Enhanced removal efficiency of bromate from aqueous solutions by nanoscale zero-valent iron immobilized on activated carbon

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ABSTRACT

Nanoscale zero-valent iron (nZVI) immobilized on activated carbon (AC) was synthesized via liquid phase reduction route. The samples were characterized by X-ray diffraction, transmission electron microscopy, and Brunauer–Emmett–Teller surface area measurement. The effects of bromate (BrO3−) removal in water with nZVI/AC samples were evaluated. The results show that nZVI/AC presented superior bromate removal efficiency, which is contributed to its reduction and synergistic adsorption/sedimentation of BrO3−. Iron species in nZVI/AC acted as electron mediator and catalyst during bromate reduction, and bromide was the final reductive product. The dosage of nZVI/AC, solution pH, initial bromate concentration, reaction time, and temperature affected the rates of bromate reduction/adsorption. The optimum pH range of bromate removal is wide enough from 4.0 to 9.0. Bromate removal capacity of nZVI/AC was determined to be approximately 25 mg/g. These findings suggest that bromate removal by nZVI/AC can be an effective method for bromate control.

Keywords: Nanoscale zero-valent iron; Activated carbon; Bromate reduction; Adsorption