PWMI Newsletter

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Plastic Waste Management Institute
JAPAN

Development of Technology for the Full-scale Enforcement of Containers and Packaging Recycling Law to Turn into New Products

Containers and Packaging Recycling Law was partly implemented in April 1997, and a considerable number of local governments are steadily moving ahead with the collection and sorting of PET (polyethylene terephthalate) bottles, and the recycling of these bottles into new products.

From April 2000, "other plastics without PET" will also be targeted by this law. In other words, we have now entered the phase of legally defining the separation standards and procedures to make new products from recycled "other plastics." This phase also covers the preparation of nation-based recycling programs as well as local government-based separation and collection programs.

From the viewpoint of supporting the smooth start-up of the law to implement full-scale recycling of containers and packaging, the Plastic Waste Management Institute regards the following three initiatives as being central to its 1999 technology development program.

(1) Development of gasification technology
(2) Use of waste plastics for cement kilns
(3) Practical application of blast furnace reducing agent for waste PVC plastics

These technologies will be promoted in effort to diversify the measures used to make new products from recycled waste.

Giving Momentum to Three Projects

In relation to the methods used to make new products from waste plastics, the Plastic Waste Management Institute has so far endeavored to establish liquefaction technology and disseminate the results yielded by this technology.

However, this is not all the institute is involved in. It intends to develop technology for the recycling of waste plastics, such as PVC resins, into raw materials and fuels for cement in cement kilns, as well as the practical application of blast furnace reducing agent for waste PVC plastics.

This is in addition to rational advice on the selection of appropriate methods according to the conditions of a site, the gasification of waste plastics. Assistance is also given to the development of gasification technology to make raw materials for the chemical industry, and to the recycling of containers and packaging.

Gasification Technology

In the area of chemical recycling using pressurized gasification, the Plastic Waste Management Institute has been commissioned by NEDO (New Energy and Industrial Technology Development Organization) to turn waste plastics into raw materials for the chemical industry.

Two companies are to participate in this program: Ebara Corporation and Ube Industries,LTD. The internally circulating fluidized bed technology, gas smelting technology and pressurized dry feed system owned by Ebara corpolation will be used in conjunction with gas refining technology, owned by Ube Industries for many years, to demonstrate efforts in the field of resource recovery.

Construction on the demonstration plant commenced in February in Ube City. The site will comprise a raw materials acceptance and storage facility, raw materials supply facility, low temperature gasification furnace, high temperature gasification furnace/slag recovery facility and waste water treatment facility. The planned processing capacity for organic waste such as waste plastics is 30 tons a day, or about 10,000 tons annually.

The demonstration period is expected to last three years from fiscal 1998, and the total business costs are projected to be around three billion yen.

The features of the gasification technology include the following.

(1) No real generation or re-synthesis of dioxins because of the reducing atmosphere of gasification temperatures between 1300 and 1500°C and partial oxidization of the entire process, and because of momentary cooling to about 200°C.

(2) Plastics containing chlorine can be used for gasified raw materials without prior sorting or processing.

(3) Non-combustibles such metals and soil from waste plastics will be collected as un-oxidized metals or slag from the bottom section of the low and high temperature gasification furnaces. Chlorine will be collected as ammonium chloride (a fertilizer) from the circulating water.

If development of this technology progresses further, it will be possible to recycle waste plastics into raw materials for the chemical industry without generating dioxins. This will contribute to the reduction of carbon dioxide emissions, as well as reduce the consumption of finite fossil fuels.

Moreover, this technology is gaining attention as one of the key ways to turn "other plastics" into new products.

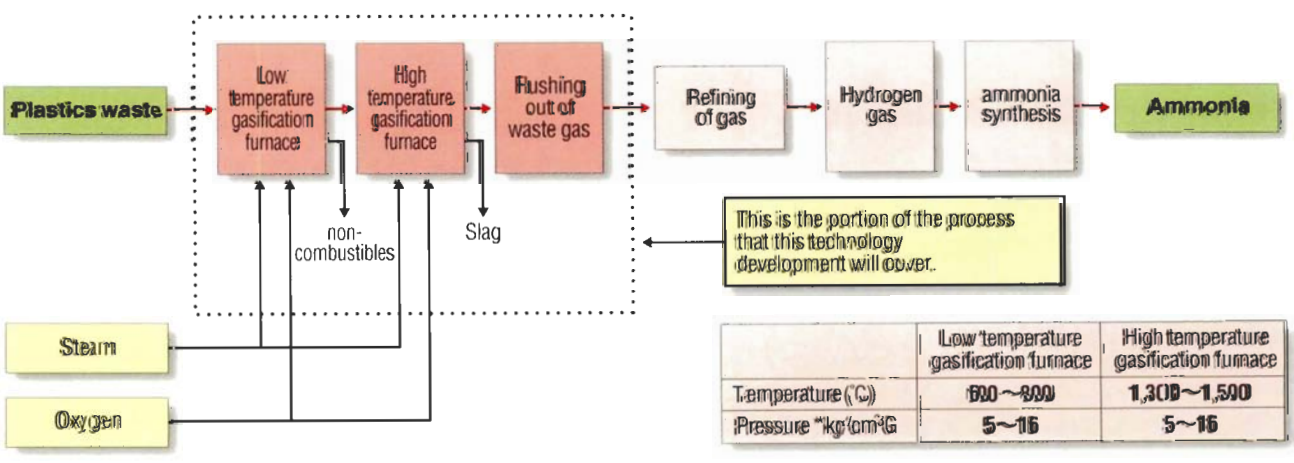
Use in Cement Kilns

The next program to produce new products from waste to be promoted by the Plastic Waste Management Institute is the use of waste plastics containing PVC in cement kilns.

The Plastic Waste Management Institute, together with Vinyl Environmental Council, Japan PVC Environmental Affairs Council and Tokuyama Corp. will endeavor to develop technology that will remove chlorine from waste plastics that contain PVC for use as raw materials for cement kilns, and refine the separated hydrogen chloride for re-use as raw materials for PVC monomer.

Tokuyama Corp. has a cement plant with a 6 million ton

ENTIRE GASIFICATION PROCESS FOR WASTE PLASTICS



	Low temperature gasification furnace	High temperature gasification furnace
Temperature (°C)	600~800	1,300~1,500
Pressure *kg/cm²G	5~15	5~15

annual output and a VC monomer plant with a 300,000 ton annual output. The company has been undertaking the recycling of waste plastic into raw materials for cement since 1995. However, PVC was removed from this process because of fears that it adversely affected the operation of cement kilns and consequently the quality of the cement.

However, Tokuyama, together with the Plastic Waste Management Institute, intend to jointly develop chlorine removal technology. This is because full-scale enforcement of Containers and Packaging Recycling Law will commence from April 2000. This will require that PVC recycling technology is established to cope with the increase in mixed waste plastics containing such components as PVC resins.

The main aims of this technology are to (1) develop a system to remove hydrogen chloride from waste plastics that contain a high level of PVC, (2) develop technology that turns this plastic into raw materials after hydrochloride has been removed, and (3) develop a system that turns the collected hydrochloride into oxi-chlorination raw materials for VC monomer.

The plant consists of a furnace to remove hydrogen chloride, hot air generator, combustion and decomposition furnace, cooling tower, hydrochloric acid absorption tower and pretreatment tower. After crushing, waste plastic will be heated to 350°C and then separated into hydrochloride and chlorine-removed plastic during the hydrochloride removal process.

In May construction of a demonstration plant that can process 500 tons of plastic waste annually will be commenced within the grounds of Tokuyama's plant in Tokuyama city, Yamaguchi prefecture. Demonstration and testing will be conducted on such elements as system performance, economic viability and safety. Technology development is scheduled for October. Development costs, including facilities costs, are projected to total around 300 million yen.

If a recycling system can be accomplished by this joint research, it will also be possible to develop a system that will integrate the processing of other plastics containing PVC (recycling slated to begin in the year 2000), thereby expanding the recycling of waste plastic into new products.

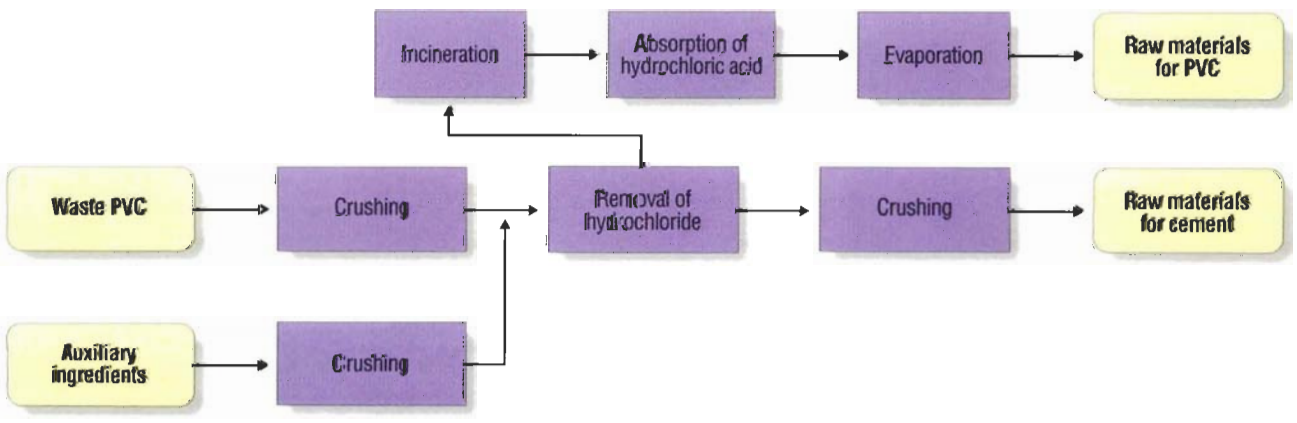
Practical Application of Recycling by Blast Furnace Reduction for Waste PVC Plastics

Another of the projects to be promoted by the Plastic Waste Management Institute is the practical application of blast furnace reducing agent for waste PVC plastics.

The use of industrial waste plastics, except PVC, as blast furnace material is already being put into practice at NKK's Keihin plant on a scale of approximately 30,000 tons annually. At present, PVC resins are not being targeted for blast furnace reducing agent because of fears that the chlorine content will adversely affect the blast furnace facilities. However, PVC resins represent approximately 17% of Japan's total plastics production volume. We must therefore endeavor to find an effective use for PVC from the viewpoint of implementing waste plastic recycling that does not discriminate between industrial and household waste.

Besides the development from August 1997 of centrifugal

CONCEPT DIAGRAM OF RESOURCE RECOVERY FROM WASTE PVC PLASTICS FOR PVC AND CEMENT



specific gravity separation technology that separates PVC resins within household plastic from other plastics, NKK, Japan PVC Environmartal Council and the Plastic Waste Management Institute have developed technology that removes chlorine from the high level of PVC resins found in industrial waste.

In April 1998, testing facilities comprising a demonstration-scale raw material supply unit, chlorine removal unit and an exhaust gas treatment unit were set up within NKK's Keihin plant. Performance checks and evaluations of the facilities have been producing good results. The Plastic Waste Management Institute, with the cooperation of NKK and Vinyl Environmental Council, will soon commence research on the practical viability of these facilities based on the technology developed so far. The research period shall last until March 2001.

The major technology that this development activity aims for are:

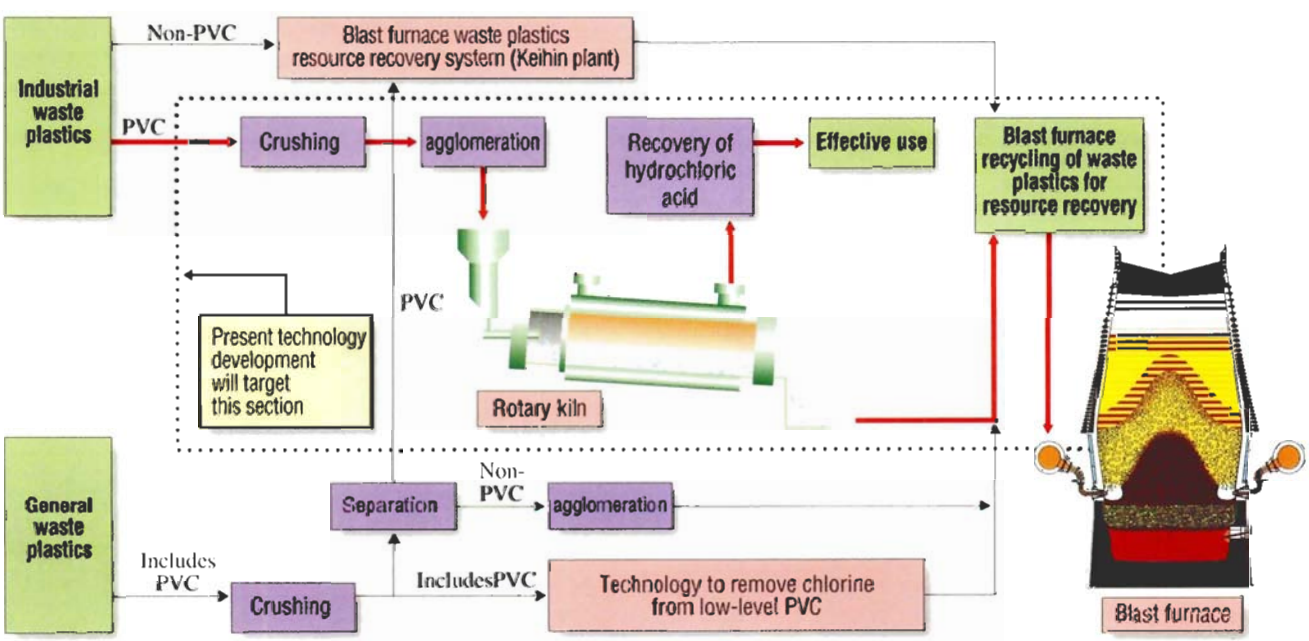
(1) continuous operational technology in integrated facilities;
(2) steady operational technology that can accommodate variations in PVC levels;
(3) agglomeration technology for blast furnace reducing agent and technology for the practical application of chlorine removal technology; and
(4) practical application of technology to remove heavy metals and organic impurities from collected hydrochloric acid in an effort to achieve practical recycling of high purity hydrochloric acid from chlorine in PVC.

A facility with an annual output of 5,000 tons will be located in NKK's Keihin plant, where technology will be developed for the purpose of practical application. The total cost required for these activities is expected to be around 2.5 billion yen, of which a portion will be subsidized by NEDO (New Energy and Industrial Technology Development Organization).

At this facility, PVC resins from industrial waste and PVC resins separated from household waste will undergo thermal decomposition in a rotary kiln, where chlorine will be removed from PVC resins. This will allow for chlorine to be collected as hydrochloric acid and put to effective use.

If this technology proves successful, large volume recycling will become a feasible means of transforming waste plastics into new products.

FLOW CHART FOR PVC BLAST FURNACE RESOURCE RECOVERY



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