Barium adsorption onto cementitious materials

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Cement-based materials are widely used in radioactive waste repositories and the analysis of their retention properties is important for the understanding of radionuclide migration mechanisms in these systems.
Barium is an alkaline earth element, which is often employed as chemical analogue of radioactive Ra, because their similar ion radius and chemical behaviour. Additionally, in the Group 2A, Ba is located between Ra and Sr, the last being another element of interest in the field of nuclear waste management.

The adsorption of ^{133}Ba was studied in different solid materials: fresh and degraded hardened cement paste; calcium silicate hydrate (C-S-H) phases with different Ca/Si ratios (0.8, 1.2 and 1.6) and the mineral ettringite. The solids were previously characterised in detail.

The aim of this study is to understand the retention behaviour of alkaline earths elements under cementitious conditions. Sorption kinetics was analysed during a time span of months and retention was analysed in a wide range of radionuclide concentrations.

The whole of results were interpreted and modelled considering the properties of the solids and the chemistry of the pore-water used in each case. The potential competitive effects of monovalent or divalent cations for sorption sites were analysed as well as the importance of pH, ionic strength and sulphate content, this last being especially relevant in Ba and Ra (co)precipitation processes.