Start of Business Operations of Resource Recycling Waste Treatment Facility (Stoker Type Incinerator) with SMASH System®

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The latest waste treatment facility using the SMASH (SMart ASH treatment) system, the Iwate Chubu Clean Center (hereinafter referred to as the facility), started business operations in October 2015. The facility features a number of the latest resource recycling systems in addition to the "SMASH System®" developed by Mitsubishi Heavy Industries Environmental & Chemical Engineering Co., Ltd. (MHIEC). The SMASH System® allows the recycling of incinerated ash as a cement resource, helping the entire facility make a contribution to global environmental conservation. In this article, the features of the facility and the actual operation status are reported.

1. Facility overview

An overview of the facility is described in **Table 1**, and the schematic flow is shown in **Figure 1**. The Design-Build-Operate (DBO) model was adopted as the business operation scheme. MHIEC constructed the plant body, and Iwate Chubu Eco Creation K.K., which is a special purpose company (SPC) wholly-owned by the MHIEC group, operates the facility. The incinerator of the facility is a complete continuous incinerator (stoker incinerator) with a rated treatment capacity of 182t/day (91t/day x 2 incinerators). The waste incineration heat is recovered by a boiler and used as the superheated steam of 4.0MPa and 400°C for the generation of electricity in a steam turbine, generating a maximum of 4,100 kW of electricity. The power generated covers the needs of the facility and the excess electricity is supplied externally (as power for sale).

Table 1 Facility overview

Facility name	Iwate Chubu Clean Center
Completion year	September 2015
Incinerator type	Complete continuous incinerator (stoker furnace)
Nominal treatment capacity	182 t/day (91 t/day × 2 furnaces)
Gas-cooling method	Waste heat boiler (4.0 MPa, 400°C)
Power generation equipment	Condensing extraction turbine (4,100 kW)
Planned value of incinerated ash output	10 t/day (when 2 furnaces are operated)

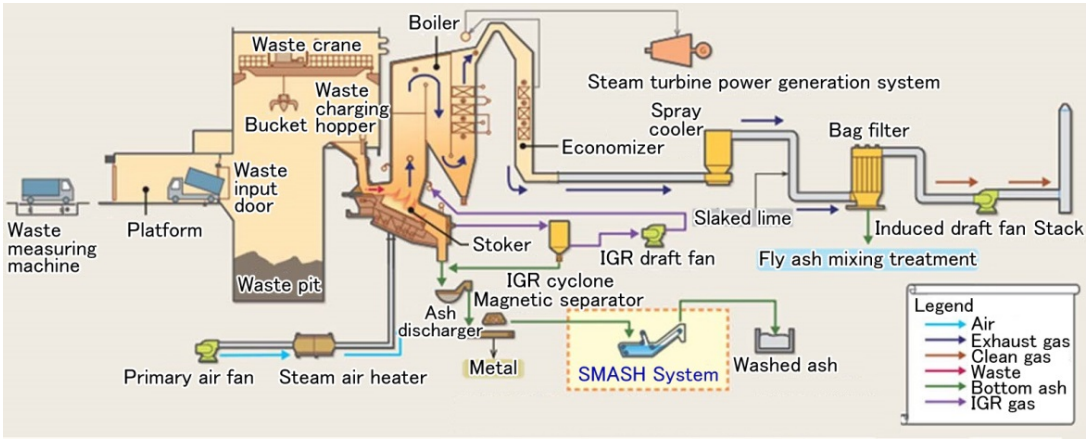

Figure 1 Schematic flow of treatment at Iwate Chubu Clean Center

2. Features of the facility

Described below are the features of the facility including the SMASH System®, the IGR system, a large-scale photovoltaic power generation system and a self-sustaining infrastructure facility intended as a disaster prevention base.

(1) SMASH System®

This system is comprised of a washing tank, pH controlling equipment and other components. The treatment flow is shown in **Figure 2**. The incinerated ash from which valuables such as metals were recovered by the pre-treatment equipment is stirred and washed in the washing tank. Next, water adhering to the washed ash is removed, and the ash is then conveyed to the washed ash pit.

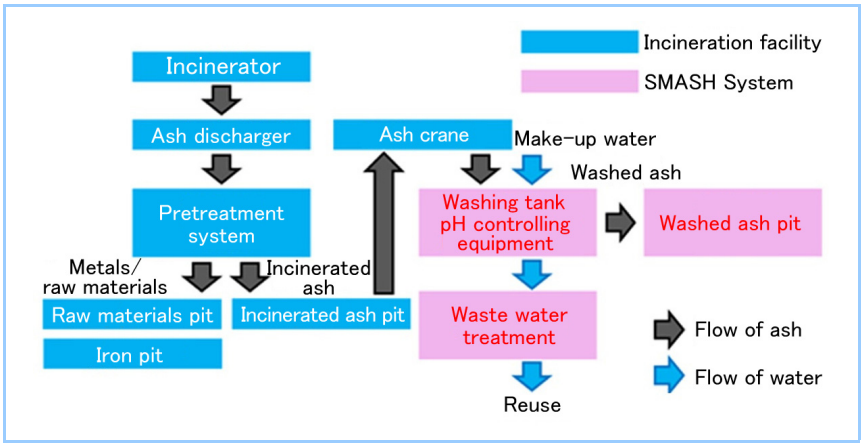

Figure 2 Flow of treatment by SMASH System®

The chlorine contents of eco-cement and eco-cement products of normal quality are specified as 0.1% or less in JISR5214 and 0.035% or less in JISR5210, respectively. Since incinerated ash normally contains 1% to 2% chlorine, the amount of incinerated ash that can be mixed with cement material is limited. On the other hand, as shown in **Figure 3**, which indicates the dechlorination effect obtained by the actual operation of the SMASH System®, it was confirmed that the washing of ash with water can reduce the concentration of chlorine to approximately 0.2%.

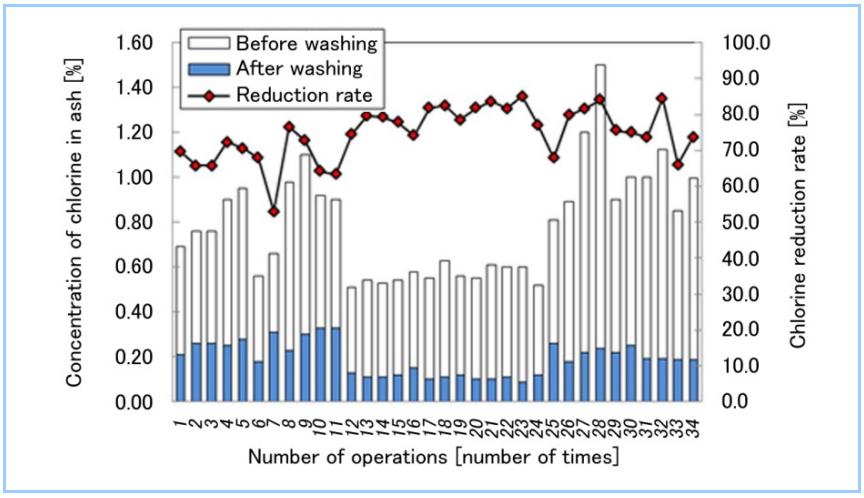

Figure 3 Dechlorination effect by SMASH System®
The content of chlorine in incinerated ash is reduced and the dispersion in chlorine concentration is reduced.

Not only can the SMASH System® reduce the concentration of chlorine in incinerated ash, it can also reduce the dispersion in the concentration of chlorine, from the wide range of 0.60% to 1.50% before washing to the range of 0.10% to 0.40%. This facilitates the management of the incinerated ash mixing ratio in the cement production process. As a result, the mixing ratio of incinerated ash in cement can be raised to increase the amount of incinerated

ash that can be accepted by a cement plant.

All the incinerated ash discharged from the facility is subjected to water washing treatment in the SMASH System® and the washed ash is received by the Mitsubishi Materials Corporation Iwate Plant to be recycled as raw material for cement.

(2) Internal Gas Recirculation (IGR) system

The flow of this system is shown in **Figure 4**. The IGR system uses and circulates, as the secondary combustion air, the combustion gas with a high oxygen concentration at the ember-burning part after the stoker, thereby eliminating a secondary air blower and allowing low air ratio operation with a reduced amount of combustible air. Low air ratio operation can reduce the amount of exhaust gas and provide highly efficient heat recovery.

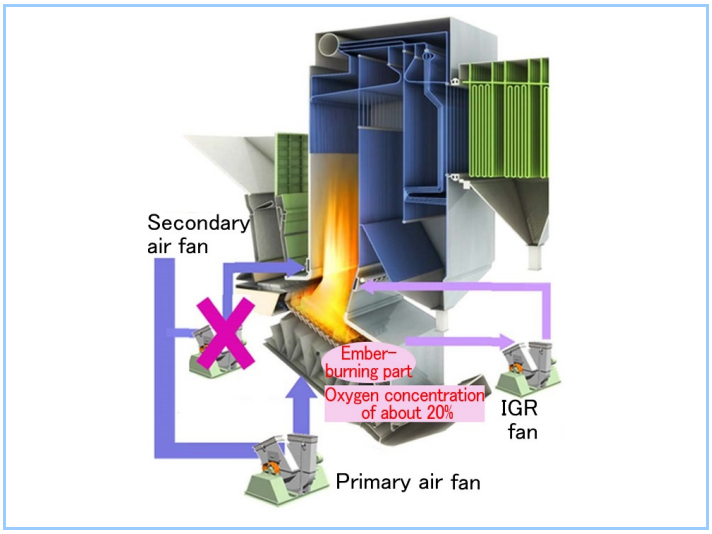

Figure 4 Flow of IGR System
The exhaust gas in a furnace (oxygen concentration of 20%) at the combustion part after the stoker is used and circulated as secondary air.

The operation status while the IGR system is operating is shown in **Figure 5**. It was confirmed that by combining the IGR system and the latest combustion control system, stable operation can be facilitated even in the low air ratio condition (air excess ratio Note 1) : about 1.35) and the amount of electricity that could be sold for each ton of waste increased by about 4% compared to existing operations.

Note 1) Air excess ratio: Ratio obtained by dividing the mass of actually supplied air by the mass of theoretically required air

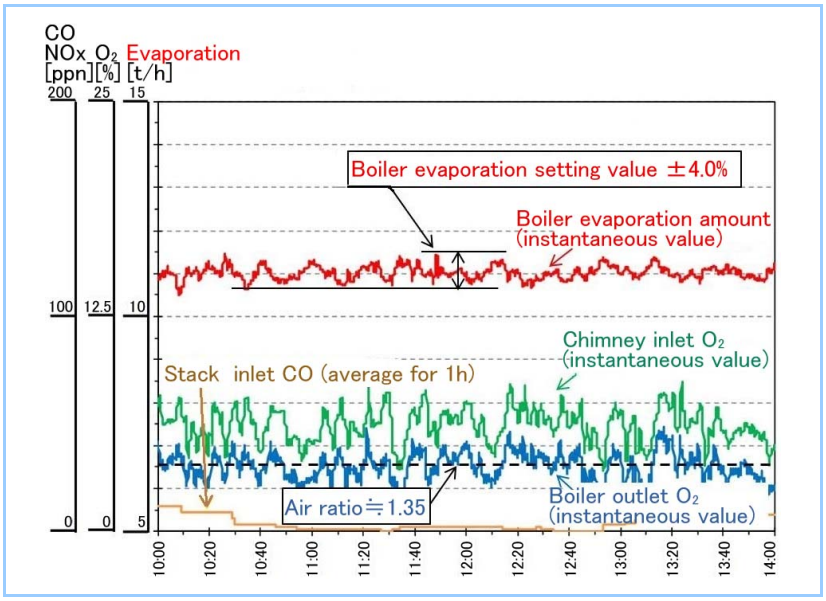

Figure 5 Stability of combustion during low air ratio operation
Stable operation was observed at (air excess ratio) λ= about 1.35.

(3) Large-scale photovoltaic power generation system

The empty space on the facility grounds was effectively utilized to set up a large-scale photovoltaic power generation system, which is the symbol of renewable energy use (**Figure 6**). This equipment generates an estimated 90 MWh annually. In October 2015 when business operations started, the actual amount of power generated was about 6 MWh.

The facility contributes to the realization of a low carbon society through photovoltaic generation and highly efficient power generation (through the effective use of waste energy), as well as by operating a "snow room" as a natural refrigerator that is used as a cold air source for air conditioning in the summer season.

Figure 6 Photovoltaic power generation system

(4) Self-sustaining infrastructure facility serving as a disaster prevention base

Recently, facilities that can serve as disaster prevention bases in the event of emergencies and contribute to local communities are in demand.

At the facility, even if a power failure occurs in the event of a disaster, the large-capacity private diesel power generation system can start the plant, and the steam turbine power generation system allows self-sustained operation, so that the facility can continue functioning as a waste treatment facility and a disaster prevention base. In simulation testing under the assumption that a power failure had actually occurred, it was confirmed that the plant could be started using only the electricity produced by the emergency power generator, and self-sustained operation could be performed by the turbine power generation system. Furthermore, in combination with the storage batteries (large lithium ion batteries), the photovoltaic power generation system allows the facility to secure the electricity required for daily life even when the waste power generation is disabled. Thus, the facility can contribute to the local community as a disaster prevention base.