PWMI Newsletter

NO 12 1996.10

Plastic Waste Management Institute
JAPAN

NEW CHAIRMAN

Inaugural Address of New PWMI Chairman

Reiichi Yumikura, president of Asahi Chemical Industry Co., Ltd., was named chairman of the Plastic Waste Management Institute at PWMI's 25th Ordinary General Meeting on May 24. The new chairman will take the lead in directing the Institute's operations for a 2-year period. As he accepted his appointment, Mr. Yumikura expressed his aspirations in an inaugural speech to the attendees.

"We must deal with the task of finding solutions to the problem of plastic waste without taking even a moment of rest.

"The three extremely important problems we currently face are those relating to the global environment, to waste, and to saving resources. And the key word that is common to the resolution of all of these problems is 'recycling.'

"In order to cope with the situation brought about by the enactment of the Container and Packing Recycling Law and other developments, all of us must come into face-to-face confrontation with this urgent issue——recycling.

"This year is the 25th that has passed since the founding of our Institute. In the 25 years since the establishment of PWMI, we have solved many diverse problems. At present, I believe that an issue we must deal with is the conversion of plastic waste into oil in accordance with the spirit of the new recycling law.

It is therefore my hope that we will all strive for the successful completion of the ongoing project for the development of next-generation technologies for the liquefaction of plastic waste."

Mr.Yumikura (right) expressed his aspirations.
Left is Mr.Furukawa,the former chairman

TOPICS 1

Development of Technology to Conver Raw Material For Blast Furnaces

By Kazumasa Wakimoto Nippon Kokan K. K.

World's First Continuous Recycling System

Nippon Kokan K. K. (NKK Corporation) has developed a continuous recycling system that crushes and granulates plastic waste and uses it as a reducing agent (as a substitute for coking coal) in blast furnaces. This system will be inaugurated in October of this year for the No. 1 Blast Furnace at NKK's Keihin Works. This article will introduce the outline and features of this recycling system and provide a general view of the results and benefits it will bring against the background of the increasingly serious waste problem that faces Japan.

Technology for employing plastic waste in blast-furnace operations has already been made practical by a company in Bremen, Germany, but this NKK-developed continuous recycling system is the first in the world that integrates the equipment for crushing/granulating the plastic waste and converting it into a raw material with the equipment necessary to operate a blast furnace.

An investment of approximately 1.5 billion yen ($1 =¥100) was made for the new installation of the pre-processing and pre-treatment facilities for the No. 1 Blast Furnace, which has an annual pig-iron production capacity of 3.9 million metric tons, at the Keihin Works, which is located in Minami Watarida-cho, Kawasaki-ku, Kawasaki City.

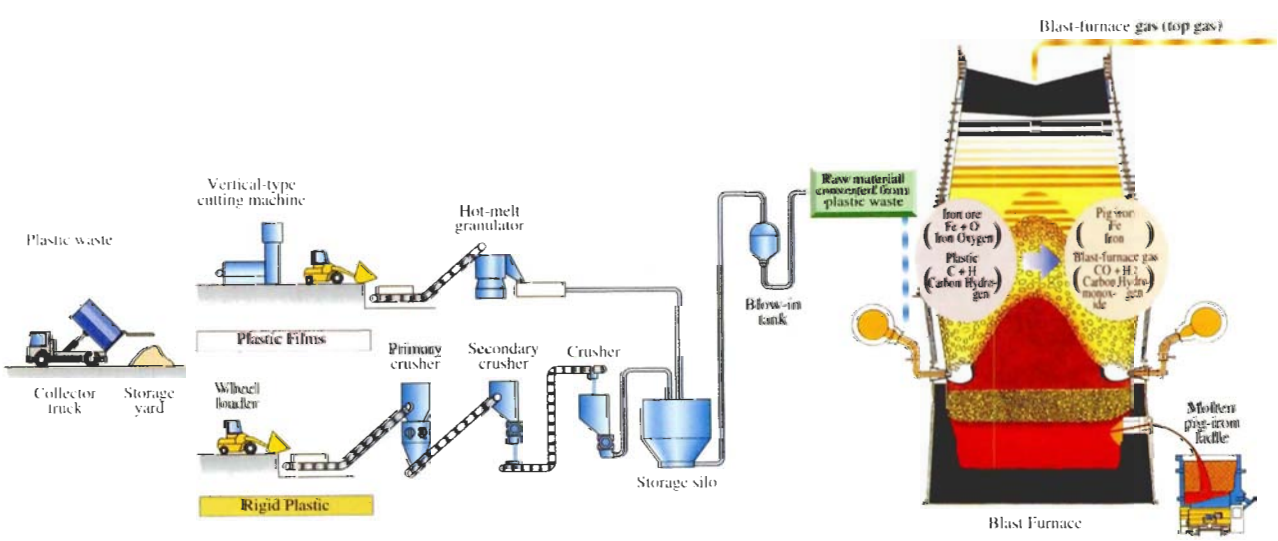
The original plan calls for the substitution of plastic waste for every 10 kilograms of the 410 kilograms of coking coal that are now required to produce each metric ton of pig iron. And it is technologically possible to use up to 600,000 metric tons of plastic waste annually (based on a maximum of 200 kilograms per metric ton of pig iron.)

We intend to obtain permission to operate as a waste processor and to establish plastic-waste collection routes prior to the full-fledged start-up of the system in October. Our immediate schedule is to secure the collection of 30,000 metric tons of plastic waste from the industrial waste generated by enterprises located primarily in the southern Kanto area.

The NKK continuous recycling system for plastic waste for use in blast furnaces sorts the plastic waste, crushes and granulates it, and blows these together with the hot air through the blast-furnace tuyeres. NKK has already been awarded 15 basic patents on various unique aspects of the system.

The features this new system provides include (1) the more

Production Equipment for Raw Material for Blast Furnaces



t Plastic Waste into a

economical use of the coal resources on which we depend, both in Japan and abroad, since the amount of coking coal that is required is reduced, (2) a reduction in the volume of carbon monoxide that is generated, thereby creating a countermeasure against global warning, (3) the use of by-product gas in existing plants for electric-power generation, etc., without generating toxic gases, and (4) benefits from the standpoint of savings in resources and energy that exceed those of other recycling processes since the blast-furnace energy-efficiency rate reaches a high level of over 80%. For these reasons, then, it is believed that the recycling of plastic waste for use in blast furnaces by the NKK system will prove to be an extremely effective process.

Steel Mill Coexisting with Urban Communities

Since the hydrogen chloride that is generated when poly-vinyl chloride is burned would cause corrosion inside a blast furnace, plastic waste of this type cannot be used at the present time. It is planned to recycle poly-vinyl chloride in the future, however, after the required progress has been made in the development of dechlorinating technologies.

Since NKK has long maintained the determination to contribute to the protection of the global environment and to the establishment of a resource-recycling society, our entire company is engaged in the task of saving resources, saving energy, and safeguarding the environment.

Especially at the Keihin Works, because of its conditions of location and other factors, we have been aiming at the creation of a steel mill coexisting with urban communities in which emphasis has been placed on compatibility with the environment and the efficient use of energy. It was while we were tackling these problems three years ago that a plan emerged for the recycling of plastic waste. Tests were subsequently conducted by employing experimental equipment and a team was then set up in December of 1995 with the goal of making operational the conversion of plastic waste into a raw material for use in blast furnaces.

Continuous recycling system for the conversion of plastic waste for use in blast furnaces

For further information, please contact:
Mr. Kazumasa Wakimoto
General Manager, Waste Plastic Dept., Keihin Works,
NKK Corporation
1-1, Minami Watarida-cho, Kawasaki-ku, Kawasaki-city Kanagawa 210, Japan
Tel 81-44-322-1654
Fax 81-44-322-1523

Tuyeres around the lower part of blast furnance

Granulated plastic waste

TOPICS 2

Present Situation and Issues Relating to Plastic Waste Recycling in China

By Rinzo Iijima

Continuing Increases in Plastics Consumption

Indications are that the amount of plastics consumed in China is rising at a level of 20% year after year and that social problems are being brought to the fore due to the contamination of the environment caused by the plastic waste that accompanies this growth.

Estimates are that the amount of domestic plastics production in China in 1994 was approximately 3.2 million metric tons. Since it is assumed that roughly the same amount was imported, the total amount of plastics consumption for the year was probably about 6.4 million metric tons.

The plastics industry in China has grown and changed greatly over the last 10 years. The number of enterprises now engaged in the industry is close to 20,000 and these include everything from "cottage-industry" companies to joint ventures with overseas firms.

Demand cannot be accommodated by domestic production alone and approximately half of it is supplied by imports from abroad. And it is a distinguishing characteristic of the Chinese plastics industry that these imports include not only virgin materials but a large amount of plastic waste as well.

It is well known that about 50% of the plastic waste collected by DSD of Germany (some 250,000 metric tons of mixed waste) is imported and then sorted for recycling in China. And large amounts of plastic waste are also imported for local recycling from the U. S. A. and Japan.

A case was recently reported concerning a problem that occurred because large amounts of refuse were found in sorted collections of PET bottles imported from the U. S. A. Because of such incidents, China enacted strict laws relating to the importation of plastic waste in April of this year.

Plastic Waste Highly Valued

Refuse in China is not disposed of by incineration but is dumped or buried instead. Both plastic cans and plastic bottles are considered to be valuable, however, and these are picked up and collected for recycling even at the dumping grounds.

Transactions involving collected plastic waste are conducted at plastic-waste-materials markets in all regions of the country. The author visited and investigated plastic-waste collection and recycling sites throughout China on two occasions last year and this year.

There is a plastic-waste-materials market on a large plot of ground in an area of farming villages approximately 200 kilometers south of Beijing where over 10,000 people annually transact business on more than 100 types of plastic waste that exceeds 100,000 metric tons in weight. Waste from every kind of plastic product is brought there, sold, and then recycled at processing plants in the vicinity.

Markets in more than 250 areas in northern Jiangsu Province engage some 7,000 people with plastic waste that has been collected and sorted by individuals. Approximately 160,000 metric tons of plastic waste are sold in these markets each year for subsequent recycling.

Markets such as these are located in every region and even dirty plastic waste or waste of the type that would be incinerated or buried in Japan is all collected, sorted by hand, and recycled through these markets.

Under these circumstances, it can be seen that the series of operations in the plastic-waste recycling process (crushing, washing, removal of foreign matter, sorting, demoisturization, drying, etc.) depend almost entirely on work done by hand. This is due more to the low labor costs than to a technological lag since these are a factor in making hand-processing more efficient than machine-processing operations.

PET-Bottle Recycling Technology

The three primary types of plastic bottles used in China are PET, PE and PVC, but PET bottles are the most widely used, collected and recycled (although PE and PVC bottles are, of course, also recycled). The reason for this is that there is a brisk business in the recycling of PET bottles for

use as textile fibers. And this is also why PET bottles are also imported from the U. S. A.

At one plant visited by the author, bottles purchased from a market were being recycled after being hand-sorted and divided into assortments of transparent PET bottles, green-colored PET bottles, PVC bottles and PE bottles. This operation was being carried out with precision by hand and with better accuracy and efficiency than is possible in a machine-sorting operation. (Hand-sorting operations of this kind are also performed on Taiwan.)

After the sorted PET bottles are crushed, washed and dried, still greater amounts of manual labor are required during visual inspections to confirm the removal of foreign matter. Following this, pelletization is performed and the product is sold to textile plants.

Conversion of Plastic Waste into Oil by Pyrolysis

Since coal is plentiful and inexpensive in China, it is in widespread use as a fuel, for heating, and for other purposes. Because petroleum is also a precious resource, however, the development of technologies that recover oil from plastic waste is being tackled in earnest.

The author made a field trip to study a pyrolysis facility that is presently in operation in a suburb of Beijing. In the method in use there, an iron cracking pot is placed inside a brick furnace and heating for decomposition is provided from below by a coal-fed fire. The coal is burned in the bottom of the equipment and cracked gas is expelled from the top through a pipe. There is also a small refining tank and at the rear of the equipment a cooling tank and a recovery tank.

The plastic waste that serves as the raw material includes polypropylene bags and polyplastic films. This is processed as it is even when soiled by dirt, sand, etc. Other materials, such as PVC, are neatly sorted out by hand.

The recovered oil is redistilled, separated into fractions for gasoline, kerosene and light oil, and sold as fuel for the City of Beijing.

Some problems seem to exist with regard to quality, but the persons in charge at the plant have confidence in the technology and are even enthusiastic about selling it together with the catalytic technology to Japan.

A second facility of the same type is scheduled to go into operation in the near future.

For further information, please contact:
Mr. Rinzo Iijima
Plastic Recycling Technical Institute
1-22-12, Shin-ishikawa, Aoba-ku, Yokohama-city
Kanagawa 225, Japan
Tel/Fax 81-45-911-3326

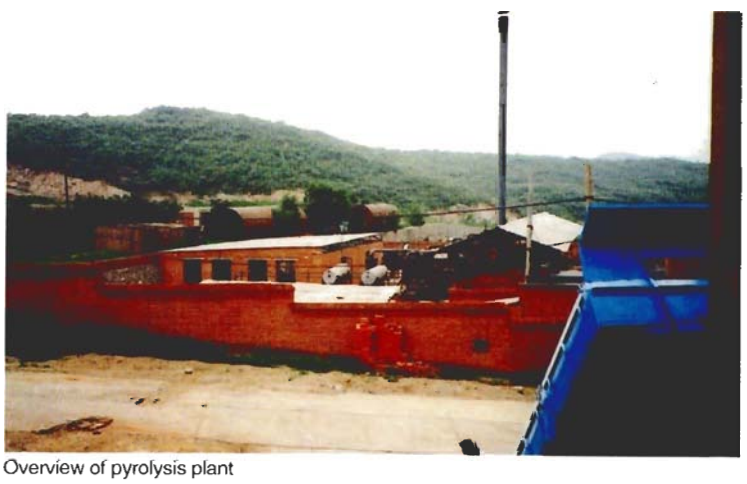
Waste plastics collected in the market

Iron cracking pot (Pyrolysis plant)

Heating by coal

Transportation of waste plastics from the market

Waste plastics market



Overview of pyrolysis plant

TOPICS 3

Reclaimed Plastic Products in Japan "Won't You Use This One More Time?"

A Catalogue Jointly Prepared by the Clean Japan Center and the Plastic Waste Management Institute

A catalogue concerning reclaimed plastic products entitled "Won't You Use This One More Time?" has been jointly prepared by the Clean Japan Center and the Plastic Waste Management Institute and has been widely distributed throughout Japan.

The catalogue introduces a broad variety of products that have been manufactured from all types of plastic waste and was published with the objective of raising the levels of understanding and interest of readers in regard to the subject of recycling plastic waste.

It has been noted that even among people who cooperate in collecting plastics for recycling there are many who do not know in which types of products the reclaimed plastics are later "reborn." By introducing the numerous actual examples of the use of these reborn plastics, it is thought that the understanding of recycling among those who see the catalogue will be deepened and that a higher degree of cooperation from them will be encouraged.

In the catalogue, color photographs show clothing, household articles, materials for industrial use and other items that have been made from plastic waste. An easy-to-understand explanation is also presented of the important role that products made of recycled plastics play in various aspects of our daily lives.

Examples of products manufactured from plastic waste as presented in the catalogue by four different organizations are listed below.

Japan PET Bottle Association

Dress shirts, work clothes and other types of clothing

Bottles for detergents, carpets and other household articles

Stationery products such as file holders, pen cases, notebook covers, etc.

Partitions in gift items, articles for automobile interiors, artificial turf and other materials for industrial use

Japan Expanded Polystyrene Recycling Association

Agents for mixing mortar, building materials, etc.

Stationery items and miscellaneous daily necessities (blackboards, hangers, toys, etc.)

Japan Plastics Effective Utilization Union

Materials for civil-engineering construction (dirty-water containment, covers, ventilation panels, hammers, adiabatic panels, etc.)

Conveyance aids, etc. (revolving stands for flower pots, containers, pallets, artificial wood, bumpers, mats for automobile interiors, etc.)

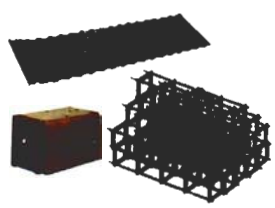
Japan Polystyrene Foamed Sheet Industry Association

Sets of tables, chairs, benches, etc.

Flower pots, platforms for storing bedding in Japanese-style closets, synthetic building materials

Ball-point pens, pen trays and other stationery items; miscellaneous daily necessities

Materials for the agricultural and fishing industries (octopus traps, sheets for greenhouses, man-made gathering places for fish, etc.)



TOPICS 4

Operational Plans in Fiscal 1996 of Organizations Involved in the Recycling of Plastic Waste

Since the enforcement of the Container and Packing Recycling Law will begin on April 1, 1997, still more vigorous recycling activities are being carried out at all of the organizations concerned with the promotion and progress of plastic-recycling work. Introduced below are the operational plans that are being conducted together with the Plastic Waste Management Institute by the Japan PET Bottle Association, the Japan Expanded Polystyrene Recycling Association, and the Japan Polystyrene Foamed Sheet Industry Association.

Japan PET Bottle Association

Ishikawa-CO Bldg., 1-9-11, Kaji-cho, Chiyoda-ku
Tokyo 101 Japan
TEL: 81-3-5294-7591 FAX: 81-3-5294-2823

We have to date worked to upgrade equipment at recycling plants, improve working rates and collection rates, and expand the scope and volume of sorted collections. In fiscal 1996, we plan to shift emphasis to the creation of new systems that will conform to the requirements of the Container and Packing Recycling Law.

Profitability for WPR

Assistance continues for WITH PET Bottle Recycling Co., Ltd. (WPR), which was founded in 1993, and the company's business outlook has improved. The goal for fiscal 1996 is for WITH's revenues to increase so that it can achieve blank-ink results on its own.

Preparations for a 2-Plant System for Kansai

Work is proceeding on a recycling plant with an annual capacity of 8,000 metric tons at Iga-town in Mie Prefecture and operations are scheduled to start there in April of 1997. This plant is being built for Yono PET Bottle Recycle Co., Ltd. (YPR), which was established in 1995, with the cooperation of six organizations, including our Association and the National Cold Beverage Industrial Association.

In combination with the WPR facilities, the completion of this project will establish a 2-plant system for the Kansai area with the capacity to receive a still greater volume of sorted collections of PET bottles.

Collection Target: 2,500 Metric Tons

Although further progress is necessary in collections from local governments in parallel with additional advances in the development of applications for reclaimed products, the collection target for fiscal 1996 has been set at 2,500 metric tons.

Japan Expanded Polystyrene Recycling Association

Fax Bldg., 2-20 Kanda Sakuma-cho, Chiyoda-ku
Tokyo 101 Japan
TEL: 81-3-3861-9046 FAX: 81-3-3861-0096

Resource-Recovery Rate of 35% by Year 2000

The goal of reaching a resource-recovery rate of 25% for expanded polystyrene waste that was set in the First 5-Year Plan when our Association was established was surpassed in the fifth year of the plan in 1995 when a rate of 27.3% was achieved.

In the Second 5-Year Plan, the target for the year 2000 has been set at 35% and the major emphasis is to be placed on materials-recycling activities.

In order to accomplish this new goal, we are proceeding in fiscal 1996 with an expansion in the distribution of processing equipment for use in local wholesale markets, where the resource-recovery rate is only 23% (compared to 70% in the central wholesale markets).

Continuing Progress in EPSY Plaza 200 Project

In May of 1996, the number of EPSY Plaza installations throughout the country with equipment for the recycling of expanded polystyrene in household articles, etc. reached 89 and we are now continuing with a further expansion of these facilities.

Japan Polystyrene Foamed Sheet Industry Association

Tokon Bldg., 26 Kanda Higashi Konya-cho,
Chiyoda-ku
Tokyo 101 Japan
TEL: 81-3-3257-3334 FAX: 81-3-3257-3339

"Social Systems" Suitable for Individual Regions

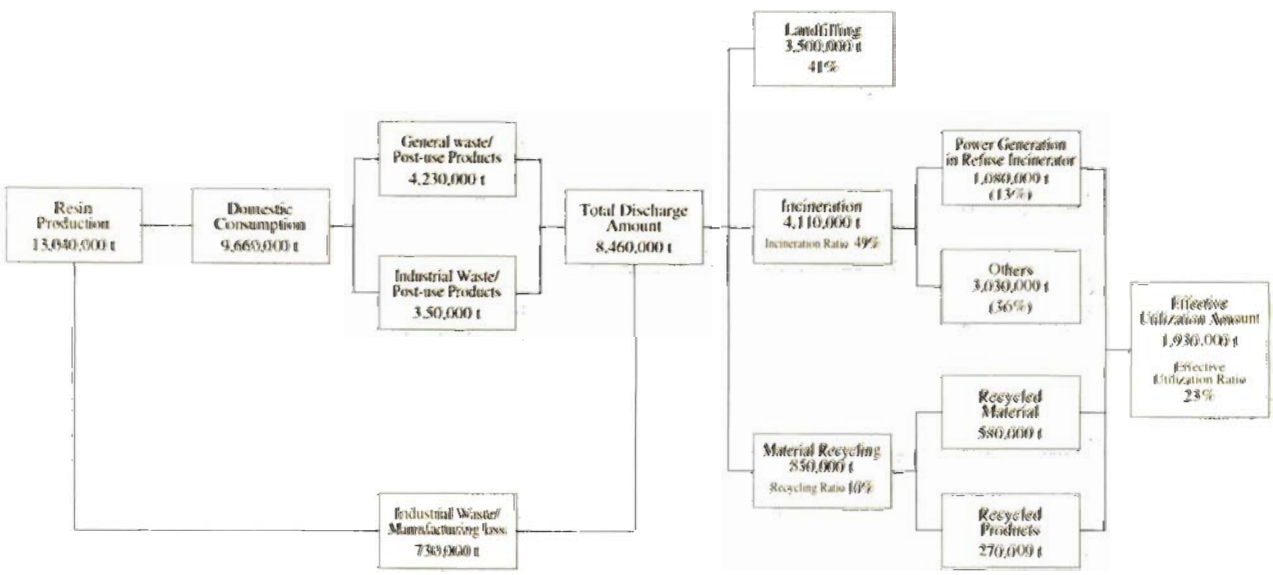
Premised on the aggressive participation of regional governments, we plan to create "social systems" for recycling that bring together in one body parties from four different sectors administrative, distribution, consumer and industrial.

Government and ministerial ordinances based on the Container and Packing Recycling Law will go into effect on April 1 of the year 2000 for items in the classification of trays, etc. that are made of expanded polystyrene and other plastics.

As we approach this day of enforcement, we plan in fiscal 1996 to deal with the above mentioned four groups as a single body and in cooperation with the local governments to schedule the timing and positioning of measures necessary to comply with the new law.

In the meantime, the collection rate for trays, etc. that are made of expanded polystyrene continues to increase year by year and reached a total of 320 metric tons in fiscal 1995. The target for fiscal 1996 is 360 metric tons.

Flowchart —— Plastics Production, Consumption, Disposal and Recycling in Japan (1994)



Material Recycling for 10% of Plastic Waste

Plastic waste is made up of articles that become waste as soon as they are used, such as wrapping films for food, and articles that become waste only after they wear out after many years of use, such as durable consumer goods. Because of this, there is a time discrepancy between the production of plastics and the disposal of plastic waste. When looked at in terms of a year of time, in recent years the amount of waste annually has been equal to approximately one half of the amount of the year's production.

In Japan, 49% of the plastic waste is treated by incineration, 41% of it is landfilled, and 10% is processed by material recycling. Material recycling is generally divided into processes that melt the plastic waste and produce products in different forms, and processes that produce the reclaimed raw material from the plastic waste.

Plastic Waste Also Recoverable in the Form of an Energy Resource

Plastic-recycling rates are low for mixtures of many types of plastics since batch recycling processes cannot be performed. The use of recycling therefore tends to be limited to those industrial fields in which easy-to-sort products are manufactured.

In the two types of plastic recycling, the effective utilization rate is 10% for material recycling, in which waste is returned in the form of the reclaimed plastic, and recycling that converts waste into various types of thermal energy, including 13% that used for electric-power generation. From this, it can be said that the overall effective utilization rate is at least not less than 23%.

And it is expected that the amount of plastic waste recycled for use as an energy resource will further increase in the future.

Plastic Waste Management Institute
Fukide Bldg.,4-1-13 Toranomon, Minato-ku Tokyo 105, Japan
Tel;81-3-3437-2251 Fax;81-3-3437-5270