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COMPLEXATION OF Am^{3+}, Cm^{3+} AND Eu^{3+} WITH EDTA AT VARYING IONIC STRENGTH

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The Waste Isolation Pilot Plant (WIPP) is a U.S. Department of Energy facility located in southeastern New Mexico, approximately 655 m (2150 ft.) below ground surface in a bedded salt, Permian evaporite formation. This mined geologic repository is for the permanent disposal of transuranic (TRU) waste from defense related activities and has been receiving waste since March 1999. Organic ligands such as ethylenediaminetetraacetic acid (EDTA), citric acid, oxalic acid etc., that are present in significant amounts in the WIPP wastes have a strong tendency to form complexes with actinides and their presence could increase the solubility of actinides in brine.

In this study, protonation and the stability constants of EDTA with Am^{3+}, Cm^{3+} and Eu^{3+} were determined as a function of ionic strength ($NaClO_4$) using potentiometric titration and an extraction technique, respectively. Under the experimental conditions the formation of only the 1:1 complex was observed for these metal ions over an entire range of ionic strengths. The stability constants show a decreasing trend from I = 0.1 to 2.0 m, followed by an increase to I = 6.60 m, which is consistent with the usually observed trend with ionic strengths. The nature of the species formed between these trivalent metal ions and EDTA was established by measurement of luminescence lifetime for Cm^{3+} and Eu^{3+}. The predominant species, $M(EDTA)(H_2O)_3^-$ was observed in the pcH range 3.6 -7.0, while species, $M(EDTA)(H_2O)_2(OH)^{2-}$ was formed at pcH>9.0. In addition, using the stability constant values for actinides with EDTA as a function of ionic strengths, the Pitzer parameters for the actinide interactions with brine components were calculated. The results of this study will improve understanding of the solution thermodynamics in the WIPP repository and could be useful for evaluating high level waste.

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