

Municipal waste carbonization system

– Making effective use of carbonized fuel manufactured from waste



At the end of June 2015, Kawasaki delivered a municipal waste carbonization system to Saikai City, Nagasaki Prefecture. This system manufactures carbonized fuel from municipal waste and sewage sludge generated in the city with minimal environmental impact. The carbonized fuel is effectively used at private facilities for mixed combustion with coal. The system features a compact-size carbonization kiln, high-performance exhaust gas treatment system, and desalination and granulation treatment to achieve high efficiency. Therefore, even if the disposal capacity is relatively small, it is possible to maintain high performance.

Preface

While there are many opinions regarding the optimal method of waste treatment, in the case of facilities with a relatively small capacity (less than 100 tons/day), carbonization is an excellent process to be used. It enables excellent thermal energy recovery from waste and effective utilization of biomass resources present in waste.

1 Background

In November 2012, Kawasaki in collaboration with Electric Power Development Co., Ltd. (primary contractor; J-POWER) accepted an order from Saikai City in Nagasaki Prefecture to build and operate an energy recovery facility, and delivered a municipal waste carbonization facility in June 2015. The project's goals included the design, construction and operation of a facility to be used for manufacturing carbonized fuel (charcoal) from municipal waste and sewage sludge generated in Saikai City. The carbonized fuel is effectively used at private facilities for mixed combustion with coal. These activities are part of efforts aimed at realizing a recycling-oriented, low-carbon society.

2 Overview

This facility has a capacity of 30 tons/day (2 processing lines, 15 tons/day each). Built to replace two facilities nearing the end of their service lives—the Seihi Clean Center and Saikai Clean Center—this facility was designed to consolidate waste treatment in Saikai City while also serving as a sewage sludge treatment facility by handling sewage sludge and human waste sludge disposal. Fig. 1 provides a general outline of the treatment processes within the facility.

Waste is transferred from the platform to the waste pit and sewage sludge to the sewage sludge hopper. The waste is reduced to a fine size using the shredder and fed via the waste feeder into the carbonization kiln, where waste is carbonized. Pyrolysis (thermal decomposition) gas produced during carbonization is combusted in the combustion furnace; processed as appropriate via the gas cooling tower, bag filter and other exhaust gas treatment equipment; and exhausted as exhaust gas. Charcoal discharged from the carbonization kiln is desalinated and granulated, then transported to an outside facility for utilization as carbonized fuel.

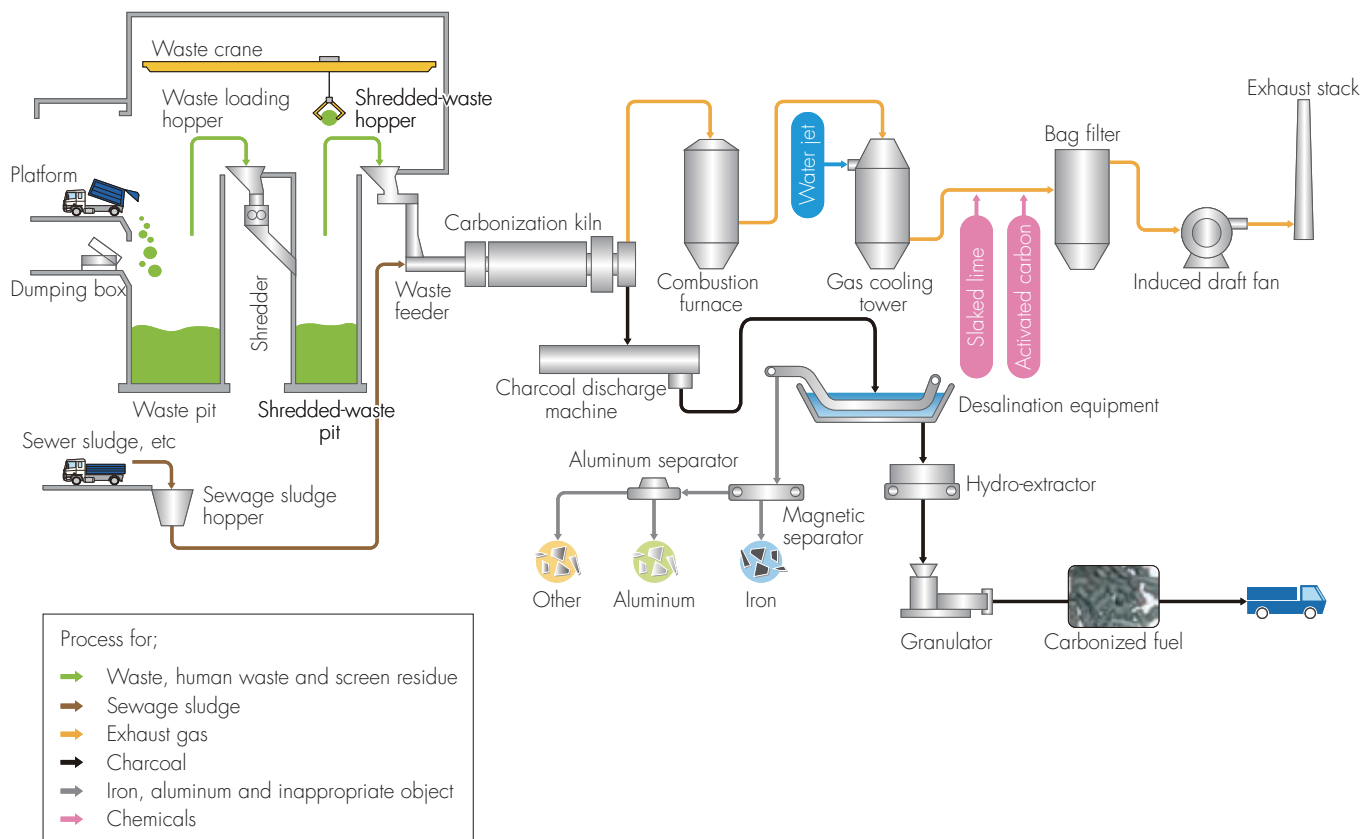


Fig. 1 Flow of municipal waste carbonization system

3 Advantages

(1) Compact carbonization kiln size

The external appearance of the carbonization kiln can be seen in Fig. 2. As shown in Fig. 3, this kiln is an indirect-

heating kiln type with excellent airtight mechanism, ensuring both safety and the manufacturing of high-quality charcoal. In this rotary-type kiln with its dual-tube kiln design, waste is fed into the inner tube and heated gas is passed through the space between the inner and outer



Fig. 2 Carbonization kiln

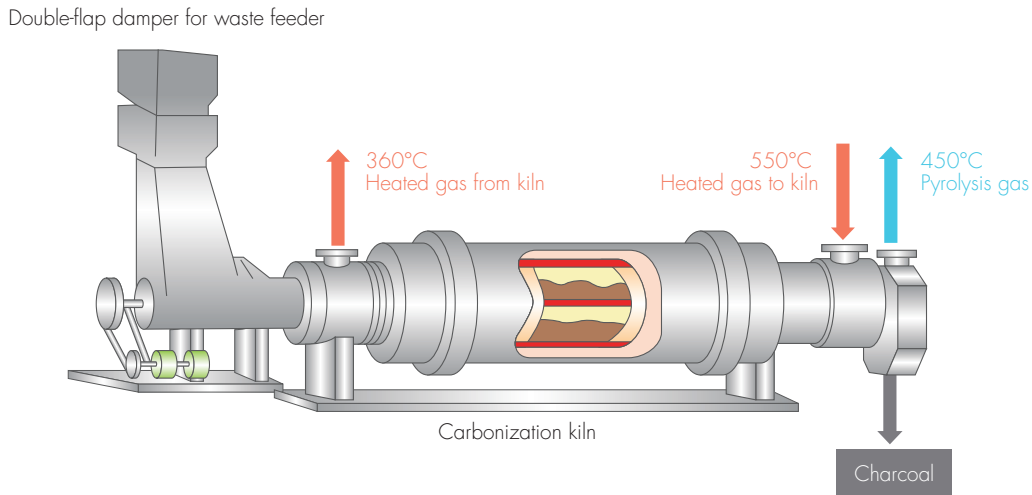


Fig. 3 Schematic view of carbonization kiln

tubes to heat the waste indirectly, producing charcoal and pyrolysis gas. The carbonization kiln's internal structure consists of a cylindrical tube divided into quadrants, which enables efficient carbonization and makes our kiln more compact than simple kiln products consisting of a single tube without internal subdivisions.

(2) Environmentally friendly treatment facility

Pyrolysis gas generated during carbonization is combusted in the combustion furnace, serving as the heat source for the carbonization kiln. Before being exhausted into the atmosphere, exhaust gas passes through a gas cooling tower and bag filter, with chemicals injected in order to thoroughly prevent potential atmospheric pollution. Facility operations have achieved extremely low CO and NOx concentration in exhaust gases.

In addition, in the case of the carbonization process, municipal waste is not incinerated completely. The municipal waste is converted into carbonized fuel (as a fuel resource). This results in low exhaust gas and dust emissions as well as ash quantities that only amount to 20% or less of those generated by a waste incineration process, leading to reduced final disposal quantities and lower environmental impact.

(3) Desalination and granulation equipment to enable use as fuel by private facilities

In order to manufacture low-chlorine carbonized fuel for the purpose of creating coal-mixture fuels to be used by private facilities, we utilize advanced desalination techniques consisting of desalination equipment, hydro-extractor and granulator. Fig. 4 shows the appearance of this carbonized fuel, and Table 1 our manufacturing facility's carbonized-fuel quality specification, in regard to which we have achieved completely satisfying performance.

(4) Advantages of carbonized fuel

When evaluated in terms of the entire process from manufacturing through to usage, the partial replacement of coal with carbonized fuel can reduce overall coal usage quantities and cut greenhouse gas emissions (CO₂).

We do, in fact, possess refuse-derived fuel (RDF) technologies for the conversion of waste for use as fuel; however, in contrast to RDF production, our carbonization process utilizes energy derived from waste itself, meaning that it is possible to reduce the use of fossil fuels. Furthermore, we have innovated desalination with the goal of further spreading the use of our carbonized fuels. This enables the manufacturing of low-chlorine carbonized fuel, thus ensuring a wider user base.



Fig. 4 Carbonized fuel

Table 1 Quality specification of carbonized fuel

| Quality Item | Standard Value |
|------------------------------|----------------|
| Lower heating value (kJ/kg)* | Approx. 13,000 |
| Chlorine concentration (ppm) | Approx. 3,000 |
| Form | Pellet |

*Anhydrous base

Postscript

In terms of waste treatment technologies, Kawasaki offers the indirect-heating type carbonization kiln described here as well as various other waste incineration technologies.

We are actively pursuing technological developments and sales efforts in order to address increasingly severe environmental problems throughout society and respond to the diversifying needs of our customers.

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