Study on Volume Reduction of Cesium Contaminated Soil by Magnetic Separation

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Abstract — In this study, we developed a new volume reduction method for contaminated soil by magnetic separation. We succeeded in selective separation of paramagnetic 2:1 type clay minerals, which strongly adsorb Cs, from 1:1 type clay minerals. As a result, it was shown that the radiation dose of 1:1 type clay minerals can be reduced.

We examined magnetic separation conditions for efficient separation of 2:1 type clay minerals. First, the separation rate of each particle size of 2:1 type clay minerals was calculated by particle trajectory simulation, because magnetic separation rate largely depends on the objective size. According to the calculation, 93.8% of 2:1 type of clay minerals could be separated at 7 T. Next, high gradient magnetic separation (HGMS) experiment was conducted using superconducting magnet. 97 % of 2:1 type clay minerals were separated under the condition of 7 T and 3 cm/s of flow rate. The separation experiment of 2:1 type clay minerals from the mixture of 1:1 and 2:1 type clay minerals was performed at 7 T. 97 % of 2:1 type clay minerals were selectively separated from the model soil. It was shown magnetic separation with superconducting magnet would contribute to the volume reduction of contaminated soil.

Keywords (Index Terms) — Clay minerals, magnetic separation, radioactive Cs, superconducting magnet, volume reduction.