

One-step hydrothermal preparation of amino-functionalized carbon spheres at low temperature and their enhanced adsorption performance towards Cr(VI) for water purification

Xianbiao Wang^{a,b,*}, Jin Liu^a, Wenzong Xu^a

^a Anhui Key Laboratory of Advanced Building Materials, School of Materials and Chemical Engineering, Anhui University of Architecture, Hefei 230601, P.R. China

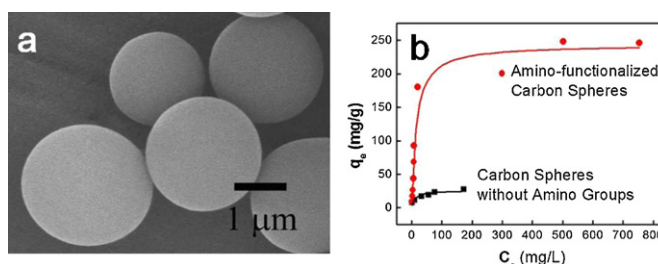
^b Key Laboratory of Materials Physics, Anhui Key Laboratory of Nanomaterials and Nanotechnology, Institute of Solid State Physics, Chinese Academy of Sciences, Hefei 230031, P.R. China

HIGHLIGHTS

- ▶ The amino-functionalized carbon spheres are fabricated with one-step hydrothermal treatment.
- ▶ Such carbon spheres exhibit significantly enhanced adsorption to heavy metal anions.
- ▶ The enhanced adsorption performance was demonstrated by adsorption of Cr(VI) in acidic condition.
- ▶ The enhanced adsorption depends on positive and more reducing surface modified by amino groups.

GRAPHICAL ABSTRACT

Carbon spheres with amino groups on their surface were successfully fabricated by one-step hydrothermal approach with ammonia in the precursor solution. Such carbon spheres showed excellent enhanced adsorption performance for removal of heavy metal anions. (a) Amino-functionalized carbon spheres; (b) the adsorption isotherms of Cr(VI) on amino-functionalized carbon spheres compared with that of carbon spheres without amino groups.



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ABSTRACT

A facile one-step hydrothermal approach to prepare carbon spheres with amino groups on their surface is reported in this work. The obtained products are composed of carbon spheres with uniform size $\sim 2\text{--}3\text{ }\mu\text{m}$. It was found that the addition of ammonia in the precursor solution would lead to modification of amino groups on the surface of carbon spheres. The existence of amino groups was verified by Fourier transform infrared spectroscopy (FTIR) and X-ray photoelectron spectroscopy (XPS). Importantly, the carbon spheres with amino groups showed an excellent enhanced adsorption performance for the removal of heavy metal anions. Their removal capacity of Cr(VI) is ~ 9 times higher than that of carbon spheres without amino groups. The enhanced adsorption performance was assumed to be induced by positively charged and increased reducing surface by modification of amino groups. This work not only supplies a novel low-cost approach to prepare amino-functionalized carbon spheres for water purification but also gives deep insight into understanding the adsorption behavior of carbon spheres.

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1. Introduction

Environmental pollution, especially the heavy metal ions released by industries in waters, has attracted much concern in recent years [1]. Many methods have been developed to remedy the heavy metal ions in water [2]. For instance, reducing the heavy

* Corresponding author at: Anhui Key Laboratory of Advanced Building Materials, School of Materials and Chemical Engineering, Anhui University of Architecture, Hefei 230601, P.R. China. Tel.: +86 551 3828100; fax: +86 551 3828106.

E-mail address: xbwang@issp.ac.cn (X. Wang).