

JFE Waste Carbonizing System[†]

1. Introduction

Toward the formation of a recycling-oriented society, the waste carbonizing system is increasingly being introduced in various parts of Japan in view of the effective use of carbon contained in waste. The waste carbonizing system has advantages in reduction in volume, weight, and odor of waste as well as in the expansion of applications of recycled materials. Expectation for this system is high because of its capability for effectively treating and utilizing waste. JFE Engineering has developed and commercialized various types of waste carbonizing systems in accordance with the types of waste to be treated and the modes of use of the materials produced by carbonizing treatment. This paper introduces the lineup of JFE Engineering's waste carbonizing technologies, focusing in particular on swinging-type carbonizing technology, and an energy-saving process developed by combining a carbonizing system with refuse-derived fuel (RDF) production from municipal waste. Applications of carbonized products are also reported.

2. JFE Engineering's Waste Carbonizing Technologies

2.1 Lineup of Waste Carbonizing Technologies

The lineup of JFE Engineering's waste carbonizing technologies is shown in **Table 1**. The most appropriate type is selected in accordance with the types of waste to

be treated (e.g., municipal waste, paper-making sludge, and wood chip), the required treatment capacity, and the applications of carbonized products.

2.2 Swinging-Type Waste Carbonizing Furnace

The internal-heating, swinging-type waste carbonizing furnace has the following features and advantages:

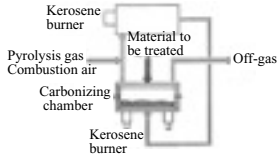
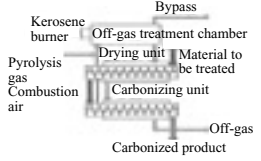
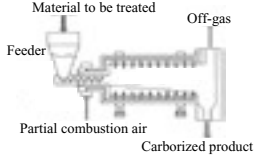
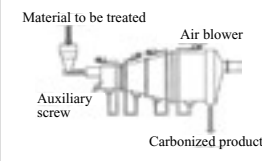
- (1) As an internal-heating carbonizing furnace, no auxiliary combustion fuel is required except when starting up, and the operating temperature for the carbonized product is arbitrarily adjusted by controlling the air volume sent from below the kiln.
- (2) Volatile matters and harmful heavy metals are removed by high-temperature carbonizing at around 800°C, enabling the production of high-quality carbonized products.
- (3) The furnace makes a reciprocating swinging motion with an angle of around 70°, making its structure comparatively simple.

2.3 Process Combining a Carbonizing System with RDF Production

The new process that can achieve large energy savings with low capital costs is realized by combining a waste carbonizing system with RDF production. This process has the following advantages:

- (1) Drying air (or circulating air) required for producing RDF is heated by waste heat discharged from the waste carbonizing furnace, and a large amount of fuel otherwise consumed for heating the air is saved.

Table 1 Lineup of JFE Engineering's waste carbonizing technologies

| Heating method | External heating type | | Internal heating type | |
|-----------------------|---|---|--|---|
| | Batch furnace | Continuous, multi-tube furnace | Rotary kiln furnace | Swinging kiln furnace |
| Schematic structure |  |  |  |  |
| Operating temperature | ≅ 500°C | ≅ 500°C | ≅ 800°C | ≅ 1 000°C |
| Capacity scale | Small | Middle | Middle | Middle-Large |
| Applicable waste | Municipal waste | Various types of sludge, including paper-making sludge | Municipal waste, RDF, wood chip, waste construction material, biomass | |

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- (2) It is possible to provide the secondary combustion zone in the carbonizing furnace with a function of deodorizing the off-gas from the drying process in RDF production, eliminating the need for a dedicated deodorizing system.
- (3) Dioxins are decomposed by the high-temperature combustion and deodorizing process, and off-gas treatment systems such as a bag-filter and catalytic unit are eliminated from the RDF production line.

3. Applications of Carbonized Products

The carbonized products produced from RDF by this carbonizing system have uniform properties. Formaldehyde and other harmful organic substances are decomposed by the high-temperature carbonizing treatment, and safe, high-quality carbonized products are obtained. Furthermore, carbonized products produced from waste wood and waste plastics can remove dioxins and other harmful substances from waste gas generated from various industrial processes. Their capability is equivalent to

commercially available activated carbon. The JFE Group is actively developing new applications of the carbonized products in various fields such as soil conditioners, adsorbents, coke-substitute in iron-making, and insulating material.

4. Closing Remark

Two swinging-type waste carbonizing furnaces of industrial scale, each with the capacity of 1.25 t/d and 0.5 t/d, are in operation at JFE Steel. The JFE carbonizing technology will be further advanced in view of effective carbonizing treatment applicable to a wide variety of organic waste.

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