



Extraction of Chlorides from MSW Fly Ash

Department of Earth and Environmental Engineering
at Columbia University

By Adam Penque, Nicholas Themelis, and Marco Castaldi

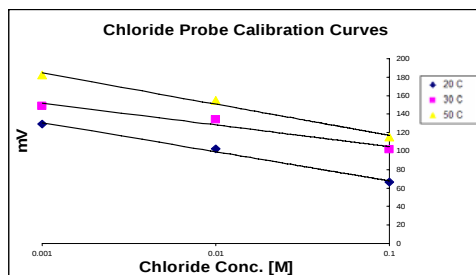
Introduction

- High chloride levels must be treated before MSW ash can be used for beneficial applications, i.e. reclaim old coal mine sites and as a building material.
- Fly ash contains roughly 20 times more chlorides than bottom ash. Treating only fly ash separately would minimize material handling.
- Our goal is to develop an extraction technique to remove chlorides from fly ash experimentally we will identify the optimum extraction parameters specific addressing temperature and liquid to solid ratio.
- Our investigation aims to maximize chloride removal while minimizing removal of heavy metals. As part of a greater treatment scheme, our process would be used in conjunction with other metal treatment processes.



Method/Setup

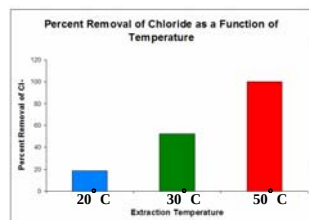
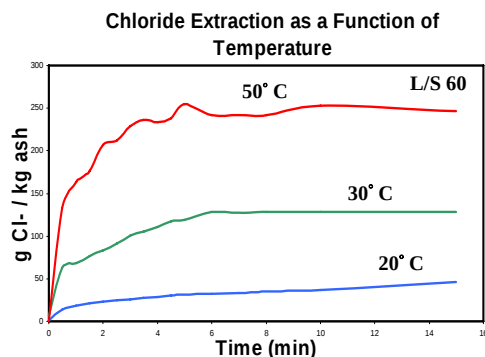
- Chloride extraction was done in batch method; a glass beaker was used as the reactor. A motorized mixer was used for constant agitation.
- Temperature was controlled by circulating water bath.
- Chloride concentration was measured using a Chloride electrode. Calibration of probe was done using a standard NaCl solution.



Chloride calibrations were prepared for each extraction temperature to account for temperature effects on the probe.

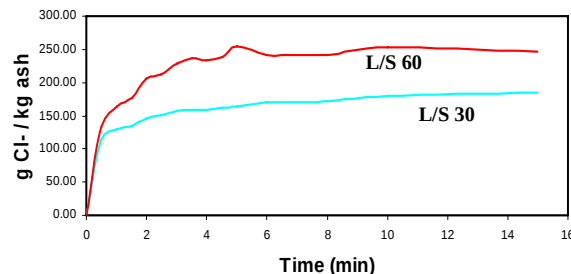
Results

- Extractions were performed for 15 min at 20°C, 30°C, and 50°C to evaluate the effect of temperature on chloride removal.
- For preliminary investigation a liquid to solid ratio of 60 (by mass) was used.



- All extractions peaked chloride removal after 4-5 min.
- 50°C found to be optimal temp for Chloride extraction
- Extractions were performed at 50°C using a L/S ratio of 30 in order to gauge its effects of less water.

Chloride Extraction Effect of Liquid to Solid Ratio at 50°C



- A liquid to solid ratio of 60 had roughly 30% greater removal of chloride than L/S 30.

Metal Release Data

- Following all extractions, samples were vacuum filtered and the filtrate was kept for metal analysis.
- Filtrate will be analyzed for lead, cadmium and mercury.
- Our goal is to understand the relationships between metal removal as a function of temperature and L/S just as done for chlorides.
- Metal analysis is done using Flame Atomic Absorption

To date preliminary analysis have been begun for all samples

Continuing work

- Ongoing experimental work will focus on optimizing extraction conditions for chloride, further defining process parameters including temperature and liquid to solid ratio.
- Additionally issues of process feasibility and scale up will be tackled.
- Future work will investigate beneficial uses for extraction residue, experiments will address the gas phase catalytic activity and scrubbing capabilities.



Solicitation for Samples

MSW WTE operators our work requires your ash. All ash samples handled by WERT are kept completely confidential with respect to plant/company source. Please contact Adam Penque aap2111@columbia.edu or Dr. Themelis njt1@columbia.edu for study involvements.