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In Situ Synthesis of Quaternary Ammonium on Silica-Coated Magnetic Nanoparticles and It's Application for the Removal of Uranium (VI) from Aqueous Media

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Abstract

In this study, a novel surface functional layer based on quaternary ammonium is synthesized *in situ* on the surface of silica coated magnetic nanoparticles. The composite is characterized by XRD, FTIR, SEM, VSM, TGA and zeta potential measurements. Sorption/desorption experiments were performed to evaluate its potential to remove uranium (VI) from aqueous solutions. The results indicated that the new composite has a capacity of ~87 mg/g with 120 min equilibrium time with good recyclability and strong magnetic response. The pseudo-second order kinetic model was found to fit the experimental data fairly well, the data also suggested the presence of intra-particle diffusion. The adsorption isotherm befitted Langmuir equation. Thermodynamic analysis for the adsorption process was performed and the values of ΔG, ΔH and ΔS are reported.

Keywords: Uranium (VI); Polyethylenimine; Magnetic nanoparticles;Adsorption; Quaternary ammonium

1 Introduction

Contamination of water resources with heavy metals is a serious environmental problem due to their high toxicity and their tendency to accumulate in the ecosystem [1]. Heavy metals most commonly found in the ecosystem include lead, nickel, zinc, mercury, arsenic,