Synthesis of iron nanoparticles with poly(1-vinylpyrrolidone-co-vinyl acetate) and its application to nitrate reduction

This study aimed to synthesize dispersed and reactive nanoscale zero-valent iron (nZVI) with poly(1-vinylpyrrolidone-co-vinyl acetate) (PVP/VA), nontoxic and biodegradable stabilizer. The nZVI used for the experiments was prepared by reduction of ferric solution in the presence of PVP/VA with specific weight ratios to iron contents. Colloidal stability was investigated based on the rate of sedimentation, hydrodynamic radius and zeta potential measurement. The characteristic time, which demonstrated dispersivity of particles resisting aggregation, increased from 21.2 min (bare nZVI) to 97.8 min with increasing amount of PVP/VA (the ratios of 2). For the most stable nZVI coated by PVP/VA, its reactivity was examined by nitrate reduction in a closed batch system. The pseudo-first-order kinetic rate constants for the nitrate reduction by the nanoparticles with PVP/VA ratios of 0 and 2 were 0.1633 and 0.1395 min⁻¹ respectively. A nitrogen mass balance, established by quantitative analysis of aqueous nitrogen species, showed that the addition of PVP/VA to nZVI can change the reduction capacity of the nanoparticles.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Surface Engineering, Department of Environmental Engineering, Urban Water Engineering, Water Resources Engineering, Korean Advanced Institute of Science and Technology (KAIST)
Number of pages: 10
Pages: 107-116
Publication date: 2014
Peer-reviewed: Yes

Publication information
Journal: Advances in Environmental Research
Volume: 3
Issue number: 2
ISSN (Print): 2158-5717
Ratings:
ISI indexed (2013): ISI indexed no
Original language: English
Keywords: Poly(1-vinylpyrrolidone-co-vinyl acetate) (PVP/VA), Nanoscale zero-valent iron (nZVI), Colloidal stability, Nitrate reduction
DOIs:
10.12989/aer.2014.3.2.107
Source: PublicationPreSubmission
Source-ID: 98207248
Research output: Research - peer-review; Journal article – Annual report year: 2014