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Development of Pumice and Zeolite Supported Zero Valent Iron Nanoparticle for the Removal of Arsenic (III) From Aqueous Solution

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Large active surface area and high arsenic adsorption capacity make zero valent iron nanoparticle (nZVI) a promising material to remove arsenic from aqueous solution, however, nZVI gets agglomerated due to its high surface energy and the inherent magnetic forces which reduces its adsorption efficiency. The main objective of this study was to synthesize the pumice and zeolite supported nZVI composites denoted as PnZVI and ZnZVI, respectively and their subsequent use for As (III) removal from aqueous solution. The Liquid phase synthesis was used to impregnate the nZVI particles on the surface of pumice and zeolite (porous materials) via reduction of iron by sodium borohydride. The surface morphology study by Fe-SEM showed that the nZVI having a mean size of 80-100 nm, distributed uniformly over the surface of granular (0.5-1.0 mm) pumice and Zeolite. A series of batch studies were then performed to determine the applicability of developed composites as a potential adsorbent for As (III) removal at varying experimental conditions. Adsorption kinetics along with the equilibrium isotherms were studied in detail for the developed adsorbent at neutral pH. Results of the batch experiments demonstrated the quick removal of As (III) at initial stages followed by a slower removal rate, making it a two-stage process. The removal capacity for As(III) by PnZVI and ZnZVI were 49.74 and 42.64 mg As/g of the developed composites respectively. The developed nZVI composites were found to be an effective adsorbent for As (III) removal over a wide range of experimental conditions which can be used for in-situ remediation of As polluted groundwater resources.