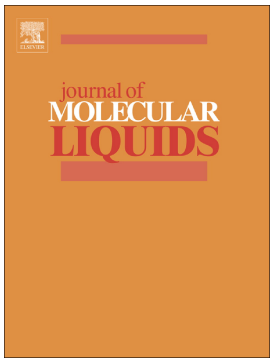

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Facile synthesis of maghemite nanoparticle from waste green vitriol as adsorbent for adsorption of arsenite

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Abstract

Environmental pollution and resource waste caused by waste green vitriol from TiO_2 industry have become an increasingly serious problem. To this end, magnetite nanoparticles were fabricated by the reduction of green vitriol with pyrite under nitrogen at 550 ℃, and then oxidized to maghemite nanoparticles under air at 350 ℃. Meanwhile, arsenite adsorption performances on maghemite nanoparticles were investigated. The properties of the as-formed samples were analyzed by X-ray powder diffraction (XRPD), Fourier transform infrared (FTIR) spectrum, transmission electron microscopy (TEM), nitrogen adsorption- desorption isotherms and X-ray photoelectron spectroscopy (XPS). The analytic results show that the as-formed samples having the average diameter of ~35 nm exhibit pure phase maghemite with cubic structure, and the BET surface area of as-formed samples is 14.63 $m^2 \cdot g^{-1}$. The adsorption results indicate that the isotherm and kinetics for As(III) adsorption on maghemite nanoparticles obey Langmuir isotherm and pseudo-second-order kinetic respectively, and As(III) adsorption is co-controlled via film diffusion and intraparticle diffusion. Adsorption capacity of As(III) obtained from Langmuir isotherm is 14.4 $mg \cdot g^{-1}$ at 55 ℃. Thermodynamic parameters show that As(III) adsorption onto maghemite nanoparticles is regarded as spontaneous endothermic process.

Keywords: maghemite nanoparticles; green vitriol; pyrite; adsorption; reduction reaction

1. Introduction

Arsenic was discharged into water through both natural sources and anthropogenic sources such as

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