

Magnetic solid-phase separation of uranium from aqueous solution using high capacity diethylenetriamine tethered magnetic adsorbents

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Abstract

The magnetic solid-phase extraction is a relatively new method among the other solid-phase extraction techniques for the separation of metal ions from aqueous solutions. However, the bare magnetic particles (Fe₃O₄) exhibit poor selectivity for sequestering the metal ions due to the absence of target-specific functional groups (ligands). The selectivity of these magnetic particles can be remarkably improved by covalently tethering the ligands. The Fe₃O₄ particles were prepared by the co-precipitation of ferrous and ferric salts in aqueous ammonia solution. Since the direct covalent linking of ligands on Fe₃O₄ is difficult, and also it is susceptible to redox reaction in acid or alkali medium, it is necessary to protect Fe₃O₄ by silica coating. Then it can be reacted with ligands to obtain the functionalized magnetic particles. Such magnetic particles offer advantage like quick phase separation aided by external magnet. In addition, the Fe₃O₄ particles covalently inscribed in mesoporous silica matrix (MCM-41) and functionalized with ligands offer further advantages in terms of extraction kinetics, high stability, reusability, and higher metal extraction capacity. These advantages are due to the large surface area, porosity and enhanced number of functional groups per unit area. In view of this, the present study deals with the synthesis and characterization of diethylenetriamine (DETA) ligand anchored on silica-coated magnetite (Fe-DETA) and magnetic mesoporous silica (Fe-MCM-DETA). The results obtained from studies like extraction of uranium, mechanism of extraction, speciation, and reusability suggests Fe-DETA and Fe-MCM-DETA are the potential candidates for the extraction of uranium from mine-water and, ground-water.



Biography:

P Amesh has completed his M.Sc degree at the age of 24 years from Andhra University and currently pursuing his PhD (4th year) in the area of “soliphase and magnetic solidphase extraction of heavy nuclides” from Homi Bhaba National Institute, Anushaktinagar, Mumbai, Maharashtra 400094, India.

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