Fabrication of Ag/halloysite nanotubes/Fe₃O₄ nanocatalyst and their catalytic performance in 4-nitrophenol reduction

Mengying Gan a,b, Yongqiang Huang a,*, Yunlei Zhang a,b, Jianming Pan b, Weidong Shi b, Yongsheng Yan b

aSchool of Environment, Jiangsu University, Zhenjiang 212013, China, Tel. +86 051188790930; Fax: +86 051188790955; emails: yqhuang@ujs.edu.cn, jsdx2011@126.com (Y. Huang)
bSchool of Chemistry and Chemical Engineering, Jiangsu University, Zhenjiang 212013, China, Tel. +86 051188791800; email: zhenjiangpjm@126.com (J. Pan)

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ABSTRACT

Ag/halloysite nanotubes/Fe₃O₄ (Ag/HNTs/Fe₃O₄) nanocatalyst was synthesized in our work. The structure of the as-prepared composite catalyst was that Fe₃O₄ nanoparticles with the size of 5.0–8.0 nm were loaded in the internal hollow lumen of HNTs and Ag nanoparticles with a mean diameter of 20 nm were randomly deposited on the external surface of HNTs/Fe₃O₄. The resultant Ag/HNTs/Fe₃O₄ exhibited satisfied catalytic activity (with conversion of 100% in 38 min) to the reduction of 4-nitrophenol (4-NP) with sodium borohydride. The catalytic activity was markedly enhanced when the catalysts concentration was increased (the rate constant was gradually increased from 0.40 to 20.18×10⁻³ s⁻¹). Also, the advantage of the obtained magnetic composite catalyst in terms of their fast separation and simple reuse was identified through five successive catalytic and separation process cycles. It could be concluded that Ag/HNTs/Fe₃O₄ showed satisfied catalytic activity, recoverability, and reusability, which showed great potential for practical application for water treatment.

Keywords: 4-Nitrophenol (4-NP); Ag nanocatalyst; Catalytic activity; Magnetic separation; Halloysite nanotubes (HNTs)