Removal of Arsenic (III) From Aqueous Solution Using Pumice and Zeolite Supported Zero-Valent Iron Nanoparticle

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Arsenic is a naturally occurring toxic element and is widely distributed in natural ecosystems. Due to the natural as well as human-induced actions, its presence in groundwater is expanding its horizons and is becoming a major concern in lower Gangetic plains. Large active surface area and high arsenic adsorption capacity make nano-zero valent iron nanoparticle (nZVI) a promising adsorbent to remove arsenic species but due to high surface energy and the inherent magnetic forces of nZVI, it gets agglomerated and reduces its efficiency for adsorption. The objective of the present study was to develop supported nZVI over the porous material (pumice and zeolite) and their use for As (III) removal from aqueous solution. The chemical approach, i.e., Liquid Phase Synthesis, was used to infuse the iron nanoparticle on the surface of the porous material via reduction of iron in the presence of the base material by sodium borohydride. The shape, size, and surface morphology studied by Fe-SEM and shows a uniform distribution of nZVI over the surface of granular (0.5-1 mm) base materials. Batch studies were performed to determine the applicability of prepared composites as an adsorbent for As (III) removal at varying initial As (III) concentration (0.5 -5 mg/L), adsorbent dose (1-10 g/L) and pH (3-12). Adsorption kinetics and isotherms were studied in detail for the synthesized adsorbent to deduce the overall performance. 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 supported nZVI was found to be an effective adsorbent for As (III) removal and due to its mechanical strength, it can be applied for in-situ remediation of arsenic-polluted groundwater

Keywords: Arsenic, Nano Zerovalent Iron, Remediation, Pumice and Zeolite

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