

Removal of radioactive strontium from sea water by biogenic calcium carbonates

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One of the possible method to eliminate ⁹⁰Sr released by the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident to environments is coprecipitation of Sr with carbonates minerals. Bacteria ureolysis is known to be able to in-situ eliminate Sr from groundwater by producing carbonates. We have studied the elimination of ⁹⁰Sr from sea water into biogenic calcite.

A marine microbe of strain TK2d inoculated in the liquid medium contained (per L) 3.74 g Marine broth, 20 g urea, 30 g NaCl with 5.0, 1.0, 0.1, and 0.02 mM SrCl₂. Sr²⁺ concentrations were monitored by ICP-OES. The precipitates were analyzed by SEM, TEM, and XAFS.

When 1.0 mM Sr was dissolved in the liquid medium, the concentration of Sr decreased up to 0.02 mM within 10 days, indicating that most of Sr in the solution was eliminated within 10 days. SEM and TEM analyses showed that needle shaped precipitates containing Ca and Sr was formed. The elemental mapping showed that Sr was present at the same position of Ca, indicating that Sr was coprecipitated with Ca. The XANES analysis of Sr in the precipitates showed that the XANES spectrum resembled with that of Sr coprecipitated with an abiotic Ca carbonates and differed from that in SrCl₂ and SrCO₃, indicating that Sr was neither adsorbed on the Ca carbonates, nor precipitated independently as SrCO₃, but was coprecipitated with CaCO₃. Thus, biological coprecipitation of Sr with Ca carbonates is effective method for the elimination of radioactive Sr from saline solution.