

Reduction of Tc(VII) by Pyrite: Influence of Substituted Ions

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The remove of Tc(VII) by synthetic pure pyrite is independent on the pH, however, it is depended on the pH for natural pyrite and synthetic pyrite incorporated with Co, Ni, Cu and Zn. The kinetical study shown that the removal of Tc(VII) by synthetic pure pyrite can be best fitted with the first-order kinetics. However, the removal kinetics for natural pyrite and pyrite adopted with impurities could not be described by a single exponential function, suggesting a multi-stage reaction which is similar to the removal of Tc(VII) by Ti-containing magenetite[1]. Aqueous chemical analysis shown that after 54 days reaction, up to 74% Tc(VII) has been immobilized by synthetic pure pyrite, comparing with more than 85% uptake by impurity-containing pyrite. Moreover, nearly 100% removal of Tc(VII) was observed in Ni, Cu and Zn-containing systems (Figure 1).

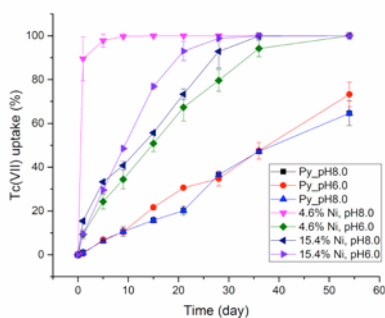


Figure 1: Comparing the Remove of Tc(VII) by pure pyrite and Ni-containing pyrite.

According to the XANES data, all the immobilized Tc has been reduced to Tc(IV). Therefore, it is proposed that Tc(VII) was reduced directly at the pyrite-water interface following the deposition of Tc(IV). EXAFS fitting indicated that most of the Tc(IV) phases are similar to $\text{TcO}_2 \cdot (\text{H}_2\text{O})_x$, with Tc-O distance at $\sim 2.0 \text{ \AA}$. Unexpectedly, TcS_2 was suggested to be the dominated reduction product in the Ni-pyrite system.

[1] Liu et al (2012) *Geochim Cosmochim Acta* 92,67-81.