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Adsorption of Trivalent Lanthanides and Actinides by Marine Sediments

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Knowledge of the chemical behaviour of (radio)toxic elements in natural/environmental systems is of fundamental importance for the performance of environmental impact assessments and the application of protection measures after possible contamination. The interaction of actinides with marine sediments is of particular interest because marine sediments constitute the final receptors for the majority of actinides (Th, Am, Pu). In order to study the chemistry of trivalent actinides (e.g. Am(III), Cm(III)) often trivalent lanthanides are used as analogues, because lanthanides in aqueous solutions are generally stable in the trivalent oxidation state, present similar chemical behaviour as trivalent actinides, are non-radioactive and possess useful spectroscopic/fluorescent properties. In this study we have investigated the interaction of Nd(III) and Eu(III) with two different types of marine sediments as a function of various parameters (e.g. pH, $[M(III)]_0$, I, t, contact) to evaluate their effect and get more information on the adsorption of Nd(III) and Eu(III) by marine sediments. Sorption of Eu(III) by marine sediments from aqueous solutions of varying pH 4 –6.5, fixed ionic strength of 0.1 M (NaClO₄) and at room temperature has been studied by fluorescence spectroscopy (LFS). In this context, the effect of the particle coating with natural organic matter (NOM, e.g. humic acid) on the adsorption properties of the sediment samples has also been studied. According to the experimental results the adsorption of Nd(III) and Eu(III) ions by marine sediments is (a) a relatively fast process (b) the adsorption data are well described by the Langmuir isotherm and (c) the adsorption properties (e.g. adsorption capacity, pH and ionic strength effects) of the different sediment types differ significantly from one another, depending on the (surface) composition.

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