Abstract:

JFE Engineering offers an advanced stoker-type incineration system, the JFE Hyper 21 Stoker System, which is equipped with new technologies to meet the requirements of municipal solid waste (MSW) treatment, including minimization of environmental pollutants, effective use of energy, applicability to various types of MSW, and reduction of operating costs. Low excess air ratio rrustion ased on hi h temperat re air

with the incinerator are features of this system. This paper describes the results of the experimental study carried out with a test plant (12 t/d) at R&D Center of JFE Engineering and a practical operation test with an MSW incinerator (105 t/d) in commercial operation.

1. Introduction

JFE Engineering has developed and constructed a variety of stoker-type waste incinerators which meet changes in market needs since receiving its frst order in 1971, such as (1) GR-type Incinerator, (2) DG-type Incinerator, and (3) HGDG-type Incinerator. The strong points of each incinerator are as follows: (1) GR-type Incinerator: equipped with rotary kiln and suitable for low calorifc value waste, (2) DG-type Incinerator: two-way gas fow incinerator with three-stage grate steps, which is suitable for high calorifc value waste and effective to suppress CO and NOx emissions, (3) HDG-type incinerator: two-way gas fow incinerator with JFE Hyper Grate System which offers excellent combustion

-

*rn*bility of stable combustion of waste with inhomogenous and fuctuating properties. The stoker-type incinerator accounts for more than 80% of municipal solid waste (MSW) incineration plants in Japan (throughtput base) and is expected to play a major role in waste incineration plants in the future.

With this background, JFE Engineering has developed an advanced stoker-type incinerator with greater superiority in both technology and economy.[1)]

tion technology and an as treatment s stem inte rated incinerator with high reliability and excellent operational stability as essential characteristics, based on JFE Engineering's long experience in the f eld. The target features were:

(1) Substantially improved heat recovery ef f ciency
(2) Reduction of environmental pollutants
(3) Simple and compact components
(4) Reduction of costs in both construction and operation
(5) Applicability to wide range of wastes

They were realized by combining existing technologies such as the two-way gas f ow incinerator[2] and hybrid automatic combustion control (ACC) system[3], and new technologies such as an exhaust gas recirculation system, water-cooled grate technology[4], and dioxins volatilization and decomposition system for f y ash[5] in the system at a high level. In particular, the original features of the system include a low excess air ratio combustion technology based on high temperature air combustion technology and integration of the ash treatment process with the incinerator. The corresponding technologies and the expected effects are shown in **Fig. 1**.

A conceptual diagram of the system is shown in **Fig. 2**. As shown in this f gure, the system supplies high temperature air, consisting of a mixture of high temperature air and exhaust gas, to the combustion beginning region in the two-w א א I and א Ş two-wiber

components of the gasi f cation gas above the waste layer are CO, H_2

concentration showed the same low level as that in the conventional combustion, and stable combustion was demonstrated even with low excess-air ratio combustion. The NOx concentration showed an average value of 86.3 ppm for the conventional combustion, whereas it was reduced by approximately one half to an average of 46.2 ppm in the advanced one, even without water spray in the primary combustion chamber. The same results as mentioned in the previous chapter concerning the pilot-scale test plant were obtained in the commercial plant. They owe to the promotion of uniform mild combustion by injecting HTMG and recirculated exhaust gas (de-dusted exhaust gas) into the main combustion region. Moreover, the conversion ratio of the fraction of N in the fuel was held at a low level by reducing the excess air ratio in the combustion chamber.

5.3.3 Exhaust gas fow rate

The change in the exhaust gas fow rate at the stack is shown in **Fig. 10**. The exhaust gas fow rate was greatly reduced in the advanced combustion under a low excess-air condition in comparison to the conventional one. **Figure 11** shows the relation between total heat input and exhaust gas fow rate at the stack. In case where the total heat input in the advanced combustion is the same as in the conventional combustion, for example, when the total heat is 10 370 Mcal/h, the exhaust gas fow rate at the stack is 17% lower in the advanced combustion than in the conventional one. Because the excess-air ratio, λ is 1.6 and the exhaust gas fow rate is 26 kNm^3/h at this time, trial calculations predict that the exhaust gas fow rate can be reduced by approximately 25% in an incinerator operating at an excess-air ratio of $\lambda = 1.7$ and 30% in operation at $\lambda = 1.8$.

5.3.4 Heat recovery ratio (Increase in steam generation)

The effect of heat recovery improvement in the advanced combustion is shown in **Fig. 12**. For example, assuming the total heat input is 10 370 Mcal/h, as in the trial calculation of exhaust gas reduction, steam generation is approximately 10% greater in the low excess-air ratio combustion than in the conventional one. This is due to a reduction in heat carried out by the exhaust gas and improved combustion by promoting uniform/mixed combustion in the combustion chamber.

Based on this result, a trial calculation of power generation by a plant with a 4 MPa, 400°C boiler °C b