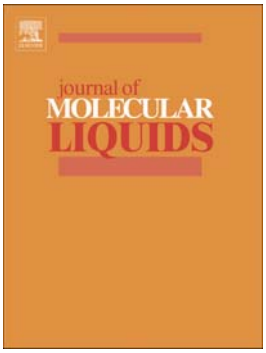

The kinetic and thermodynamic adsorption of Eu(III) on synthetic maghemite

Bin Xu, Yuke Zhu, Haibo Liu, Tianhu Chen

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The kinetic and thermodynamic adsorption of Eu(III) on synthetic maghemite

Bin Xu, Yuke Zhu, Haibo Liu, Tianhu Chen*

School of Resources and Environmental Engineering, Hefei University of Technology, Hefei, 230009, P. R. China

Abstract: In this study, maghemite (γ-Fe_2O_3) nanoparticles were synthesized by calcining limonite under H_2 atmosphere. The adsorption of Eu(III) on maghemite was studied by batch experiments under various experimental conditions. The kinetic adsorption processes were well described by pseudo-second-order model with high correlation coefficient. The macroscopic results showed that the adsorption of Eu(III) on maghemite significantly decreased with increasing ionic strength, indicating that outer-sphere surface complexation predominated their adsorption of Eu(III). The adsorption isotherms indicated that the removal of Eu(III) adsorption on maghemite were fitted by Freundlish models better than Langmuir and D-R models. The calculated thermodynamic parameters showed that the adsorption of Eu(III) on maghemite was a spontaneous and endothermic process. According to XPS analysis, the high effective adsorption of Eu(III) was mainly attributed to oxygen-containing functional groups of maghemite.

Keywords: Synthetic maghemite; Eu(III); XPS analysis; Interaction mechanism.

1. Introduction

The contamination of radionuclides has been paid great attention in the recent years [1]. Eu(III) as an chemical analogue of trivalent lanthanides has been widely investigated on heavy metals [2-4], clay minerals [5,6] and synthetic nanoparticles [7-9]. Sun et al. found that the maximum adsorption capacity of Eu(III) on carbon nanofibers was 91 mg/g at pH 4.5 and T = 298 K [10]. Such high adsorption performance of nanoparticles could be attributed to a variety of oxygen- containing functional groups. However, the expensive precursors and the complicated synthetic procedure involved in these syntheses significantly hinder the large scale production