



Preparation of CNTs/silica composite aerogels beads by a water-in-oil emulsion method and a study of their application in the removal of toluene from an aqueous mixture

Mingbo Jiang^{a,*}, Chenggong Ju^b, Zhitao Du^a, Jing Liu^a, Xiao Peng^b, Yan Wu^{b,*}

^aBeijing Institute of Applied Meteorology, No. 8 Minzuyuan Road, Chaoyang District, Beijing, China, Tel.: +(86) 1055482552/ +(86)18910802257; emails: qxjlcs@163.com (M. Jiang), 527239365@qq.com (Z. Du), 454684189@qq.com (J. Liu)

^bCollege of Chemical Engineering and Materials Science, Tianjin University of Science and Technology, No. 29 13th Avenue, Economic and Technologic Development Zone, Tianjin, China, Tel.: +(86) 022-60601457; Fax: +(86) 022-60602845; emails: wuyan_tust@163.com (Y. Wu), juchenggong@tust.edu.cn (C. Ju), pengxiao@tust.edu.cn (X. Peng)

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ABSTRACT

Utilizing silica sol as precursor and carbon nanotubes (CNTs) as additives, the CNTs/silica composite aerogels beads (CS-CABs) with different CNTs content were synthesized by a water-in-oil emulsion method combining sol-gel process. The effects of content of CNTs on the macro- and micro-morphology, even pore structure of CS-CABs were investigated by scanning electron microscopy and N₂ adsorption-desorption measurement. The results reveal that CNTs have great influence on their morphology and pore structure characteristics. When the addition amount of CNTs is 0.4%, CS-CABs (labeled as 0.4% CS-CABs below) yield the best overall performance of removing toluene in aqueous bodies, and its corresponding values of surface area, pore diameter and pore volume are 321 m²/g, 38.56 nm and 1.44 cm³/g, respectively. Furthermore, the 0.4% CS-CABs was characterized by Fourier-transform infrared spectroscopy, X-ray powder diffraction and contact angle analysis, and the mechanism of isotherm and adsorption kinetics were also studied. The maximum saturated adsorption capacity of toluene under 293 K is as high as 214 mg/g, which is about 1.2 and 1.4 times to SiO₂ aerogels beads and CNTs. Freundlich model and quasi-first-order kinetic adsorption model fit the adsorption process well, and it is proved that the adsorption process is dominated by physical adsorption.

Keywords: Silica aerogels; Carbon nanotubes; Aerogels beads; Adsorption; Mesoporous

* Corresponding authors.