Advanced Utilization Technology of Biomass and Waste

Background and Objective

Electric power companies are promoting the mixed firing of biomass at coal-fired power plants, which is one of the efforts for reduction of carbon dioxide emissions. This leads to more use of biomass fuel. However, it is difficult to secure a large amount of biomass fuel, so it is important to develop new business models considering the potential of biomass fuel. This project has two aims. One is the development of potential evaluation technology, which supports a new biomass business. The other one is the development of the advanced utilization technology of biomass. These technologies accelerate the creation of a recycling society.

Main results

1. Evaluation technology of domestic waste potential for power generation

In the PFI business etc., it is important to select an optimal scale when the power generating unit is introduced into the waste treatment facility. We investigated the introduction situation of the power generating unit to the general waste treatment facilities of the municipality. The result shows that the power unit has not been introduced into the waste facilities of throughput 100t/d or less. The introduction case with the power plant was examined according to the throughput based on above (Table 1). As the result, the region where the large-scale power generation by the wide-area waste collection becomes possible is limited, and it is effective to introduce a high efficiency power generation unit into the waste treatment facilities of throughput 100t/d or less to expand the amount of power generation (Fig. 1).

2. Advanced utilization technology

1) Assessment of biomass storing safety

For establishment of safety guidelines of biomass storage, the spontaneous heating accelerated testing of RDF (Refuse Derived Fuel) was carried out. As the result of the test, it succeeded in confirmation of the RDF temperature rise by the spontaneous heating and the generation of CO (Fig. 2).

2) Development of biomass carbonizing gasification technology

To establish the carbonizing gasification technology, it is necessary to understand the carbonization and gasification characteristics of a biomass in which moisture and volatile matters are high. As the result of the water addition gasification test by the carbonized gasifier with the pellets of red pine and EFB (Empty Fruit Bunch), it succeeded to operate the carbonized gasifier in 30% moisture biomass without increasing the gasification performance. And also, we showed that the concentration of tar in the syngas is governed by the temperature of the reforming area in the gasifier. This temperature is useful as an operational index of gasifier to control the concentration of tar (Fig. 3).

3) Development of small-sized next-generation gasification technology

We are developing a molten carbonate gasification process through which gas purification is possible at the same time as gasifying for a small-scale dispersed power system. In this process, because moisture in the fuel acts as a gasifying agent, the hydrogen concentration and heat value of syngas are high. The prototype experimental apparatus of throughput 30-100 kg/d has been designed and produced (Fig. 4) based on the fundamental experiment result of gasification performance to the temperature of molten carbonate [M08024].

Table 1 Case of examination

Case	Installation condition at replacement
1	Large-scale incineration waste 300t/d or more
2	Case1 & replacement within 5 years and broad area collection from 50km range
3	Large-scale incineration waste 200t/d or more
4	Middle-scale incineration waste 100t/d or more
5	Small-scale incineration waste 100t/d or less

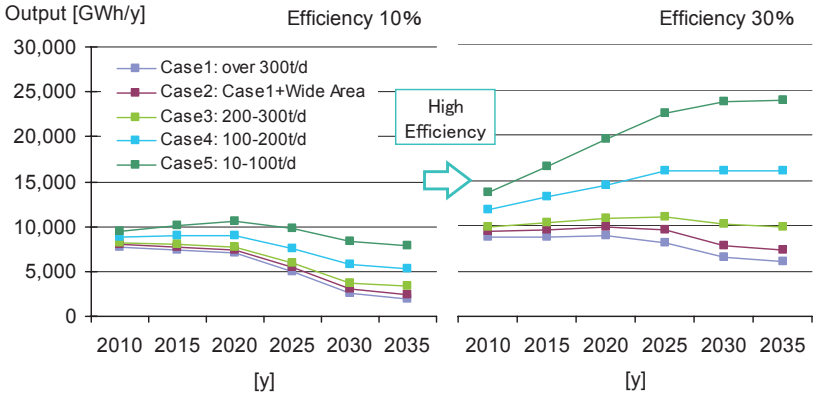

Fig. 1 Introduction effect of power unit

Difference of replacement time greatly influences the introduction amount. High efficiency power unit and its installation at 10-100t/d scale incineration plant for the expansion of waste power generation.

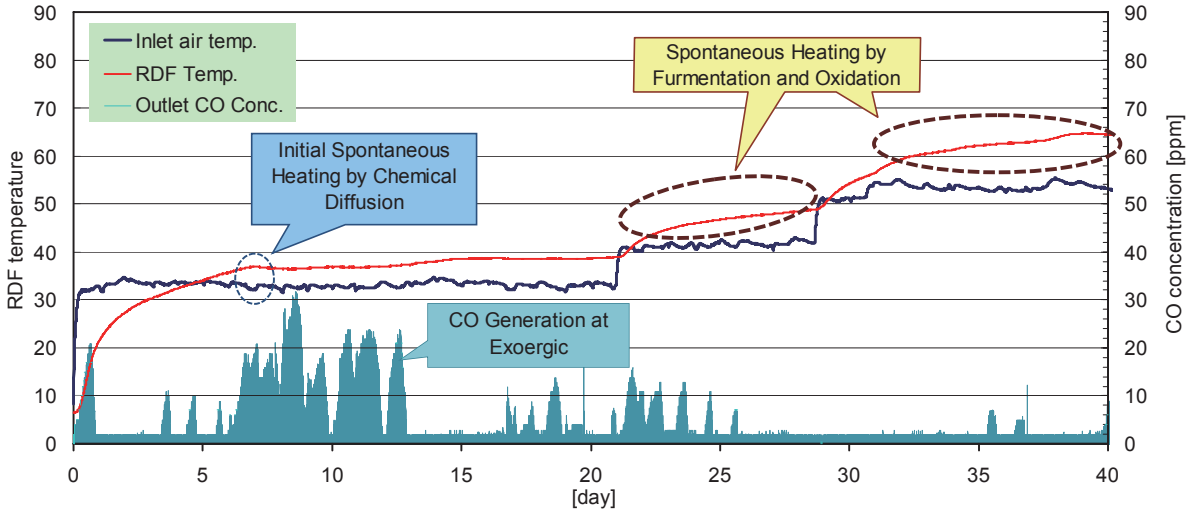

Fig. 2 Trend of RDF/air temperature and CO concentration

RDF temperature is higher than inlet air temperature. CO generation at exoergic is able to be confirmed.

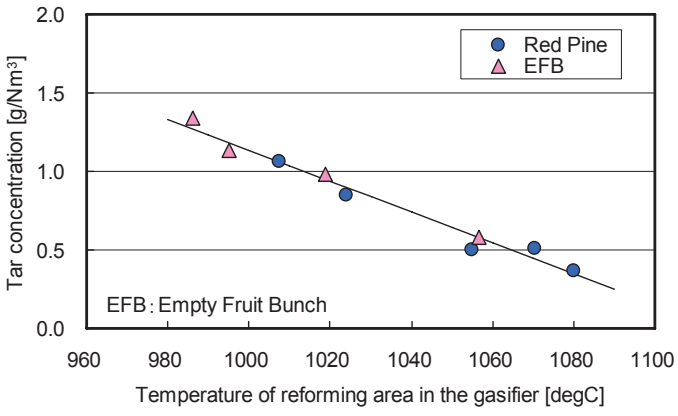

Fig. 3 Correlation between Tar and temperature

Tar concentration depends on temperature of reforming area in gasifier, and is lower than 1.0g/Nm^3 to maintain a temperature of 1020degC or more.

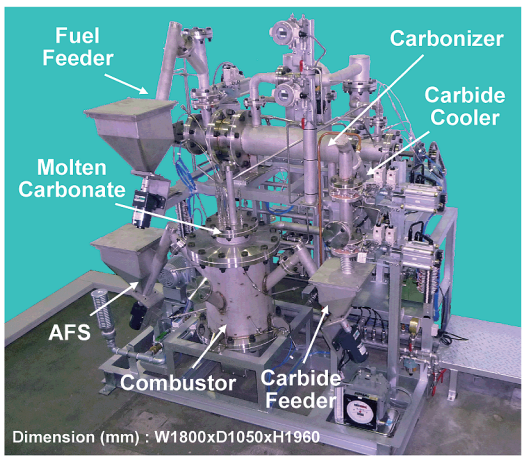

Fig. 4 Molten carbonate gasifier

Molten carbonate plays a role of dehalogenation agent and desulphurizer at the same time as supplying heat for gasification reaction as a heat transfer medium.