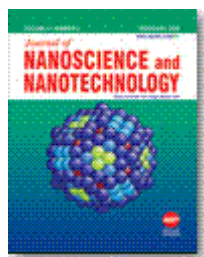


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Extraction of Dysprosium Ions with DTPA Functionalized Superparamagnetic Nanoparticles Probed by Energy Dispersive X-ray Fluorescence and TEM/High-Angle Annular Dark Field Imaging

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...
Abstract

 References

 Citations

 Supplementary Data

 Suggestions

The extraction of dysprosium (Dy^{3+}) ions from aqueous solution was carried out successfully, using magnetite (Fe_3O_4) nanoparticles functionalized with diethylenetriaminepentaacetic acid (MagNP@DTPA). The process was monitored by energy dispersive X-ray fluorescence spectroscopy, as a function of concentration, proceeding according to a Langmuir isotherm with an equilibrium constant of $2.57 \times 10^{-3} \text{ g(MagNP)} \text{ L}^{-1}$ and a saturation limit of 63.2 mgDy/gMagNP . The presence of paramagnetic Dy^{3+} ions attached to the superparamagnetic nanoparticles led to an overall decrease of magnetization. By imaging the nanoparticles surface using scanning transmission electron microscopy equipped with high resolution elemental analysis, it was possible to probe the binding of the Dy^{3+} ions to DTPA, and to show their distribution in a region of negative magnetic field gradients. This finding is coherent with the observed decrease of magnetization, associated with the antiferromagnetic coupling between the lanthanide ions and the Fe_3O_4 core.

Keywords: Dysprosium Ions; Lanthanide Extraction; Nanohydrometallurgy; Rare Earth Processing; Superparamagnetic Nanoparticles

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