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Complexation of Sn with Boom Clay Natural Organic Matter and its effect on Sn sorption onto Illite, Montmorillonite and Boom Clay

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^{126}Sn is a long-lived fission product and as such a waste relevant radioisotope. Understanding its fate under deep-geological repository conditions is of importance for safety assessment. However, the data on Sn solubility, speciation, sorption and transport properties in repository conditions are extremely limited.

In Belgium, Boom Clay (BC) is investigated as a potential host rock for high-level and intermediate-level waste disposal. It contains a significant amount of dissolved organic matter (DOM) and it was shown to strongly influence the mobility of several radionuclides and notably of tetravalent actinides [1]. By chemical analogy, the speciation, sorption and mobility of Sn(IV) in BC is assumed to be controlled by its binding to DOM but until now it has never been experimentally verified [2].

In this work the complexation of ^{113}Sn with BC DOM under present-day BC conditions – i.e. in $NaHCO_3$ 0.015 M – was experimentally quantified using the ultrafiltration technique [3]. It was shown that BC DOM forms strong complexes with Sn that control the Sn speciation and could significantly increase Sn solubility in BC pore water. The investigated range of Sn and DOM concentrations ($DOM_{tot}/Sn_{tot} = 2.8 \times 10^2$ to 5.7×10^3) also showed that the binding constants are dependent on the metal loading ($5.0 < \log K^{(Sn\text{-}DOM)} < 6.0$). A two-site Langmuir isotherm is used to describe this dependency and it highlights the binding of Sn on both strong and weak sites present on DOM.

In a complementary study, sorption of ^{113}Sn on Illite du Puy and Montmorillonite was quantified in both $NaClO_4$ 0.015 M and $NaHCO_3$ 0.015 M in presence and absence of BC DOM. Sorption of Sn was reduced in presence of DOM. The experimental results are described with the 2SPNE/CE model. Sorption experiments of ^{113}Sn on BC are ongoing.

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