JFE TECHNICAL REPORT
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Construction and Operation of Yokohama Eco-Clean Factory, JFE Kankyo†

1. Introduction

In July 2011, JFE Kankyo started up the Yokohama Eco-Clean Factory using the world's first combined incineration and melting system in which a kiln-type ash melting furnace is directly linked with a kiln-stoker furnace. The facility was designed and constructed by JFE Engineering. With the startup of this facility and the existing Kawasaki Eco-Clean Factory (Kawasaki Ward, Kawasaki City) and the Ogishima Incineration Plant (Ogishima, Tsurumi Ward, Yokohama City), JFE Kankyo has now established a 3-incinerator system with an annual treatment capacity of 167 000 tons in the Tokyo Metropolitan area.

2. Outline of Yokohama Eco-Clean Factory

2.1 Treatment Capacity and Treatment Flow

This facility has a treatment capacity of 200 tons per day and 62 000 tons per year, and handles a wide range of industrial wastes, including waste plastics, sludge, waste oil, waste acids, waste alkalis, and others.

Figure 1 shows the treatment flow of the Yokohama Eco-Clean Factory. Industrial wastes which are delivered to the facility are received in the waste pit or receiving tank. And then, waste solids are conveyed to the rotary kiln furnace, and waste liquids are sent to the secondary combustion chamber. Plastics and other materials are gasified and dried in the rotary kiln, and then completely burned with abundant air in the stoker furnace. The combustion gas generated by incineration is held up in the secondary combustion chamber for 2 seconds at 850°C in order to decompose dioxins, and its heat is then recovered by the boiler. Superheated steam generated by the boiler is sent to the steam turbine, where it is used to generate electricity.

In the off-gas treatment process, chemical treatment by caustic soda or slaked lime and denitration reaction treatment are performed, after which the gas is detoxified and discharged from the chimney.

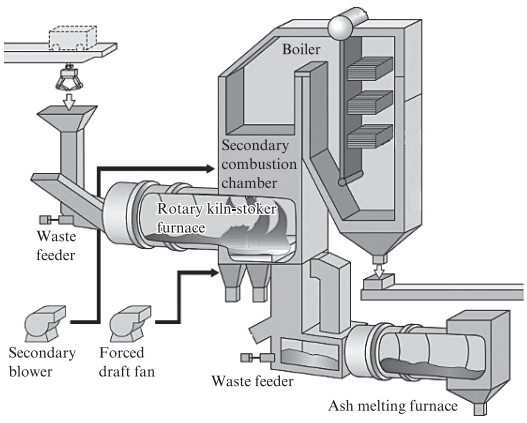

Fig. 1 Schematic illustration of incineration facility

2.2 Features of Equipment

The features of this facility are as follows.

(1) Adoption of a kiln-stoker type incinerator enables stable incineration treatment of wastes of diverse quality, including waste plastics which are rapidly gasified, sludge with a high water content, etc.

(2) Melting treatment of ash is performed by using the world's first kiln-type melting furnace directly linked with a stoker furnace. The slag obtained by ash melting is used as a substitute for sand in subbase course material for road construction.

(3) A feedforward control system was introduced for off-gas treatment, making it possible to clear strict emission standards.

(4) A steam turbine generator with an output of 1 800 kW was installed and is used to generate electricity. Surplus power is supplied to neighboring factories.

(5) Rain which falls in the site and on-site wastewater are collected in a water storage tank and recycled for use in furnace temperature control at the stoker furnace and secondary combustion chamber.

2.2.1 Feedforward control system

Feedback control systems are generally used in the off-gas treatment systems at incinerators. In feedback control, the amount of chemicals used is controlled based on values from an off-gas analyzer installed at the

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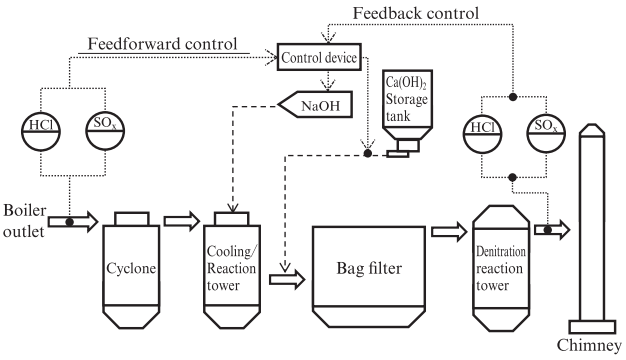

Fig. 2 Flowchart of feedforward control system

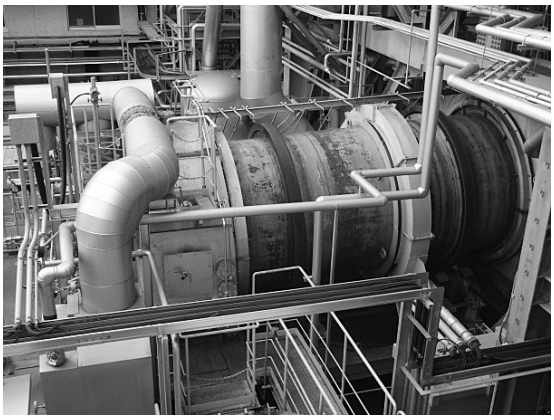

Photo 1 Aspect of ash melting kiln

chimney.

At the Yokohama Eco-Clean Factory, a feedforward control system was also adopted for the off-gas treatment system. This system controls chemical use based on values not only from the chimney, but also from an off-gas analyzer installed at the boiler outlet. **Figure 2** shows an outline of the feedforward control system. As shown in this figure, the concentrations of HCl and SO_x at the boiler outlet are measured continuously, and the amount of chemical spraying is controlled at the cooling/reaction tower and before the bag filter based on their concentrations. If only the conventional feedback control system is used, it is sometimes impossible to follow rapid changes in waste quality. However, adoption of the feedforward control system makes it possible to follow more accurate analytical value information, thereby enabling reliable control of off-gas treatment. This has made it possible to meet the emission standards of this area, where strict regulations are imposed. The Eco-Clean Factory also provides emission composition values from the chimney to Yokohama City and publishes this information.

2.2.2 Kiln-type ash melting furnace

This incineration plant has adopted a kiln-type ash melting furnace, in which the ash melting furnace is linked directly to the stoker furnace. The features of this system are as follows.

(1) Because the incineration ash from the stoker chamber is charged directly into the ash melting furnace without passing through a hopper or conveyor, heat loss is reduced and the equipment is compact.

(2) The high temperature flue gas generated by the ash melting furnace is sent from the secondary combustion chamber to the boiler, achieving high heat recovery efficiency.

Photo 1 shows the appearance of the kiln-type ash melting furnace. Incineration ash which drops from the stoker furnace is charged into the kiln-type ash melting furnace, where it is held for approximately 2 hours and becomes molten slag. Water granulated slag is produced from this molten slag by quenching in a water tank at the furnace outlet. The water granulated slag then passes through a magnetic separator and crusher. After confirming that its quality satisfies the relevant JIS (Japanese Industrial Standard) standards, it is used by material recycling as a substitute for sand in subbase course material for roads.

3. Condition of Operation

After construction was completed on July 12, 2011, it was possible to achieve a vertical startup in which the plant reached its rated capacity in a short time of

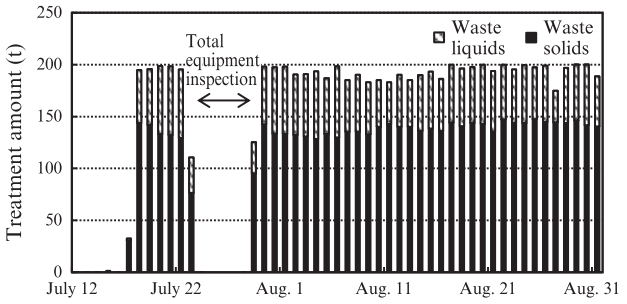

Fig. 3 Starting performance after completion of construction

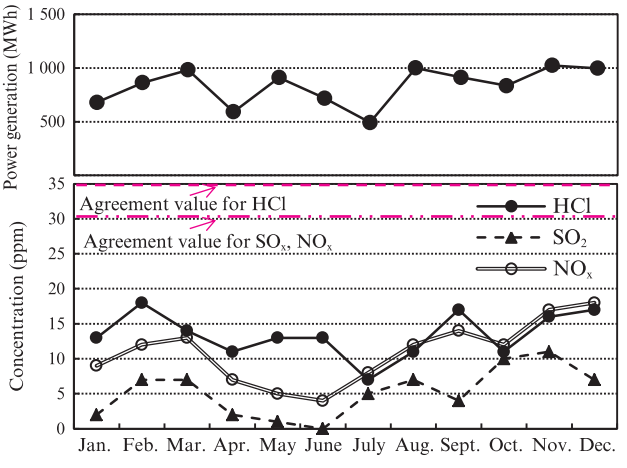

Fig. 4 Operation performance in 2012

1 month. The startup performance is shown in **Fig. 3**. This startup was the result of the soundness of the test run of the plant and practical training at another facility for a half-year period, followed by training of the operators involved in the startup. The transition of power generation and off-gas analysis values over a one-year period (calendar year 2012) are shown in **Fig. 4**. In spite of some variations in power generation due to regular equipment maintenance, which was performed at 3-month intervals, operation has been stable. The composition of emissions also trended well below the values specified in the environmental preservation's agreement with Yokohama City, demonstrating that the Yokohama Eco-Clean Factory is a low-environmental load incineration facility.

4. Conclusion

Because of the startup of the Yokohama Eco-Clean Factory, JFE Kankyo in 2011 substantially expanded the waste treatment and resource recycling business, which the company is actively promoting, and also enables further promotion of recycling. During fiscal year 2012, a pilot test of a detoxification process for low concentration polychlorinated biphenyl (PCB) was conducted and detoxification treatment was confirmed. The start of commercial operation is scheduled for fiscal year 2013.

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