# THE IMPACT OF DIATOMITE ON IMMOBILIZATION OF LEAD IN MUNICIPAL SOLID WASTE INCINERATION FLY ASH

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## 1. Introduction

Municipal solid waste incineration fly ash (MSIWFA) is usually classified as hazardous waste owing to high contents of toxic metals. Therefore, MSWIFA must be immobilized by regulated treatments in order to dispose to controlled landfill as non-hazardous waste. Nowadays, chemical immobilization using organic chelating reagent is preferred in Japan [1]. However, COD components derived from chelating reagent requires long-term leachate treatment at landfill. Therefore, inorganic immobilization might be better than organic chelating reagent. Previous researches have been focused on metal decontamination in aqueous environments using diatomite owing to its high surface area [2]. Diatomite consists mainly of amorphous silica [3]. Therefore, it has also been used cement materials owing to pozzolanic reaction between diatomite and lime [3]. Thus, diatomite might have possibility of metal immobilization for MSWIFA. In this context, this study investigated the impact of diatomite on immobilization of toxic metals, in particular lead (Pb), in MSWIFA.

## 2. Materials and methods

MSWIFA sample was collected from bag filter of a stoker-type incinerator in Japan. The incineration capacity is 80 tons/day. In this facility, $Ca(OH)_2$ was injected into flue gas in order to neutralize acidic gas such as HCl and SOx. In this study, food grade diatomite (DiatomaceousEarth.com, U.S.) was used as additive in order to immobilize Pb in MSWIFA. In immobilization experiment, 10 % diatomite and 75 % distilled water were added to MSWIFA by weight. The mixture (FA-DE) was kneaded by mixer (DLC-1J, Cuisinart). The kneaded FA-DE was wrapped by a thin plastic sheet and stored in sealed plastic bottle in order to keep moistening condition. It was cured at 25, 50, and 70 °C for 14 days, respectively. After 1, 7, and 14 days, cured FA-DE was dried in a desiccator. After drying, cured FA-DE was subjected to leaching test. The cured FA-DE added distilled water were shaken at 200 rpm for 6 hours in leaching test bottle. The liquid to solid ratio was 10. After shaking the bottle, the suspension was filtrated through 0.45 µm membrane filter in order to obtain leachate. Leaching concentration of Pb in leachate was measured by ICP-MS (720 ICP-MS, Agilent Technologies) and -OES (7500CX ICP-MS, Agilent Technologies). Mineral compositions of cured FA-DE were determined by XRD (MultiFlex, Rigaku Co.). Raw MSWIFA without diatomite (RFA) was also subjected to same immobilization experiment as mentioned above in order to investigate the exact impact of diatomite on Pb immobilization.

## 3. Results and discussion

Figure 1 shows leaching concentration of Pb. The results indicated that Pb

concentration significantly decreased by addition of diatomite. After curing at 70 °C for 7 days, Pb concentration form cured FA-DE was less than regulated limit for landfill disposal (< 0.3 mg/L). In addition, curing by higher temperature could immobilize Pb quickly. Figure 2 shows XRD patterns by curing at 70 °C for 14 days. Cured RFA consists of Ca-bearing minerals ($CaSO_4$ and CaClOH) and inorganic salts (KCl and NaCl). In contrast, XRD peaks of Ca-bearing minerals were disappeared in cured FA-DE. It is considered that diatomite reacted with Ca-bearing minerals through pozzolanic reaction and then form calcium silicate minerals [3]. Curing by higher temperature accelerated their pozzolanic reaction. Thus, Pb in MSWIFA could be immobilized by newly formed calcium silicate minerals [4].

## 4. Conclusion

This study investigated the impact of diatomite on immobilization of Pb in MSWIFA. The results showed that Pb in MSWIFA could be immobilized effectively by newly formed calcium silicate minerals by curing with heat treatment.


## Acknowledgment

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## References


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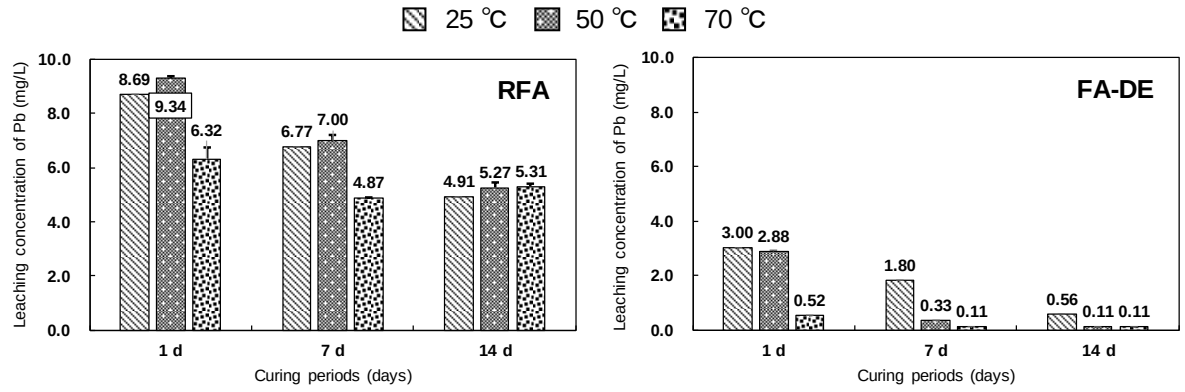


Figure 1 Leaching concentration of Pb from cured MSWI FA

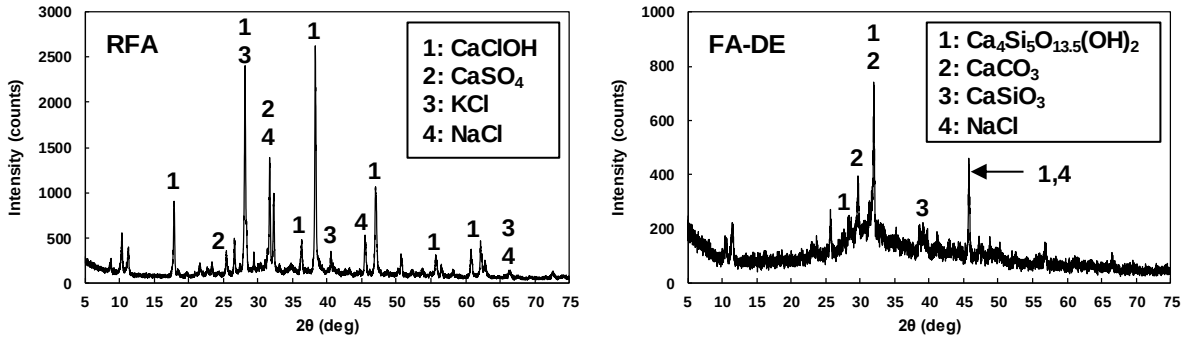


Figure 2 XRD patterns of cured MSWIFA at 70 °C for 14 days