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Volume Reduction of Cesium Contaminated Soils by Magnetic Separation

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Summary

A large amount of soils contaminated by radioactive Cs are discharged by the decontamination works after the nuclear accident, and there is urgent need for the volume reduction technologies. We have investigated the possibility of volume reduction method by combination of wet classification and magnetic separation, which can collect high-dose 2:1 type clay minerals selectively. One of the important requirements toward practical use is to reduce the radiation dose of sand gravel and 1:1 type clay minerals to the reusable level. Two issues prevents the soil from sufficient dose reduction; one is that sand gravel and 1:1 type clay minerals also adsorb Cs ions, and the other is that organic components such as humic substances aggregates the soil particles which degrades the separation accuracy. We proposed a physical and chemical pretreatment with low environmental burden. Polishing the soil in the low-concentration potassium fertilizer strips off the surface of sand gravel and migrates Cs ions to 2:1 type clay from other soil components. In addition, mixing with potassium carbonate solution, which is used as food ingredient, dissolves organic polymers in the soil. We succeeded to migrate Cs and dissolve humic substances by the treatments.

Based on the results, we applied the classification and magnetic separation methods to actual contaminated soils in Fukushima. The soil can be separated into the low-dose and high-dose portions by separation of 2:1 clay. The low-dose soil after the separation achieved the clearance level or the dose that can be used for road materials with 30 cm cover soil, which shows the feasibility of effective volume reduction. This technique is prospective as one of the effective volume reduction techniques with low environment load.

Key Words: Magnetic separation, Soil classification, Radioactive cesium, Clay minerals, Volume reduction