

# PWMI Newsletter

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Plastic Waste Management Institute  
JAPAN

## LIQUEFACTION TECHNOLOGY

### Reopening of Niigata Plastics Liquefaction Center

The Niigata Plastics Liquefaction Center, a pyrolytic liquefaction plant, is the next link in the development of advanced plastic waste liquefaction technology being pushed forward by the Plastic Waste Management Institute.

Work on the plant was started in September 1995 by Rekisei Koyu Co., Ltd., a local firm, in Heiwa-cho, Niigata City.

A ceremony was held on November 12, 1996 to mark the completion of the plant. Plant operations were begun at that time, however, a fire on December 19 of that year shut down the facility.

As a result of the efforts made in the year since the fire, restoration work was completed on December 2, 1997, and the plant began test operations in the second half of the month. Test operations will continue until March 1998, with regular operations scheduled to begin in April after examining the test results.



**T**he Niigata Plastics Liquefaction Center liquefies the plastics in the sorted collections of waste from the households in Niigata City, which has a population of approximately 500,000. The new plant is capable of handling about 6,000 metric tons of plastics per year and the recovered oil is used as a fuel in the city's public facilities.

The plant provides both pretreatment and liquefaction processes and these have four major features. (1) Liquefaction is preformed regardless of the types of plastic waste that has been collected from the households. (2) Adequate environmental countermeasures have been considered for waste gases, sewages, etc. (3) Liquefaction can be conducted at low cost because of the simplified processes and the general-purpose materials that have been selected. (4) Fully automatic operation ensures significant savings in labor.

The outstanding performance made possible by these features resulted from the technological development work carried out by PWMI in fiscal year 1995 and 1996 in cooperation with other construction firms.

Due to the promotion of the plastic waste liquefaction plan, the sorted collection of waste has taken place since April 1996 in the western area of Niigata City, where 40% of the city's residents live. Sorted collection was expanded in April 1997 to cover the remainder of the city. Plastic waste from the entire city can now be liquefied at the new plant.

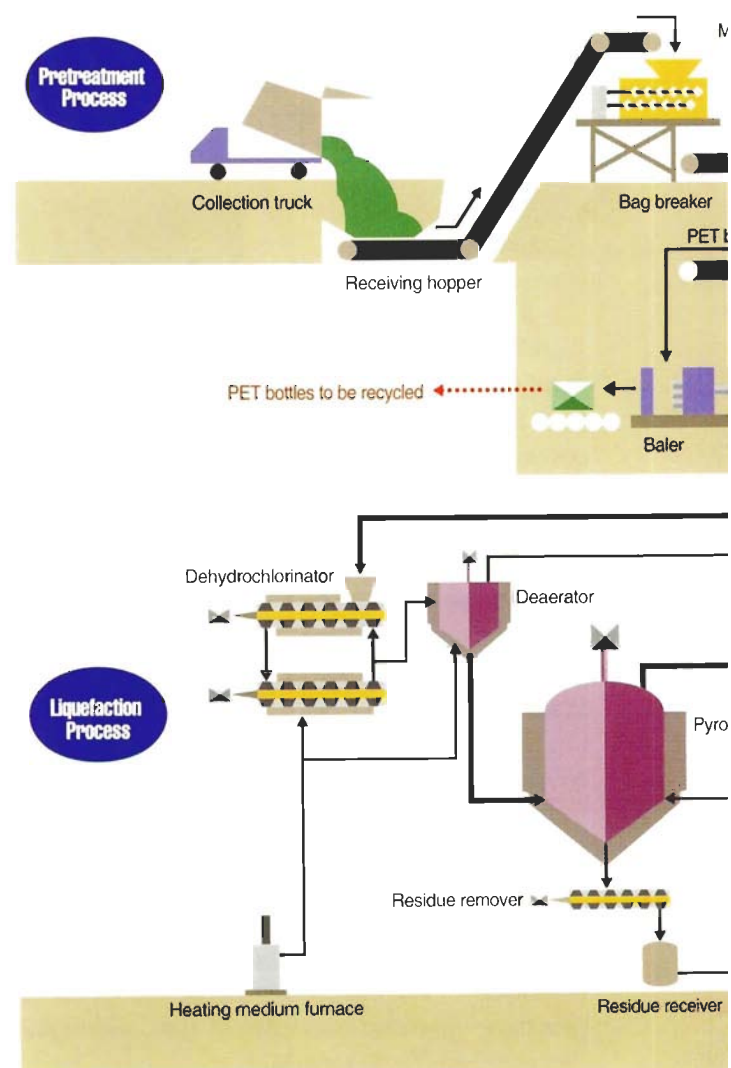
In addition, the recovered oil is used at an aquarium in the city (Marinpia Japan Sea) and at other public facilities. At the aquarium, the oil is used to operate diesel generators that supply electricity for the interior of the building.

PWMI will collect and analyze verification data on the plant's operations, and will promote widespread use of this technology in the future. It is anticipated that the new facility will make a major contribution to the alleviation of Niigata City's waste problem. It is also consistent with the goals of the Container and Package Recycling Law, which was put into effect from fiscal 1997.



This overall view of the Niigata Plastics Liquefaction Center shows the plant for the pretreatment process in the background on the right and the plant for the liquefaction process on the left. This facility can treat 6,000 metric tons of plastic waste annually.

Process Flowchart for the Liquefaction Plant





Shown here is the front entrance to the Niigata Plastic Liquefaction Center. The building on the right is for offices and the liquefaction plant can be seen in the background.

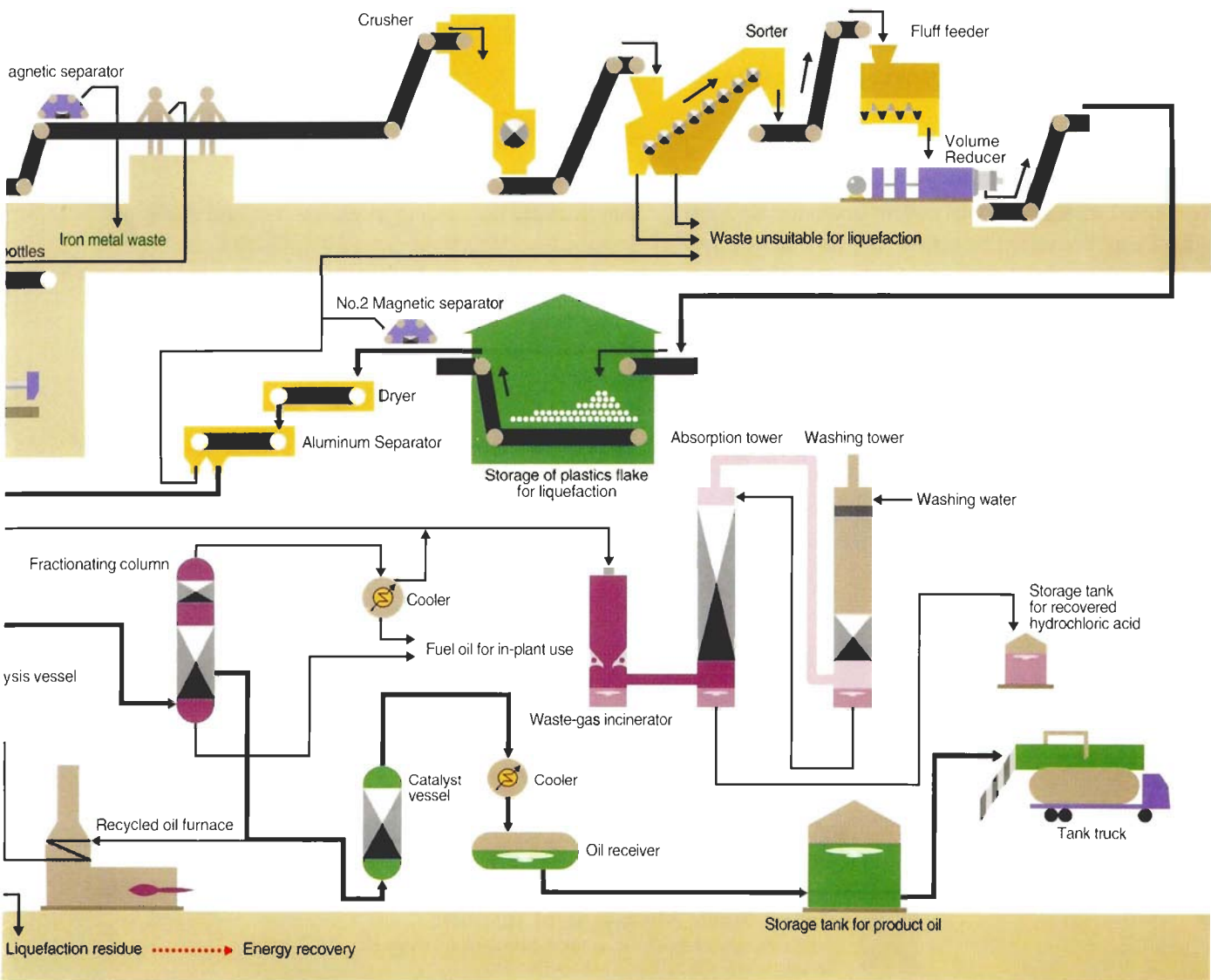


A sorted collection of plastic waste is dumped into the receiving hopper from a collection truck.



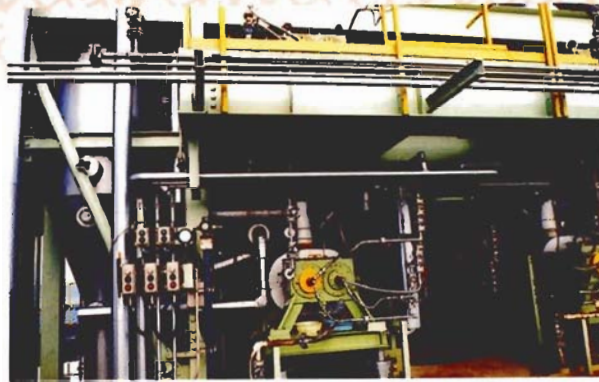
PET bottles are sorted out by hand and then compressed in the baler.

The compressed PET bottles are banded and sent to the recycling plant.





Plastic waste that has previously been crushed into the form of flakes is further compressed into high-density flakes in this reducer. This marks the final stage of the pretreatment process.



In this dehydrochlorinator, the polyvinyl-chloride resins in the plastic waste are heated and melted and the chlorine fraction is isolated in the form of hydrogen-chloride gas. The deaerator can be seen on the left.

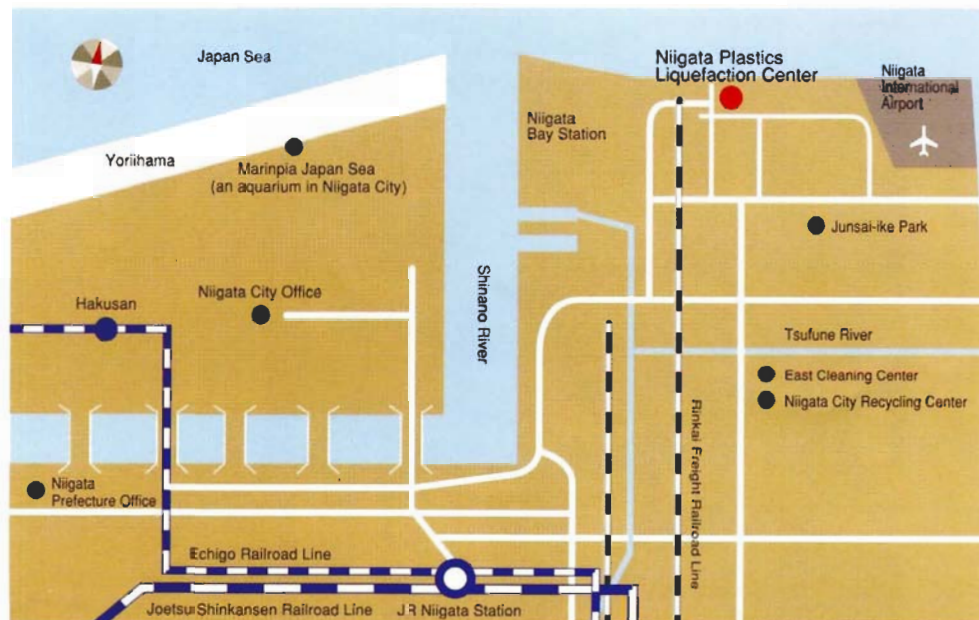


In these catalyst vessels, the chlorine fraction is removed from the oil that has been formed by pyrolysis. Terephthalic acids are decomposed and other small amounts of constituents are regulated.



Plastic waste that has been dechlorinated is converted to oil in this pyrolysis vessel by heating it under normal pressure to a temperature of approximately 400 C.

Map showing location of Niigata Plastics Liquefaction Center



# The 23rd Far-East Plastic Industry Conference

Sixty-six participants from Japan, Korea and Taiwan attended the 23rd Far-East Plastic Industry Conference, held on November 7, 1997 in the Shilla Hotel in Seoul.

Korea reported that to promote reuse of plastic waste, several systems have been tried to get businesses to bear some of the cost (advance deposit system, allotment system), reduce quantity used, and improve the rate of recycling (require use of recycled raw materials). As an example, the government invested capital to improve the recycling rate of plastic waste that general recyclers don't accept, passing it through government-operated Korea Resources Recovery and Reutilization Corporation but an improvement was not seen. The reason for these results is thought to be the lack of an organization specialized for plastic waste.

In Taiwan, major revisions of plastic waste laws are being considered by the Environment Protection Administration. In the area of collection, the Waste Purification and Disposal law will be revised and the separate recovery foundations for each type of problem plastic material will be integrated into the Waste General

Materials and Containers Recovery Foundation. Money will be collected from plastic container manufacturers for waste collection and treatment. The deposit system has been adopted for PET bottles, but due to the competition with PVC bottles in some markets, the Environmental Protection Office for the first time in 1997 added PVC bottles to the system.

Japan reported that the implementation in April 1997 of the Container and Package Recycling law began separate collection of PET and glass bottles and creation of recycled products. The law establishes sharing of roles as follows:

consumer	separate disposal
local government	separate collection
businesses	recycling

In addition, recycling of "other plastics" (besides PET bottles) is scheduled to begin in April 2000. At present only liquefaction has been selected as a method of recycling but other methods are being examined, such as use for blast furnaces and cement kilns, eco-cement, gasification and refuse-derived fuel.



# Joint Research on PVC Waste Recycling Technology

Nippon Kokan K.K. (NKK Corporation), the Japan PVC Environmental Affairs Council, and the Plastic Waste Management Institute in August 1997 began a joint research project on PVC waste recycling technology (dehydrochlorination, hydrochloric acid recovery, blast furnace feeding technology, etc), which will continue until July 1998. Test equipment for the project has been set up in NKK's Keihin steelworks facility.

Since October 1996 NKK has been operating its integrated plastic waste blast furnace recycling system and reusing industrial plastic waste as a raw material for steel and, in particular, as a reducing agent. However, because the chlorine component of PVC causes corrosion and other harmful effects, it is currently not a target for the integrated blast furnace system.

However, PVC accounts for about 15% of plastics at present, and regardless of type (industrial or municipal), this problem can't be avoided in order to progress with recycling. Furthermore, according to the Container and Package Recycling Law, plastics other than PET bottles are required to be recycled beginning in the year 2000, making the development of practical technology urgent in all fields.

If technology for the dehydrochlorination of PVC can be established in the current research, NKK can expand the target range for blast furnace recycling of plastic waste. In other words, this will open the door to recycling of not only

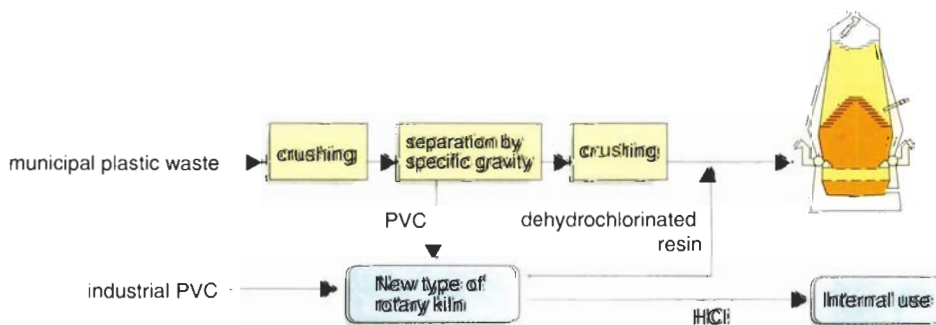


Plastic waste in powdered form is injected through the tuyeres near the bottom of blast furnaces to act as a reducing agent during the ore reduction and smelting process.

industrial plastic waste as at present, but also municipal plastic waste. In addition, it is expected to find a use for the separated hydrogen chloride.

#### Main test items

- (1) Test the equipment capacity of each type of PVC product for dehydrochlorination and granulation.
- (2) Test feeding dehydrochlorinated plastics into a blast furnace.
- (3) Test reuse of the gas created.
- (4) General evaluation of actual equipment.



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