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Original

Decontamination of Radioactive Cesium from Contaminated Incineration Bottom Ash by a Thermal-chemical Treatment Method and Estimation of its Decontamination Mechanism

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Summary

A thermal-chemical treatment method for soil decontamination was applied to remove insoluble-radioactive (r-Cs) from contaminated bottom ash (BA) discharged from two actual incineration plants dealing with municipal solid waste. By heating BA at 1000 to 1200 °C in the presence of sodium chloride (NaCl) and calcium carbonate ($CaCO_3$), r-Cs was successfully removed as follows; r-Cs removal ratios at 1100 ºC and at 1150 ºC were 90.0% and 95.7%, respectively. We found difference in rate-determining step during the removal process of r-Cs between small size of BA (smaller than 2 mm) and large size of BA (larger than 2 mm). Therefore, the latter had to be pulverized to fine particles with a diameter of 10 μm or less as a pretreatment for improving mass transfer. Furthermore, 98.6% of r-Cs was removed by heating up to 1200 ºC as far as the small size of BA. From effect of the amount of the two additives on r-Cs removal ratio and also difference in crystal structure before and after the treatment, we consider molten NaCl is predominantly responsible for volatilization of r-Cs from BA as a mechanism of the present BA decontamination. During the treatment, in addition, the major aluminosilicate minerals in BA disappeared, and then Ca-rich minerals such as larnite (Ca_2SiO_4) were newly generated. $CaCO_3$ is considered to promote generation of the new minerals. Finally, we revealed that similar r-Cs removal mechanism occurred during heating pollucite, which is assumed to be a model mineral containing r-Cs in BA, in the presence of the two additives.

Key Words: Radioactive cesium, Municipal solid waste, Bottom ash, Thermal treatment, Decontamination technology