Surface complexation models for prediction of radionuclide adsorption on clay minerals

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Surface complexation models (SCMs) have been developed in the last decades to describe metal ion sorption to clay minerals. In principle, these models can provide relevant information about sorption of radionuclides to be used in performance assessment (PA) of radioactive waste disposal systems. However, these SCMs have been developed in parallel with the acquisition of distinct adsorption datasets, which are not always consistent with each other. The objective of this study was to compare new experimental adsorption results with literature data to understand these discrepancies and to propose a SCM approach that could be amenable to determine sorption related retention parameters necessary for PA calculations. This study focused on lead (Pb) adsorption on montmorillonite, illite and in a natural clay (Callovo Oxfordian) as case studies of a strongly sorbing radionuclide that undergoes a range of retention processes depending on the chemical conditions. The experiments showed that many experimental artifacts lead to misinterpretations of the processes underlying the measured retention values. These include Pb precipitation in the presence of carbonate in solution. The determination of SCM parameters to provide sorption related information for PA of clay minerals should rely on preliminary building of an adequate adsorption database, where adequate means that all experimental conditions are met to quantify surface complexation only[1]. The building strategy for such a database will be exemplified with a vast range of data from the literature.

REFERENCES

1. Orucoglu E., Tournassat C., Robinet J.C., Madé B., Lundy M., 2018, Applied Clay Science, 163, 20-32.