Geophysical Research Abstracts
Vol. 21, EGU2019-3377, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

Clay-supported nano zero-valent iron composites for As(III) removal from aqueous solution

Zhihan Tian (1) and Yiqun Gan (2,3)

(1) School of Environmental Studies, China University of Geosciences, Wuhan, China (tzh@cug.edu.cn), (2) School of Environmental Studies, China University of Geosciences, Wuhan, China (yiqungan@cug.edu.cn), (3) Key Laboratory of Biogeology and Environmental Geology, China University of Geosciences, Wuhan, China (yiqungan@cug.edu.cn)

Arsenic is a heavy metal which is highly toxic and carcinogenic to living organisms. The remediation of aqueous solutions containing arsenic has turned into an important environmental issue. Over the last decade, growing attention has been paid to clay-supported nanoscale zero-valent iron (nZVI) composite materials, which are efficient and promising remediation materials in wastewater treatment and groundwater remediation technologies. Halloysite, a multiple-layered aluminosilicate clay with a natural nano-hollow shape, consisting one alumina octahedron sheet and one silica tetrahedron sheet alternating in a 1:1 stoichiometric ratio, is an environmentally friendly candidate for the preparations. Zeolite is a stable aluminum-silicate crystal with abundant micropores, which is suitable for unique adsorption and being a support material. In this study, zeolite, nZVI-halloysite (nZVI-HNT) and nZVI-Zeolite(nZVI-Zeo) were synthesized from natural nano-halloysite by simple and low-cost methods, and used for aqueous As(III) removal. The characterization of these synthetic materials and interactions between materials and As(III) was performed by the N2 adsorption and desorption isotherms, transmission electron microscopy (TEM), Fourier transform infrared spectroscopy (FTIR), X-ray photoelectron spectroscopy(XPS) and X-ray diffraction (XRD). The effects of pH, reaction time, initial As(III) concentration, and adsorbent dosages on As(III) adsorption were also investigated. Both Langmuir isotherm model and Freundlich isotherm model were proposed. The intra-particle diffusion model showed that adsorptions were not the only rate-limiting step. Results showed that the nZVI-HNT and the nZVI-Zeo exhibited strong adsorption properties for As(III), the maximum adsorption capacities were up to 95.4 mg/g and 75.8 mg/g, respectively. As(III) concentration could be reduced to less than 10 μg/L (the WHO recommended value) after adsorbed by nZVI-HNT. The removal mechanisms were attributed to physical-chemical processes, nZVI and the formation of iron oxide promoted the exclusive sorption of As(III) onto adsorbents due to the complex redox mechanism. The results suggested that the halloysite clay mineral is an efficient precursor for preparation of nZVI-HNT and nZVI-Zeo, which could be applied as adsorbents for removal of As(III) from the aqueous solutions.