

CE-ICP-MS as speciation technique to analyze the complexation behavior of Europium, Gadolinium and Terbium with organic ligands

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For the long-term disposal of radioactive waste, detailed information about geochemical behavior of radioactive and toxic metal ions under environmental conditions is necessary. In the project europium, gadolinium and terbium as homologues of americium, curium and berkelium were used and their sorption and desorption behavior onto Opalinus clay was studied. Natural organic matter (NOM) can play an important role in the immobilisation or mobilisation of metal ions due to complexation and colloid formation. This complexation behavior could interfere the sorption of metal ions onto Opalinus clay. In addition to humic acid (HA) we used in Opalinus clay natural appear organics like lactate, formate or propionate. Therefore, we investigated the complexation behavior of the metals with NOM. As a selected technique, capillary electrophoresis (CE) was hyphenated with inductively coupled plasma mass spectrometry (ICP-MS). With this method, both the uncomplexed metal ions and metal organic complexes can be simultaneous detected in one analysis step.

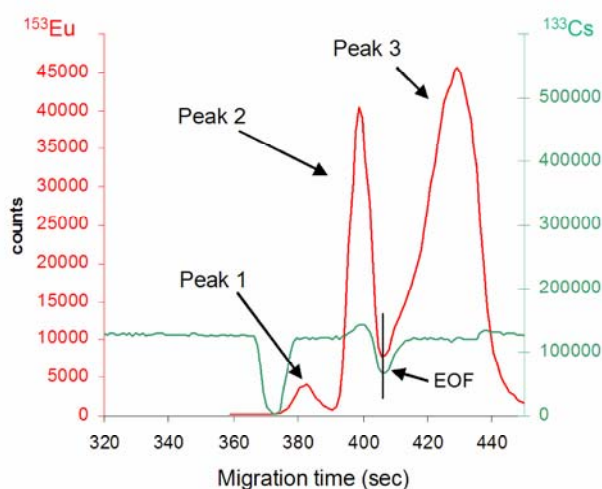


Fig. 1: Typical electropherogram of uncomplexed and HA-complexed Eu species and Cs as CE flow marker.

Fig. 1 shows a typical electropherogram with three Eu species. The first signal (peak1) represents the uncomplexed metal before CE separation. The aquatic Eu^{3+} ion was complexed with the acetate in the electrolyte buffer and migrates during the separation as EuAc^{2+} towards the CE cathode. Peak 2 and peak 3 pictured the HA complexed metal ions. The difference between peak 2 and peak 3 is caused by the stability of the bindings. During the separation the weak bound Eu^{3+} dissociates out of the HA complex and migrates as peak 2 towards the cathode.

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