A METHOD OF REMOVING QUICKLY WASTE INCINERATOR FLY ASH

BACKGROUND OF T H E INVENTION

1. Field of the Invention

The present invention relates generally to a processing technology of waste incinerator fly ash, and more particularly to an innovative one which is designed to remove quickly harmful substances in the waste incinerator fly ash, such as: heavy metal and Dioxin, allowing to processing and recycling them in compliance with relevant regulations.

2. Description of Related Art

The waste fly ash generated by the incinerator is referred to as waste incinerator fly ash. As the incineration temperature is normally between 850–1,050°C, the heavy metal in the waste, with its boiling point lower than the incineration temperature, is easily gasified, and then fed into air pollution control facility of the incineration plant along with waste gas and fly ash, where the heavy metal is condensed and attached onto the fly ash. In addition, if organic substance containing chlorine, etc, is contained in the waste, precursor synthesis and de novo synthesis will occur during incineration and air pollution process to form a very little of Dioxins, most of which are attached onto fly ash.

The hazardous property of waste incinerator fly ash is determined by the criterion of harmful substances: (1) the concentration of heavy metal subject to toxicity characteristic leaching procedure (TCLP), and (2) Dioxin's total toxicity equivalent concentration (Dioxin total quantity). Generally, it is required to check regularly the

heavy metal's concentration and Dioxin's total quantity from the toxicity characteristic leaching procedure of fly ash for domestic incineration plants; in most cases, Pb dissolution is higher than the common specified value of TCLP (e.g.: 5.0 mg/L), and in some cases Cd dissolution is higher than the specified value of TCLP (e.g.: 1.0 mg/L), with the dissolution of other heavy metals lower than the specified value of TCLP. Besides, Dioxin's total quantity of fly ash from the incineration plants is lower than the common specified value (e.g.: 1.0 ng I-TEQ/g). It is thus learnt that, the waste incinerator fly ash is a harmful waste caused by heavy metal with its dissolution higher than TCLP specified value.

Traditionally, the waste incinerator fly ash is firstly processed through solidification/stabilization process with cement and chemical stabilizer, and then the fly ash condensate is conveyed to an independent landfill site for burying. However, such method makes it impossible to recycle the fly ash, but also increases the waste volume and space of landfill site; moreover, due to incorrect solidification of fly ash or rainfall in the landfill site, the harmful substances in the fly ash condensate are easily dissolved into the water and soil environment. So, it is important to know how to remove efficiently harmful substances in the waste incinerator fly ash, rather than solidification and burying, such that the fly ash could be recycled in compliance with the relevant regulations (including: heavy metal dissolution and Dioxin's total quantity of TCLP).

Amongst the patents of processing fly ash and bottom slag (bottom ash or bottom residue) generated from incineration or high-temperature treatment of waste or other substances, solidification/stabilization or gasification or high-temperature treatment technologies are generally adopted based on the operating mechanisms: the solid harmful substances in the fly ash are solidified with the solidification and stabilization

agent; or decomposed or converted into gaseous substances and then removed in high temperature; or inorganic substances in fly ash are melted to packet the fly ash without dissolution. With the use of extraction mechanism, the solid harmful substances in the fly ash are removed to liquid phase, as shown in US patent No. 7635796 obtained by the inventor.

The inventor of the present invention has developed the technology herein through continuous improvements.

SUMMARY OF THE INVENTION

The primary objective of the present invention is to provide a method of removing quickly harmful substances in the waste incinerator fly ash, which are sourced from the converged fly ash of the waste incineration plant (namely, converged fly ash before entering solidification facility); so, it enables to remove quickly and efficiently the harmful fly ash and reuse it in a recyclable and environmental-friendly way.

The present invention provides a method of removing quickly harmful substances in the waste incinerator fly ash, which contains the following steps:

Preparation of fly ash and fresh water: prepare the converged fly ash generated by the waste incineration plant as well as necessary fresh water;

Stirring extraction: add fresh water into the fly ash at low liquid-solid ratio and then conduct stirring extraction;

Immersion extraction: immerse the fly ash slurry extracted at high speed, such that the substances are released from the fly ash;

Solid-liquid separation: conduct solid-liquid separation of fly ash slurry after immersion extraction;

Drying: dry up the fly ash to remove moisture after solid-liquid separation;

Pulverization: the dried fly ash must be pulverized to avoid agglomeration for further use;

Test: test TCLP heavy metal dissolution and Dioxin's total quantity of pulverized fly ash; if OK, the pulverized fly ash can be recycled as a harmless substance; otherwise, return to step 1.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow chart of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention will be more readily understood upon a thoughtful deliberation of the following detailed description of a preferred embodiment of the present invention with reference to the accompanying drawings:

FIG. 1: a flow process chart of the preferred embodiment of the present invention.

Referring to FIG. 1--a preferred embodiment of the present invention showing a method of removing quickly harmful substances in the waste incinerator fly ash, which comprises the following steps:

Step 1: preparation of fly ash and fresh water 100: the fly ash refers to the converged fly ash collected by air pollution control facility of waste incineration plant; the fresh water refers to tap water, distilled water or softening water.

Step 2: stirring extraction 110: add fresh water into the fly ash, fully stir the fly ash and fresh water at high speed, then pulverize the fly ash for extraction, "liquid weight: solid fly ash (dry weight) ratio": 2–5: 1, stirring speed: 500–1,500 rpm, duration:

3–10 min. In this step, fly ash is stirred and pulverized at high speed, such that the substances in the fly ash are quickly released for mass transfer; in addition, numerous OH^- ions are formed from the reaction of the alkali metal, alkaline -earth metals oxide and water in the fly ash; owing to low liquid-solid ratio, the concentration of OH^- ions is high, so that most of Pb, Zn species and some Cd species in the fly ash will have reaction with OH^- to form dissoluble species for shifting to the liquid phase; the other heavy metal species of lower concentration in the fly ash easily form precipitate of hydroxide for chemical reaction.

Step 3: immersion extraction 120: after high-speed stirring extraction, place fly ash slurry aside 10–60 min for immersion extraction. In this step, the substances in pulverized fly ash are continuously released to realize slow diffusion between solid and liquid phases.

Step 4: solid-liquid separation 130: the fly ash slurry after immersion extraction is separated from the liquid waste by means of pressure filtering, vacuum filtering or centrifugal filtering. In this step, the solid fly ash is separated from liquid waste for further processing of the solid fly ash prior to recycling; in addition, the liquid waste containing heavy metals, etc, must be treated by waste water treatment facility.

Step 5: drying 140: after solid-liquid separation, heat up the fly ash at 100–200°C to remove moisture in the fly ash.

Step 6: pulverization 150: pulverize the dried fly ash to the particles less than 1.0 mm using a common pulverizer. Pulverization is required for further recycling since fly ash is easily dried and agglomerated.

Step 7: test 160: test TCLP heavy metal dissolution and Dioxin's total quantity of pulverized fly ash; if OK, the pulverized fly ash can be recycled as a harmless substance; otherwise, return to step 1.

Additionally, the liquid waste containing heavy metals, etc, must be treated by waste water treatment facility after solid-liquid separation. As Dioxin in fly ash isn't dissoluble in water, acid and alkali, a slight amount of Dioxins in the fly ash is shifted to waste water by means of high-speed stirring, pulverization of fly ash and solid-liquid separation, along with some water and tiny colloid. Thus, the solid Dioxin in the fly ash is also lower than the specified value.

Here are the results of converged fly ash generated from a big incineration plant based on the patent technology of the present invention:

		Specified value	Prior to treatment	After treatment	
				L/S = 2; 1,200 rpm; 5 min	L/S = 5; 600 rpm; 10 min
TCLP (mg/L)	Cd	1.0	ND	ND	ND
	Pb	5.0	10.3	ND	3.28
Dioxin (ng I-TEQ/g)		1.0	--	0.287	--

Note: -- means no test is conducted.

It is thus learnt that, cheap fresh water is taken as the extracting agent of the present invention, and the fly ash is pulverized to generate easily high-concentration OH^- at low liquid-solid ratio and high operating speed, such that harmful substances such as Pb, can be shifted cost-effectively from solid to liquid phase within a short period of time; moreover, the harmless fly ash after treatment can be used as a

recyclable and environmental-friendly raw material. Hence, the patent claims are made hereunder.

WHAT IS CLAIMED IS:

1. A method of removing quickly harmful substances in the waste incinerator fly ash, which contains at least the following steps:

preparation of fly ash and fresh water: prepare the converged fly ash generated by the waste incineration plant and also prepare fresh water as the extracting agent;

stirring extraction: add fresh water into the fly ash, fully stir the fly ash and fresh water, and then pulverize the fly ash for extraction;

immersion extraction: place fly ash slurry aside after stirring extraction for immersion extraction;

solid-liquid separation: dehydrate fly ash slurry after immersion extraction, so as to remove fly ash from liquid waste;

drying: dry up the fly ash after solid-liquid separation;

pulverization: pulverize the dried fly ash; and

test: test TCLP dissolution and Dioxin's total quantity of pulverized fly ash; if OK, the pulverized fly ash can be recycled as a harmless substance; otherwise, return to step 1.

2. The method defined in Claim 1, wherein the fly ash in step 1 refers to the converged fly ash collected by air pollution control facility of waste incineration plant, i.e. converged fly ash before entering solidification facility.

3. The method defined in Claim 1, wherein the fresh water in step 1 refers to tap water, distilled water or softening water.

4. The method defined in Claim 1, wherein the "liquid weight: solid fly ash (dry weight) ratio" in step 2 is: 2–5: 1, stirring speed: 500–1,500 rpm, duration: 3–10 min.

5. The method defined in Claim 1, wherein fly ash slurry in step 3 is placed aside 10–60 min for immersion extraction.

6. The method defined in Claim 1, wherein the fly ash slurry in step 4 is separated from the liquid waste by means of pressure filtering, vacuum filtering or centrifugal filtering.

7. The method defined in Claim 1, wherein the fly ash in step 5 is heated up at 100–200°C to dry up the fly ash after solid-liquid separation.

8. The method defined in Claim 1, wherein the dried fly ash in step 6 is pulverized to the particles less than 1.0 mm using a common pulverizer.

9. The method defined in Claim 1, wherein the test methods and judgment value in step 7 shall be subject to the regulatory test methods and specified value.