

Oxidative Adsorption of Arsenic by Fe-Mn Oxides

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Extended Abstract

Treatment of As(III) can be a challenging task due to its high mobility and small affinity to mineral surfaces and that pre-oxidation step to As(V) is necessary for enhancing removal efficiency[1]. In this study, Fe-Mn oxide was synthesized through chemical precipitation in solutions with varying concentrations of $\text{FeCl}_3 \cdot 4\text{H}_2\text{O}$ and $\text{MnO}_2 \cdot 4\text{H}_2\text{O}$ for oxidative adsorption of As(III) in aqueous solution. The synthesized Fe-Mn oxide mineral possessed oxidation property rendered from manganese dioxide phases and adsorption capacity from the iron oxide phases. The Fe-Mn oxide was characterized for surface area, morphology, composition, and magnetic property and bench scale laboratory experiments were carried out to investigate potential utility of the mineral in treating As(III) under the mineral dose of 1 g/L and 1mg/L As(III). The results of kinetic experiments revealed the oxidation of As(III) occurred in very short period time (less than 30 min.), followed by adsorption to iron oxide phase, with its removal efficiency being the highest for the mineral synthesized under 1:0.25 Fe:Mn condition. The maximum adsorption capacity determined from isotherm experiments was found to be 200 mg/g. The removal of As(V) remained relatively constant in the pH 3-6 at around 60% removal but dramatically decreased when pH was raised to 10. The ionic strength in the range of 0.001-0.1 M NaNO_3 and the presence of competing anion (0.1-1 mM PO_4^{3-}) had little effect on the As(III) removal. The overall results of this study demonstrated the potential utility of the Fe-Mn oxide for treatment on the As(III) in field applications for high removal capacity and magnetic property that enables better separation of reacted material after treatment process.

References

- [1] M. Baloch, S. Talpur, H. Talpur, J. Iqbal, S. Mangi, S. Memon, "Effects of arsenic toxicity on the environment and its remediation techniques: a review," *Journal of Water and Environment Technology*, vol. 18, no. 5, pp. 275-289, 2020.