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**Removal of Arsenite by Ferrate [Fe(VI)] in combination with Fe(III) or Al(III) Salts: Effect of pH, and Anions**

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Abstract:

Arsenic contamination of drinking water poses a serious health risk throughout the world. In natural water, arsenic is primarily present in inorganic forms as oxyanions of trivalent arsenite [As(III)] and pentavalent arsenate [As(V)]. The current treatment methods are not as effective for As(III) removal as for As(V) removal. Considering both forms are often present in water because of their slow redox transformation, there is a need to develop a method to remove both arsenite and arsenate from water. The objective of this study is to evaluate the efficiency of ferrate[Fe(VI)] in combination with Fe(III) or Al(III) salts to remove arsenite from water below the drinking water standard of  $10 \text{ } \mu\text{g L}^{-1}$ . The effect of pH, and anions on the removal of arsenite was also evaluated. Ferrate[Fe(VI)] as the potassium salt ( $\text{K}_2\text{FeO}_4$ ) was prepared by hypochlorite oxidation of ferric nitrate. Batch experiments were conducted at pH 6.5 by adding various concentrations of ferrate ( $6.7\text{-}20 \text{ } \mu\text{M}$ ) and ferric chloride or aluminum chloride ( $13\text{-}127 \text{ } \mu\text{M}$ ) to the arsenite solution ( $6.7 \text{ } \mu\text{M}$ ). After 24 h of equilibration, the samples were filtered using  $0.2 \text{ } \mu\text{m}$  filter membranes. Arsenic was analyzed by atomic absorption spectrometer using graphite furnace and hydride generation techniques. Fe(VI)/Al(III) salts were much more effective than Fe(VI)/Fe(III) to remove arsenite in drinking water. A molar ratio of 6:1 for Fe(VI)/Al(III) to As(III) reduced arsenite concentration from 500 to  $1.4 \text{ } \mu\text{g L}^{-1}$  at pH 6.5. Arsenic removal exhibited less pH dependence in the Fe(VI)/Al(III) system than in the Fe(VI)/Fe(III) system in the pH range 6 - 8. Phosphate, silicate and bicarbonate ions interfered with arsenite removal whereas nitrate and sulfate had none to minimal effect on arsenite removal. Overall, Fe(VI)/Al salts demonstrated potential practical applications for removing arsenite and arsenate below the current drinking water standard.

Impact Statement:

The results of this study has advanced our scientific knowledge and provided technical solution to address water quality issues particularly arsenic contamination which has a great detrimental impact on the quality of human lives.

Category: Other Water Resource Topics  
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