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Complexation of Eu(III) in artificial digestive media by aminopolycarboxylic acid EGTA

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Radionuclides released from nuclear accidents can be widely distributed and even enter the human food chain. If ingested, they interact with the fluids from the digestive system and can cause necrosis or carcinogenesis of human cells. To remove these radionuclides, decorporation agents are used. Clinical approved decorporation agents like ethylenediaminetetraacetic acid (EDTA) or diethylenetriaminepentaacetic acid (DTPA) that are used against heavy metal poisoning show low oral activity.[1] Therefore, the focus of this work is set on EDTA and DTPA related compound ethylene glycol-bis(β-aminoethyl ether)-N,N,N′,N′-tetraacetic acid (EGTA). Europium(III) is used as a non-radioactive analogue for trivalent actinides like americium and curium. The overall goal of the study is to expand the knowledge of processes underlying the interactions of radionuclides in the human digestive system in the presence of decorporation agents on a molecular level. To derive thermodynamic parameters, the Eu-EGTA-system is investigated at different physiological relevant pH values and molar ratios, using time-resolved laser-induced fluorescence spectroscopy (TRLFS), NMR spectroscopy, electrospray ionization mass spectrometry (ESI-MS) and isothermal titration calorimetry (ITC). Between pH 3 and 9 a very stable complex with a Eu(III)-EGTA-ratio of 1:1 is observed and comprehensively characterised from the ligands and metals perspective. Our knowledge on the speciation of Eu(III) in artificial biofluids of the human digestive system is now extended by the impact of EGTA on the speciation to measure the suitability of EGTA as possible decorporation agent for usage in radiation protection.[2] This work is funded by the German Federal Ministry of Education and Research (BMBF) under grant number 02NUK057A and part of the joint project RADEKOR.

[1] P. W. Durbin, Health Phys. 2008, 95, 465.
[2] C. Wilke, A. Barkleit, T. Stumpf, A. Ikeda-Ohno, J. Inorg. Biochem. 2017, 175, 248.

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