Abstract

This study aimed to remove arsenite As(III) via co-processes of oxidation and adsorption in a continuous flow system using fixed-bed columns. Manganese oxide octahedral molecular sieve (K-OMS2) and iron-based metal-organic framework (Fe-BTC) were applied as an oxidizer and an adsorbent, respectively. Before use in the column, K-OMS2 and Fe-BTC powders were coated on the ceramic ball through the mechanical orbital shaking technique with each of K-OMS2 and Fe-BTC to ceramic ball ratios of 1 to 50. Then, they were characterized by X-ray diffraction (XRD) and X-ray absorption near-edge structure (XANES) techniques. Finally, the As(III) and arsenate As(V) removal efficiency in every single fixed-bed column of K-OMS2 (coated) and Fe-BTC (coated), respectively, and the two columns combined were conducted. From the results, in the single-column test, K-OMS2 (coated) maintained good efficiency to oxidize As(III) for a 3-round reuse cycle with lower than groundwater standard of Mn and K leaching. In the Fe-BTC (coated) column test, adsorption kinetics fit well with the Yoon-Nelson model having the highest q_0 of 52.60 mg/g and Fe leaching of 0.23 mg/L. With two columns combined, the system enabled to remove total As for 60% within 2,200 min. In part of Cerium Oxide (CeO_2) application, batch experiments indicated that the arsenic removal process was accurately described by a pseudo-second-order kinetic model with maximum removal capacities of 21.27 mg/g. As results of effect of ions species, Phosphate (PO_4^{3-}), Bicarbonate (HCO_3^-), Sulfate (SO_4^{2-}) and Selenium (Se) play the role of inhibiting arsenic removal. Hence, it was suggested that the arsenic removal by the nanoiron process can be improved through pretreatment of these ions, especially Se. In this study proposed the technic for Se removal by NZVI supported by zeolite (Z-NZVI). The results showed that Se could be effectively removed by Z-NZVI.

Keywords: adsorption; arsenic; arsenite; fixed-bed column; oxidation

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