Desalination and Water Treatment
www.deswater.com
doi: 10.5004/dwt.2021.27497

(2021) 149–164

Removal of Ni(II) from aqueous solutions by sulfide-modified nanoscale zero-valent iron supported by hydroxyapatite (HAP/S-nZVI)

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Received 24 February 2021; Accepted 2 June 2021

ABSTRACT

Sulfide-modified nanoscale zero-valent iron (S-nZVI) has been widely used to remove various contaminants due to its excellent reactivity and selectivity. In this study, hydroxyapatite-supported sulfide-modified nZVI (HAP/S-nZVI) was synthesized and applied for Ni(II) elimination. The excellent performances of HAP/S-nZVI in Ni(II) removal showed that 98.25% of Ni(II) were removed using HAP/S-nZVI (1:0.5) after 15 min, much higher than HAP, nZVI and other adsorbents, and maximum adsorption capacity reached 302.27 mg g^{-1} at pH = 7 and 298 K. The morphology and structure of HAP/S-nZVI (1:0.5) composites were characterized by X-ray diffraction, X-ray photoelectron spectroscopy and transmission electron microscopy and other techniques, which verified the high disperse and activity of nZVI after sulfide-modified and supported by HAP. Furthermore, the stability study confirmed that the sulfide-modified nZVI can retain high Ni(II) removal efficiency than that of pristine nZVI after storage 60 d due to such powerfully protective layers of FeS_x synthesized during the sulfide modification. The pseudo-second-order kinetic model and Freundlich isotherm model more conform to describe the removal of Ni(II). The dynamic adsorption experiments further illustrated its potential ability for real applications.

Keywords: Sulfur-modified; Nano zero-valent iron; Hydroxyapatite; Removal; Ni(II)

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