

Removal processes of dissolved elements in groundwater leached from waste by redox reaction

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In the safety assessment of radioactive waste disposal, understanding the migration behaviour of radionuclides near the surface environment is important for assessing exposure in the biosphere. After radionuclides migrate from the subsurface to the biosphere via groundwater to aquatic environments such as well water and river water, their concentrations are controlled by dilution by surface water and adsorption to soil and sediments. A more realistic assessment of the amount of radionuclides emerging to the surface and their subsequent mobility and bio-transferability requires an understanding of the processes that groundwater may be subjected to immediately after emerging to the surface.

At Ningyo- toge Environmental Engineering Center, JAEA in Okayama Prefecture, heavy metals such as U and As are leached by groundwater from a sedimentation site where residues after U extraction from uranium ore are disposed, and JAEA manages the quality of these waters and discharges them into an off-site river. The groundwater immediately after passing through the sedimentation site is considered to contain high concentrations of divalent iron, but during a certain period of storage iron oxidation forms iron hydroxide minerals, which are deposited in the mill tailing pond. In this study, this anoxic groundwater and the water that subsequently migrated to the mill tailing pond and in situ sediments were sampled to investigate the trace element compositions and mineral compositions of the sediments. The results showed that trace elements such as REEs, As and U in the groundwater after the upwelling decreased with change of redox condition of water. Geochemical modeling based on these results showed that changes in the concentrations of these elements can be explained by adsorption reactions on iron hydroxide produced by the oxidation of divalent iron present in groundwater.

Geochemical analysis of trace elements suggests that it is possible to assess the control of migration and concentration limitation of nuclides by iron hydroxide minerals.

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