

Removal of arsenite by Fe(VI), Fe(VI)/Fe(III), and Fe(VI)/Al(III) salts: effect of pH and anions

Abstract:

The removal of arsenate and arsenite from drinking water poses challenges, especially when arsenite is present in a significant amount. The removal of arsenite by K_2FeO_4 , $K_2FeO_4/FeCl_3$, and $K_2FeO_4/AlCl_3$ salts was studied at pH 6.5 and at an initial As concentration of 500 $\mu g\ As(III)L^{-1}$. The arsenite removal in Fe(VI)/Fe(III) and Fe(VI)/Al(III) systems was also examined as a function of pH (6.0-8.0). Arsenite was first oxidized by Fe(VI) to arsenate, which was subsequently removed through adsorption by Fe(III) or mixed Fe(III)-Al(III) oxy/hydroxide phases. Fe(VI)/Al(III) salts had higher removal efficiency of arsenite than Fe(VI) and Fe(VI)/Fe(III) salts. A molar ratio of 6(3/3):1 for Fe(VI)/Al(III) to As(III) decreased arsenite concentration from 500 to 1.4 $\mu g\ L^{-1}$ at pH 6.5. Arsenite removal increased with a decrease in pH from 8.0 to 6.0 and exhibited less pH dependence in the Fe(VI)/Al(III) system than in the Fe(VI)/Fe(III) system. Aluminum chloride salts performed better than $FeCl_3$ and $FeCl_3/AlCl_3$ salts (Fe:Al=1:1) in removing As(V) from water. Effect of anions (phosphate, silicate, bicarbonate, nitrate, and sulfate) on the arsenite removal by Fe(VI)/Al(III) salts at pH 6.5 was examined. Phosphate, silicate, and bicarbonate ions interfered with the removal of arsenite in water. Nitrate and sulfate had none to minimal effect on arsenite removal. Fe(VI)/Al(III) salts showed a potential for removing arsenite below the current drinking water standard (10 $\mu g\ L^{-1}$).