

Plastic Recycling System

1. Introduction

To contribute to the establishment of a recycling-based society, Nippon Steel Corporation has actively promoted the recycling of waste plastics effectively utilizing steelmaking processes.

The Law on Recycling Containers and Packaging was put into full force in April, 2000, and according to the law, municipalities collect plastic containers and packaging from households and classify them for recycling. Nippon Steel receives and recycles the plastics using coke ovens of its steel works by the Coke Oven Waste Plastics Recycling Method to turn them into chemical raw materials.

2. Characteristics

The process steps of the method are divided roughly into two parts: a pretreatment process and a thermal decomposition process.

(1) Pretreatment process

- In the pretreatment process, the quality and shape of the waste plastic containers and packaging collected by municipalities are conditioned suitably for charging into coke ovens. Specifically, these plastics are rid of all foreign matter, and then compacted and formed into pellets. The process consists of shredding, sorting and compacting/pelletizing, and is characterized by the following:

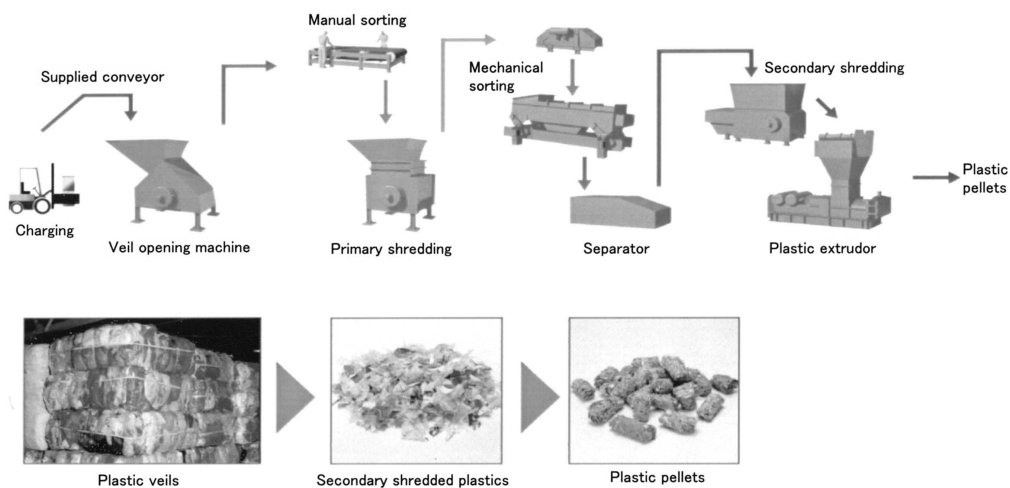
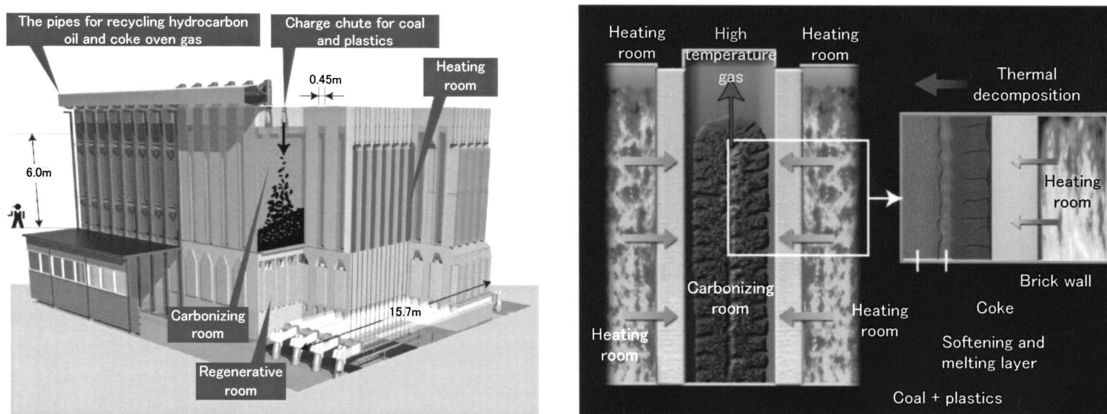


Fig. 1 Flow diagram for plastic recycling



Structure of coke oven and mechanism of thermal decomposition

Fig. 2 Coke oven

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- Virtually all foreign matter (metals, glass, sand, etc.) is removed.
- Since the plastics are compacted and pelletized at low temperatures, the process does not discharge any exhaust gas or waste water that requires treatment.

(2) Thermal decomposition process (in coke ovens)

The pelletized plastics are heated in an atmosphere free of oxygen in airtight carbonizing chambers of coke ovens, and thermally decomposed into hydrocarbon oil, coke and coke oven gas, which are then recovered for use.

- The plastics are charged into the carbonizing chambers after mixing with coal.
- The coal and plastics in the carbonizing chambers are heated to 1200°C by the heat from heating chambers through brick walls without an oxygen supply.

(3) Reutilization examples

The hydrocarbon oil, coke and coke oven gas are used effectively at chemical plants, blast furnaces and power plants inside the premises of the steel works as follows:

- The hydrocarbon oil, which accounts for 40% of the decomposition products of plastics, is used as the raw material for plastics and other products at chemical plants.
- The coke, which accounts for 20%, is charged after heat recovery into blast furnaces as an agent to reduce iron ore.
- The coke oven gas, which accounts for 40%, is a fuel gas composed mainly of hydrogen and methane, and is used as the fuel at power plants and furnaces inside the steel works.

3. Recycling Activities

Nippon Steel began to recycle waste plastics in 2000 at Nagoya and Kimitsu Works. The same plastic recycling plants were constructed also at Muroran and Yawata Works and put into commercial operation in April, 2002. Thus, the company has established a system to recycle waste plastics arising virtually from all over the country.

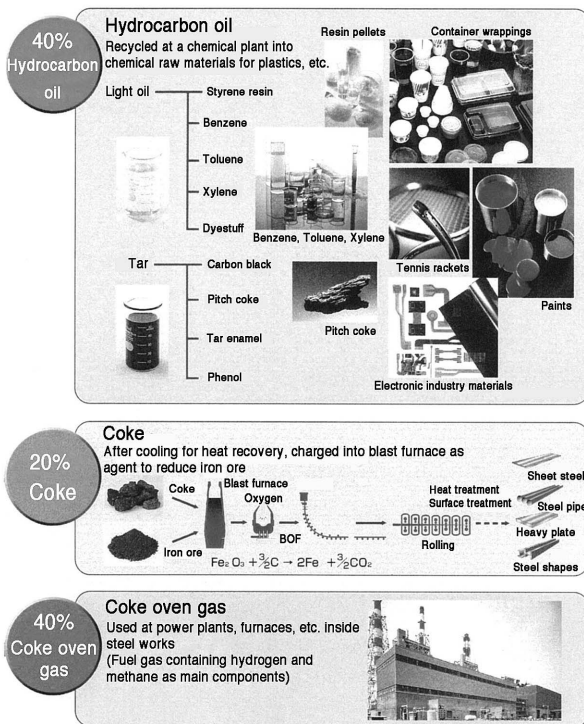


Fig. 3 Products

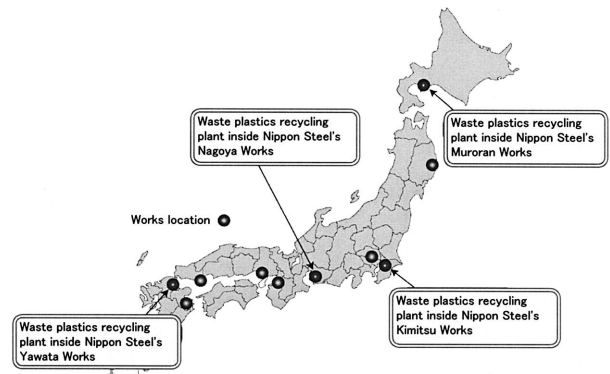


Fig. 4 Recycling plants

(For further information, contact Steel Plant & Environmental Engineering Division)