Insolubilization of Pb Contained in MSW Fly Ash by Co-heating with Aluminosilicates

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INTRODUCTION

**MSWI Fly Ash**
(MSWI: Municipal Solid Waste Incinerator)

Fly Ash: 1% of MSW, contains soluble salts, dioxins and heavy metals. It's hazardous waste.

Fly Ash Processing:
1. Solidification with Cement
2. Thermal Treatment
3. Chelating Agent
4. Acid Extraction
   * Etc.

Most prevalent method in Japan. Decomposition of chelate-metal complex and re-release of Pb after several years are reported.

**Aluminosilicate**

Aluminosilicate are minerals composed of Al, Si, and O, plus counter cations. Feldspar is a kind of nature aluminosilicate mineral that make up about 41% of the Earth’s continental crust by weight.

**Lead Glaze**

Lead glaze is mainly made by feldspars and PbO, it is used as cover for pottery and porcelain. After combustion, lead glaze will become glass-like structure to protect the ware from penetrate by water and insolubilize Pb in the glaze.

PREVIOUS RESEARCH

**Using Feldspars to Insolubilize Cs**

- After co-heating, Cs is captured in amorphous glass phase formed on surface of Potassium Feldspar (KAISI₂O₈).

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**METHOD**

Aluminosilicate + Fly Ash / Heavy metals chloride

Co-heating residue

Muffle furnace

Water Washing

Filtrate

Insoluble – AR

Aqua Regia Digestion

Filtrate

Insoluble – HF

RESULT

**Co-heating Aluminosilicates with chloride**

Materials for Co-heating:
Aluminosilicates + Chloride
7g

For Object-1

The figures is showing:
1. Insoluble part of heavy metals exist, which should not without co-heating.
2. Compare to 900°C and AIF, 700°C and sol can make more heavy metals insoluble.

**Aluminosilicates can insolubilize heavy metals in chloride.**

**Co-heating Sol Reagent with Fly Ash**

Materials for Co-heating:
Sol Reagent + Fly Ash
3 / 6 / 9 g

For Object-2

The figures is showing:
1. No soluble and volatile Pb.
2. But the insoluble Pb is over initial amount of Pb in the fly ash.

**Aluminosilicates can insolubilize Pb in Fly Ash.**

- **Confirmation Run – Co-heating by Tube Furnace**
  - Volatile Pb is nearly Zero. Volatile: 0.21%

- **Confirmation Run – Retest Soluble Pb**
  - Table: Soluble Pb in the residue after co-heating with 3g FA

EXPERIMENT

**Objective**

1. To prove whether aluminosilicate can insolubilize Heavy metals or not.
2. To confirm aluminosilicate can insolubilize Pb in fly ash.
3. To find out the optimal condition for aluminosilicate to insolubilize Pb in fly ash, different setting of heating were examined.

**Materials - Aluminosilicates**

1. Amorphous Indian Feldspar: Made by grinding powder one with planetary ball mill at 450rpm for 6 hours.


**EXPERIMENT**

1. Mixed materials then be dried and ground to powder.

2. After co-heating, Cs is captured in amorphous glass phase formed on surface of Potassium Feldspar (KAISI₂O₈).

The optimal temperature to insolubilize Cs is 700°C.

**Optimal condition for insolubilizing Pb**

- Table: Soluble Pb in the residue after co-heating with 3g FA

- **Soluble Pb is ppb level.**

Fig. A surface lead-glazed earthenware salted horse statue, Tang Dynasty, colored lead glaze.

**Elemental Composition of Fly Ash**

- The fly ash used in this study.

**Pb in Fly Ash:**
- Pb in fly ash is mainly chloride, which is easily soluble.
- Concentration determined by Leaching Test (JLT-13) of this FA is Pb: 63 mg/L