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Interaction of Cm(III) with human serum transferrin studied by Time-Resolved Laser Fluorescence Spectroscopy (TRLFS)

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In case of an accidental release of radionuclides to the environment actinides can cause a serious health risk upon incorporation. There is only deficient knowledge about the chemical behavior and toxicity of actinides in man. With regard to the development of potential decontamination therapies, a detailed understanding of the mechanisms of relevant biochemical reactions is necessary.[1] Human serum transferrin is an iron carrier protein in the blood. It is folded into two lobes housing the metal binding sites for Fe(III).[2] In the normal blood serum, only 30 % of transferrin is saturated with iron, which indicates that there is a high capacity for the complexation of other metal ions.
Human serum transferrin is found to be contaminated by EDTA. In the present work a purification process was developed using size exclusion chromatography and centrifugal filters. After purification the complexation of Cm(III) with transferrin is studied at various pH values and transferrin concentrations by time-resolved laser fluorescence spectroscopy (TRLFS). The results show that two different species are formed. In the pH range from 6.3 to 7.7 the spectra are dominated by the Cm(III) transferrin species I, displaying an emission band at 600.0 nm. The fluorescence lifetime of 97 µs correlates with a coordination of six water molecules indicating a threefold coordination mode with the protein and/or a synergistic anion such as hydroxid or carbonate at the binding site.[3] Above pH 7.7 the Cm(III) transferrin species II with an emission band at 620.3 nm is formed. The extraordinary bathochromic shift of 26.6 nm relative to the emission band of the Cm(III) aquo ion and the fluorescence lifetime of 221 µs confirm incorporation of Cm(III) at the transferrin binding site resulting in a 4-fold coordination via amino acid groups (Asp-63, Tyr-95, Tyr-188 and His-249) of the protein. The remaining coordination sites of Cm(III) are occupied by synergistic anions and water molecules.

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Primary author: BAUER, Nicole (Institute for Nuclear Waste Disposal, Karlsruhe Institute of Technology, Germany)

Co-author: PANAK, Petra (University of Heidelberg, Institute of Physical Chemistry)

Presenter: BAUER, Nicole (Institute for Nuclear Waste Disposal, Karlsruhe Institute of Technology, Germany)

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