Sequestering Uranium and Technetium through Co-precipitation with Aluminum in ORIFRC Acidic Sediments


OBJECTIVES

- Provide long-term immobilization and stabilization of contaminant U and Tc through subsurface pH manipulation

Scientific Questions Addressed:

1) What is the effectiveness of pH manipulation in sequestering U(VI) and Tc(VII) with Al-oxide/hydroxides?

2) What are the aqueous speciation during pH titration? Can it be predicted by geochemical modeling?

3) What is the stability and mobility of precipitated or co-precipitated U(VI) and Tc(VII)?

RESULTS – Batch Titration

- U(VI) and Tc(VII) rapidly precipitate out with Al. Nearly 100% U(VI) and >90% Tc(VII) removed at pH 5.5.
- U(VI) and Tc(VII), and Al removed quicker at lower pH (<4.2) in the presence of sediments than in the groundwater (pH ~5.5).
- Ca2+ removed at higher pH and only in the presence of sediment; similar pattern observed with other divalent cations, probably due to the sorption of hydroxy-metal ions and precipitates.

RESULTS – Column Flow Experiments

- U(VI) and Tc(VII) remained in the groundwater column.
- U(VI) and Tc(VII) removal was observed in the column with Al in the feed solutions.

EXPERIMENTAL APPROACH

- Batch titration of the contaminated groundwater and sediment (sample of aqueous speciation, mineral precipitation, EARS, etc.)

BACKGROUND

- ORIFRC 5.0 ponds, Area 3 soil and groundwater: highly contaminated with U (59 mg/L), Tc (3.5 mg/L), Sr (60 µM), and Ni & Co (15 µM).
- High nitrate concentration (up to 10,000 mg/L).
- High Al3+ content (up to 600 mg/L).

RESULTS – Batch Titration


PUBLICATIONS
