



Contribution ID: 896

Type: Poster

Multi-method investigation of europium(III) complexation with the decorporation agent HEDP over a wide pH range

Tuesday, 17 May 2022 17:15 (6 minutes)

In case radionuclides (RN) enter the food chain and are incorporated by humans, they pose a possible health risk due to their radio- and chemotoxicity. In case of such incorporation, HEDP (1-Hydroxyethylidene-1,1-diphosphonic acid; etidronic acid) and DTPA (diethylenetriaminepentaacetic acid; pentetic acid) are common decorporation agents for uranium and transuranium RN, respectively.

Since HEDP also binds trivalent actinides, An(III), we investigated the complexation of HEDP with Eu(III) as a luminescent non-radioactive analog of An(III) at $I = 0.1$ M (NaCl) from pH 1 - 12 using a variety of spectroscopic and analytical methods. The pH-dependent ligand behavior was studied with infrared spectroscopy with attenuated total reflection (ATR-FT-IR) combined with density functional theory (DFT) and pKa values were determined by nuclear magnetic resonance spectroscopy (NMR). The Eu(III)-ligand system was, then, investigated by time-resolved laser-induced fluorescence spectroscopy (TRLFS), ATR-FT-IR, solution and solid-state NMR as well as mass spectrometry with inductive coupled plasma (ICP-MS) and with electron spray ionization (ESI-MS).

Depending on both the pH and the metal to ligand ratio, several Eu(III)-HEDP complex species were observed and characterized within this study. Over a wide pH range and especially at physiological values, the complexation of Eu(III) and HEDP leads to the precipitation of hardly soluble species.

This work is funded by the German Federal Ministry of Education and Research (BMBF) under grant number 02NUK057B and part of the joint project RADEKOR.

Primary author: Dr HELLER, Anne (Technische Universität Dresden, Analytical Chemistry, Radiochemistry/Radioecology)

Co-authors: Mr SENWITZ, Christian (Technische Universität Dresden, Analytical Chemistry, Radiochemistry/Radioecology); Dr FOERSTENDORF, Harald (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Resource Ecology); Prof. TSUSHIMA, Satoru (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Resource Ecology); Dr PAASCH, Silvia (Technische Universität Dresden, Analytical Chemistry, Bioanalytical Chemistry); HOLTSMANN, Linus (Leibniz Universität Hannover, Institute of Radioecology and Radiation Protection); Dr KRETZSCHMAR, Jérôme (Helmholtz-Zentrum Dresden-Rossendorf, Institute of Resource Ecology)

Presenter: Dr HELLER, Anne (Technische Universität Dresden, Analytical Chemistry, Radiochemistry/Radioecology)

Session Classification: Environmental Radioactivity

Track Classification: Radionuclides in the Environment, Radioecology