*Desalination and Water Treatment*
www.deswater.com

doi: 10.1080/19443994.2015.1061955

57 (2016) 7963–7975
April

Taylor & Francis
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# Reductive decolorization of acid blue 113 azo dye by nanoscale zero-valent iron and iron-based bimetallic particles

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Received 13 March 2015; Accepted 7 June 2015

ABSTRACT

In this study, effectively reductive decolorization of wastewater with synthesized C.I. Acid Blue 113 (AB113) was obtained by nanoscale particles of zero-valent iron (NZVI), bimetallic iron/nickel (nFe/Ni) and iron/zinc (nFe/Zn) which were prepared in the laboratory with large surface area and reductive potential. The particle size was identified less than 100 nm by field emission scanning electron microscope (FESEM) that nickel was homogeneously distributed with iron element by FESEM mapping for nFe/Ni sample. Moreover, the surface areas of bimetallic nanoparticle samples such as nFe/Ni and nFe/Zn were significantly increased than that of NZVI. The effects of experimental variables such as nanoparticle dosage, initial dye concentration, and metal composition on AB113 decolorizing were investigated. From the results, the synthesized AB113 wastewater of high color and total organic carbon (TOC) was successfully reductive decolorized using three iron-based nanoparticle samples. The optimal conditions were obtained the best color removal efficiencies in 30 min while an initial dye concentration of 100 mg $l^{-1}$ and nFe/Ni dosage of 0.2 g $l^{-1}$. Besides, a modified pseudo-first-order kinetic equation was developed to describe the color removal efficiency affected by both initial dye concentration and nanoparticle dosage. The higher nanoparticle dosage, the higher color and TOC removal efficiencies were obtained within the nanoparticle dosage of 0.2 g $l^{-1}$. Furthermore, among three iron-based nanoparticle samples, nFe/Ni preformed the best color and TOC removal as well as durability.

*Keywords:* Zero-valent iron; Bimetallic; Nanoparticles; Reductive decolorization; Azo dye

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*Presented at the 7th International Conference on Challenges in Environmental Science and Engineering (CESE 2014) 12–16 October 2014, Johor Bahru, Malaysia*

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