



The Tenth International Conference on Waste Management and Technology (ICWMT)

## Chlorides removal and control through water-washing process on MSWI fly ash

Xiongfei Chen<sup>a</sup>, Yafan Bi<sup>b,\*</sup>, Hongbo Zhang<sup>c</sup>, Jia Wang<sup>d</sup>

<sup>a</sup>*School of Chemistry and Environment Engineering, Wuhan Institute of Technology, Wuhan 430074, China*

---

### Abstract

Wet pretreatment is widely employed as the most economic method to treat municipal solid waste incineration (MSWI) fly ash. Meanwhile, much wastewater containing high concentration of chlorides generated during the wet process if the liquid-solid weight ratio was not appropriate. So measures were taken to control the dissolving amounts of calcium chlorides which contribute to the further reuse as basis with cement kiln and remove more chlorides like sodium chloride (NaCl), potassium chloride (KCl) and so on which produce negative impact. In laboratory experiments, the water-washing process was applied to study the typical MSWI fly ash and investigate the optimal parameters. First, multi-step water-washing process was carried out and key parameters influencing the removal rate of chlorides were determined. Then, cyclic water-washing process was conducted to overcome defects on the basis of the former. In this experiment, calcium hydroxide as a cheap and easily got chemical was added to affect the ionic equilibrium and solubility equilibrium associated with calcium. When compared with the original fly ash, calcium chlorides remained in the treated fly ash won't be a huge loss while other chlorides are greatly reduced. Combined with the demand for raw materials of low chlorine in cement production, it's potential for MSWI fly ash after wet treatment to be applied in cement kiln when this ash in the cement kiln is at a lower rate of substitution.

© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of Tsinghua University/ Basel Convention Regional Centre for Asia and the Pacific

*Keywords:* MSWI fly ash; water-washing; chlorides

---

---

\* Corresponding author. Tel.: 02787053875.

E-mail address: [biyafan@qq.com](mailto:biyafan@qq.com)

## 1. Introduction

With the continuous development of urbanization and enhancement of people's living standard, domestic municipal waste output is growing at an annual rate of 8% to 10%<sup>[1]</sup>. Basic methods of disposing municipal solid waste are consisted of landfill, incineration and composting in which incineration is widely used because it fulfills the requirement of waste disposal in harmlessness, reduction and reuse. However, waste incineration technology also has its shortcomings and the main residue of MSWI fly ash enriches a higher concentration of heavy metals and other hazardous substances like dioxins and furans. Additionally, this fly ash is classified as hazardous waste by "National Catalogue of Hazardous Wastes" because of its high leaching concentration of heavy metals and toxic equivalent of dioxins.

Currently, effective treatments for MSWI fly ash are mainly cement solidification<sup>[2]</sup>, heat treatment<sup>[3]</sup>, chemical stabilization<sup>[4]</sup> and resourceful utilization<sup>[5]</sup>. Considering the similarity of main chemical composition between MSWI fly ash and raw materials such as coal ash, slag and so on which are widely used in cement industry, this MSWI fly ash could be employed to replace part of raw materials in cement and concrete manufacturing<sup>[6,7]</sup>. More importantly, heavy metals, dioxin, furan and other toxic substances could be stabilized or completely decomposed in the unique environment of high temperature which is up to 1450°C and alkaline atmosphere in cement kiln<sup>[8]</sup>. However, there will be a lot of volatile containing high concentration of metal chlorides from fly ash due to the high temperature which present great threat to the normal operation of the kiln system and even the quality of products from the cement kiln<sup>[9]</sup>. Obviously, the chlorides in the MWSI fly ash produced during incineration are the main consideration of its comprehensive utilization.

Therefore, chlorides must be removed and controlled before the MSWI fly ash is utilized for resource. A lot of soluble chlorides such as NaCl, KCl, CaCl<sub>2</sub> and CaCl<sub>2</sub>•Ca(OH)<sub>2</sub>•H<sub>2</sub>O were removed after the process of water-washing and the results of energy spectrum analysis also demonstrated that the loss of a large number of chlorides, which proved that it was a good way for water-washing to remove the high concentration of chlorides in MSWI fly ash<sup>[10]</sup>. Other scholars conducted washing experiments for MSWI fly ash to remove chlorides and a method of taking advantages of solubility difference in ethanol to recover these chlorides was developed which meant that large quantities of chlorides in MSWI fly ash could be removed<sup>[11]</sup>.

However, much wastewater containing high concentration of chlorides and heavy metals generated after experiments especially if the goal of the trial is to remove all chlorides by washing singly. So the research in this paper is to determine key parameters which help to remove and control chlorides. And in order to improve the recycling rate of water resources, cyclic washing process was developed. Additionally, calcium hydroxide was added to stop the calcium components from losing severely. This technology will be a supplement to the washing treatment for the MSWI fly ash.

## 2. Materials and methods

### 2.1. Materials

The MSWI fly ash for this research, which appears to be grey colour, comes from Beijing municipal solid waste incineration plants in China. About 80% of the particle size is below 100µm. Bulk density of the fly ash is around 0.73g/cm<sup>3</sup>. Moisture content is about 4.22% and pH for the filtrate of the fly ash is about 12.72. Fly ash samples after grinding sieved through a 150-mesh standard sieve, then it was dried under 105°C after 8h to constant weight. Finally it was stored for experiment in brown glass bottle.

### 2.2. Methods

Multi-step water-washing process and cyclic water-washing process were conducted sequentially to determine the optimal parameters for the removal and control of chlorides in MSWI fly ash. Orthogonal Test of L<sub>16</sub>(4<sup>5</sup>) is employed during former experiment to study the parameters like liquid-solid ratio (L), temperature (T), washing time (W), vibration rate (V) and frequency of dealing (D), influencing the removal rate of chlorides (F<sub>1</sub>) and soluble solids (F<sub>2</sub>). The water-washing experiments were carried on with deionized water as the extracting agent in water

Download English Version:

<https://daneshyari.com/en/article/4401586>

Download Persian Version:

<https://daneshyari.com/article/4401586>

[Daneshyari.com](https://daneshyari.com)