NH₂/EDTA loaded with heavy-metal ions can be reused as a magnetic nanomaterial after being treated with HNO₃ or Na₂EDTA solutions.

Keywords: Magnetic nanoparticles; Magnetic nanomaterial; Functionalization; Heavy metal; Removal; Extraction

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