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Original

Fate of Strontium during Waste Incineration and Leachability from Incineration Residues (Ⅱ): A Mineralogical Study and Thermodynamic Equilibrium Calculation

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● **Summary** ● The fate of radioactive cesium (Cs) and strontium (Sr) in waste incineration plants is important, especially because such radioactive species spread to areas near the Fukushima-Daiichi Nuclear Power Plant following the nuclear accident in 2011. As a result, municipal solid waste, disaster waste, and waste generated from decontamination efforts in these areas were contaminated by these radioactive species. At our institution, the concentration and leachability of ^{134}Cs, ^{137}Cs, and ^{90}Sr in the incineration residues of such contaminated wastes were measured. This study aimed to identify the mineralogical composition of incineration residues of various wastes using X-ray diffraction (XRD) and scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM-EDS) and conduct thermodynamic equilibrium calculations to elucidate the behavior of Sr during waste incineration and flue gas condensation processes. We wanted to understand the chemical forms of Sr in the incinerator ash and the reasons behind the relatively high leachability of Sr from the fly ash. We discovered that potential products of Ca, which is an element homologous to Sr in the periodic table, in the bottom ash included amorphous and crystalline silicates, aluminosilicates, phosphate, and sulfate. In contrast, the fly ash primarily contained calcite, portlandite, CaClOH, and amorphous and crystalline silicates. In sewage sludge incineration ash, the chief components were phosphate, sulfate, and amorphous materials containing phosphorus and silicon. Owing to the similarities in the chemical reactivity of Ca and Sr, the probable chemical forms of Sr in the ash are likely similar to Ca compounds. The results from our thermodynamic equilibrium calculations support this hypothesis. Based on our results and calculations, we speculate that Sr species, which leach from fly ash in leaching tests, are most likely in the form of Sr chlorides and hydroxides.

Key Words: strontium, waste incineration, ash, leaching test, thermodynamic equilibrium calculation

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