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Generation of inorganic colloids in the chemical disturbed zone in the proximity of a cementitious repository

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The current concept for the disposal of intermediate- and low-level waste in the UK involves the placement of grouted waste confined in stainless steel canisters in a cementitious repository deep underground. While the cement will buffer the porewater to a highly alkaline pH, contributing to the retardation of radionuclides by precipitation, this could potentially create an alkaline plume moving from the repository into the host rock. The alkaline cement leachate can react with the host rock, promoting dissolution of some mineral phases, precipitation of new phases and the generation of colloids that may affect radionuclide movement within the chemically disturbed zone of the host rock.
The aim of the present work is to study the generation of inorganic colloids from a generic host rock in contact with an alkaline plume. An intact core of sandstone has had an artificial "young"cement leachate (pH 13.10) under CO2-free conditions pumped through it. The solution at the outlet was then sequentially ultrafiltered in-line through a rig fitted with
12 µm, 1 µm, 30 kDa and 1 kDa membranes. After passing more than 500 pore volumes of the young cement leachate, the imaging of the filters by Scanning Electron Microscopy (SEM) in combination with X-ray microanalysis showed no evidence of the formation of inorganic colloids under these experimental conditions. On the other hand, analysis of the outlet solution by ICP-MS indicates that there is significant dissolution of some mineral phases present in the sandstone, however no difference were found between the elemental composition of the solution before and after ultrafiltration. Additional tests with artificial colloids indicate that silica and iron oxides colloids are unstable in "young"cement leachate.

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