Vol.4, No.4, pp.303-312, 2016 / J. Soc. Remed. Radioact. Contam. Environ.

Original

Decontamination of Radioactive Cesium from Contaminated Soil and Clay Mineral by a Thermal-chemical Treatment Method and Prediction of its Decontamination Mechanism

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Summary

A thermal treatment in the presence of sodium chloride (NaCl) and calcium carbonate ($CaCO_3$) at a middle temperature of 1000 to 1100 ºC is useful for decontamination and volume reduction of radioactively contaminated materials. This method is different from the conventional chloride volatilization using calcium chloride. Therefore, the volatilization mechanism of radioactive cesium (r-Cs) is not clarified. In this study, we applied the thermal-chemical treatment to a model of contaminated soil, which was mainly composed of vermiculite (one of clay minerals) containing stable Cs. In addition, we investigated its volatilization mechanism based on X-ray diffraction analysis of treated samples and TG-DSC-MS analysis of the thermal treatments. Heating up to more than 1000 ºC and addition of NaCl and $CaCO_3$ are required to diminish key mineral phases in the model, resulting in volatilizing Cs sufficiently. We suggested the possibility that Cs was volatilized together with NaCl gas from its molten salt. Furthermore, we applied this thermal-chemical treatment to actual soil contaminated by r-Cs. The relevant removal ratio for r-Cs was obtained. This demonstrated that r-Cs was successfully decontaminated by the thermal-chemical treatment even though the soil included only a small amount of vermiculite.

Key Words: Radioactive cesium, Clay mineral, Thermal treatment, Volume reduction, Decontamination technique