PWMI Newsletter

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Plastic Waste Management Institute
JAPAN

Project Started for the Development of Next-Generation Technology for the Liquefaction of Plastic Wastes

Verification in FY 1996 by Applying Essential Technological Developments in a Model Plant

by Kiyotsugu Saka, Thermal Recycle Project, Plastic Waste Management Institute

Secondary oil produced in Japan

This April, PWMI started a two-year project for the development of the next-generation technology for the liquefaction of plastic wastes.

This new project has the goal of establishing a technology that will radically upgrade conventional plastic-liquefaction techniques and allow the full-fledged reuse of plastic wastes from household refuse as fuel. Verification of the technology will be performed by testing the essential technological developments in a model plant.

A total of Y 240,000,000 ($2,400,000; Y 100=$1US) has been appropriated for project expenses in FY1995 in order to proceed with the urgent development of the essential technologies.

The raw material of plastics is petroleum, which can be reused after recycling even though it has once been used in another form. This means that it can be effectively reused as a fuel when plastic waste has been recycled in a manner that converts it into oil.

In a word, since plastic wastes can be converted into a new energy source by the practical use of an efficient liquefaction technology, the process can be thought of as the production of secondary oil here at home in Japan.

In the Container and Packaging Recycling Law that was enacted in June of 1995, the assumption was that the major portion of the plastic wastes that is recycled will be converted into oil by means of pyrolysis. For this reason, the development of this new liquefaction technology will facilitate the conditions necessary for the smoother execution of this law.

In the past, PWMI has studied projects for recycling plastic wastes into oil for use as a raw material or fuel by pyrolysis. In addition to successful practical applications, the current project will result in the compilation in a single source of all available knowledge on this subject–both that pertaining to existing know-how and that related to the new technologies to be developed. An outline of the project is described below.

Essential technological developments

The major objectives of the project are as follows:

1) Processing is to be made possible for polyvinyl chloride and other plastic wastes that contains constituents of Cl and N;

2) A significant increase in energy efficiency;

3) A reduction in the costs of process technology.In order to accomplish these goals, the cooperation of several companies specialized in the following fields will be necessary for the development of the essential technologies:

① Liquefaction technology;
② Evaluation of upgrading catalysts;
③ Heat recovery from residues;
④ Dehalogenation technology;
⑤ Recovery of hydrochloric acid and clean-up technologies for effluents and waste water;
⑥ Development of new upgrading catalysts;
⑦ Research on polymer cracking catalysts.

Operation of model plant

In the second stage of the project, a model plant will be built and its operation will be verified in cooperation with Rekisei Koyu K.K., which has its headquarters in Niigata City. This plant will be constructed for the conversion of plastics to oil by pyrolysis and will incorporate the results of the essential technological developments that have been achieved in the first stage of the project.

The plant will have a processing capacity of 6,000 metric tons per year and will be capable of converting to oil all of the plastic waste discharged by Niigata city, which has a population of

A Step Forward in the Recycling of Plastic Waste

Less than 2 Years Remain until the Enforcement of the Law for the Promotion of Sorted Collection and Re-commercialization of Containers and Packages

by Isami Kishimi, Journalist

In Japan, too, a law has now come into existence which has as its subjects the containers and packages that are contained in municipal solid wastes (MSW). Enforcement of the Law for the Promotion of Sorted Collection and Re-commercialization of Containers and Packages will begin in 1997.

The volume of MSW continues to increase, and this new law is intended to integrate the activities of the national government, local governments, industries and consumers into a single recycling system for containers and packages for the purposes of restraining the volume of waste discharged from households and effectively utilizing MSW in the form of reclaimed resources.

Laws of this type are already being enforced in Germany, France and other countries, and the enactment of the law here will keep Japan from lagging behind in this worldwide movement.

For this reason, while the detailed rules, government ordinances and ministerial ordinances that will accompany the enactment of the law remain to be worked out later, its enactment can be seen as a step forward in the field of plastic recycling.

The national government will establish fundamental policies, plans for re-commercialization and other measures in mid-December of this year. Plans for the sorted collection by prefectures as well as municipalities will be formed and made public in June of 1996. Finally, step-by-step enforcement of the law will begin in June of 1997.

As its fundamental concept, the main point of the new law makes clear the allotment of responsibility for all of the waste containers and packages, as follows:

1) Consumers will be responsible for sorted discharge;
2) Municipalities will be responsible for sorted collection;
3) Industries will be responsible for re-commercialization.

A second feature of the law is that it directly deals with the so-called "Polluter Pays Principle (PPP)." It has been premised that the responsibility for re-commercialization is to be imposed on industry, that the newly increased recycling expenses may be shifted in a reasonable manner into the prices of products, and that the burden of these increased prices is to be borne by the consumer.

The concept of the systems for reclaiming resources is the same as that in Germany and France, but the new Japanese law can be said to have broken new ground because it clarifies how the burden of recycling costs is to be shared in a system that incorporates the relative merits of recycling administration in these and other countries.

In any case, since this is the first attempt of its kind, many

approximately 500,000 people.

After the operation of the model plant has been verified, it will then receive a supply of plastics that has been collected and sorted from municipal solid wastes by all of the municipalities in the Niigata area.

Organization structures for promoting development

Earlier this year, PWMI established a "Thermal-Recycle Project." The essential technological developments described above are now being studied in this project. And, in the near future for the full-fledged production of oil from plastics, the policies for the promotion of the utilization of oil that has been converted by pyrolysis will be deliberated in this project.

Moreover, in order to execute the project in the most efficient manner, a "Next-Generation Liquefaction Committee" composed of learned and experienced men in this field has been formed.

PWMI is promoting both material- and thermal-recycling approaches as methods to achieve the effective processing of plastic wastes, but this project will be the primary pillar of the latter.

hurdles stand in the way of realizing plans for re-commercialization. The highest hurdle is the costs of re-commercialized products. It is said that the extra cost of reclaiming pellets from PET bottles is approximately $2.00 per kilogram. Furthermore, from the standpoint of quality, there are slight faults in reclaimed products when they are compared with new products. In addition, reclaimed products have limitations in terms of applicability.

In this connection, the new law states that "Industries that can use reclaimed products shall have an obligation to use them." Moreover, the national government's plans to expand utilization include policies to induce greater usage of reclaimed products by the public sector. Re-commercialization will no doubt gain momentum when such applications expand.

Organizations (appointed corporations) can be entrusted to act as third parties, but the exact nature of their activities must be promptly and completely clarified and organizational structures must be established.

Examples of such systems, such as the DSD in Germany and the Eco-Emballages in France, already exist and the knowledge provided by these should be put to use.

The outlook is that the new law will be enforced for PET bottles from 1997 and for other plastic containers and packages from the year 2000. It is safe to assume that the re-commercialization of plastics other than PET will for the most part take the form of conversion into oil.

In its trial estimates of re-commercialization expenses as they will be five years from now, the national government predicts that 90% (or approximately $1.1 billion) of the total will be spent on the costs of the re-commercialization of plastics. The reason for this is the large expenditures that are required for the conversion of plastics into oil.

Hopes have therefore been placed on the Ministry of International Trade and Industry and the relevant industries for the development of economical methods for the conversion to oil.

From the standpoints of restraining the discharge of waste and promoting the reclamation of resources, it can be appreciated that the new law represents a step forward for the legal system. In the future, further progress in plastics recycling can be made by improving problem points, carrying out detailed studies on the introduction of the thermal-recycling method that is starting to become established, and by the flexible application of the laws.

Operational Plans in FY1995 of Organizations Involved in the Recycling of Plastic Waste

Japan PET Bottle Association

Ishikawa-CO Bldg., 1-9-11 Kajicho, Chiyoda-Ku Tokyo 101
Tel 81-3-5294-7591 Fax: 81-3-5294-2823

Improving the operating efficiency of recycling plants.

With the goal of increasing processing volume to 2,857 metric tons in FY1995, studies and investigations are being conducted on the subjects of raising productivity, establishing quality-control systems, and technologies for separating polyvinyl chloride (PVC) and labels .

Doubling the collection volume of PET bottles

Significant progress was made in regard to the collection of PET bottles in FY1994 and the Association plans a further improvement this fiscal year. The collection target for FY1995 is 2,500 metric tons, which would double the amount that was collected last fiscal year. In order to achieve this, the Association intends to upgrade compacting machines and provide support to local governments for the installation of these machines.

Increasing importance of developing applications for reclaimed products

In addition to the developmental tests conducted in FY1994 on applications that did not relate to foods, the Association plans to perform experiments in hygienics in FY1995 in order to expand the utilization of applications in the foodstuff industry. This testing will be done in cooperation with Associations concerned with the Japan Hygienic Olefin and Styrene Plastics Association.

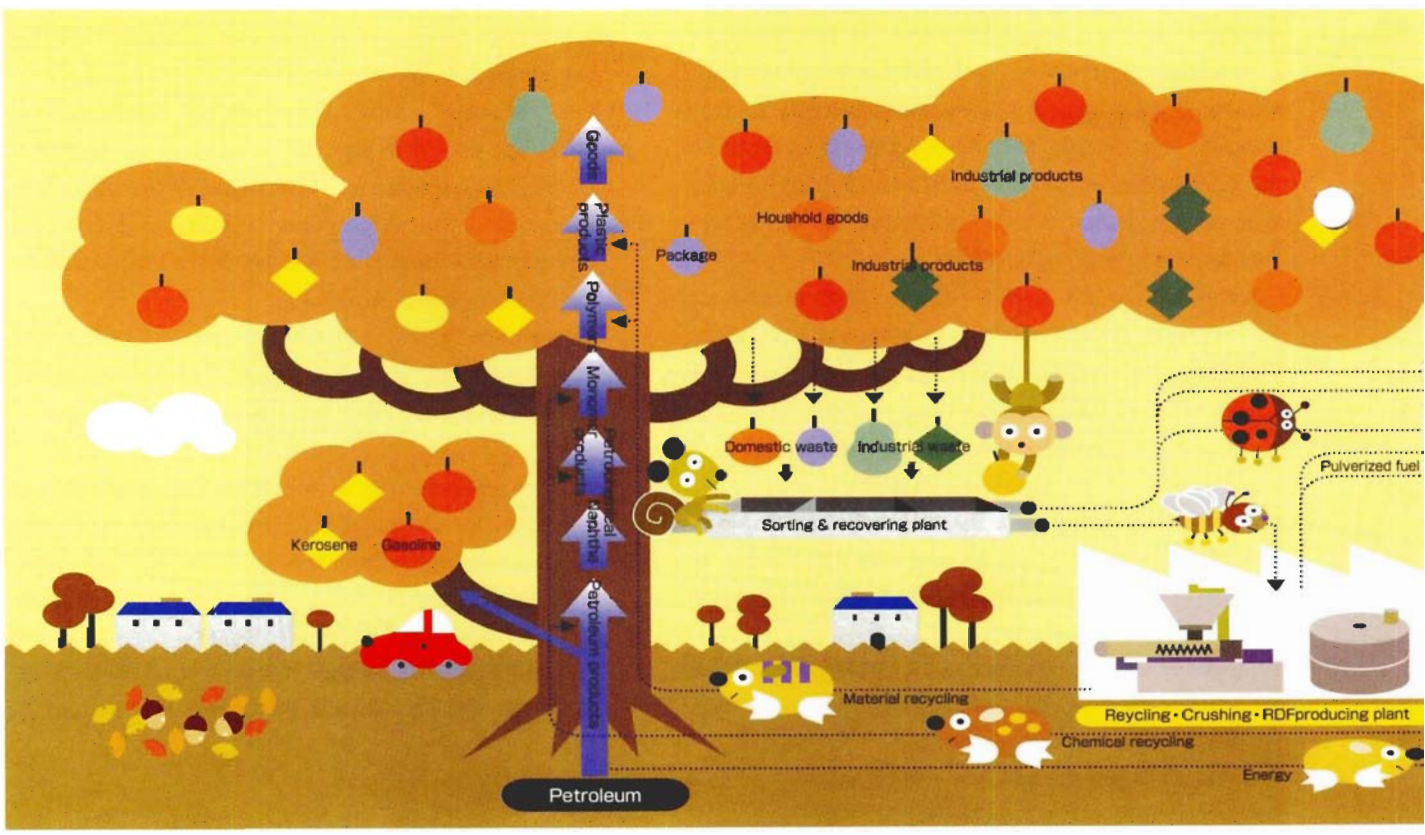
Finally, the Association is studying the use of labels or other identifiers that can be applied to a product to indicate that it contains reclaimed PET.

Japan Expanded Polystyrene Recycling Association

Fax Bldg., 2-20 Sakuma-Cho, Kanda, Chiyoda-Ku Tokyo 101
Tel 81-3-3861-9046 Fax 81-3-3861-0096

Aiming at a target of 25% for container recycling

In FY1994, a total of 21,000 (or 23.2%) of the 91,000 metric tons of the expanded polystyrene (EPS) containers that were distributed throughout Japan were recycled. Financial aid was given on 10 occasions to recipients in the wholesale markets



where container-recycling activities are centered and reached a total of approximately ¥34,000,000.

The primary technique used for recycling was the compacting-solidifying (ingot) method, but successes were also achieved by systems that convert plastics to oil as well as by thermal-recycling by means of incineration.

Improved recycling results in the home electric appliance industry

The "EPSY PLAZA 200" project continued to make progress. The addition of 17 new facilities equipped with reclamation plants has now brought the total number of plazas to 70. Moreover, the association has already concluded memorandums concerning the promotion of recycling with four makers of home electric appliances and negotiations are in progress with other manufacturers.

In FY1994, the amount of EPS recovered from the packaging used for home electric appliances was 13,700 metric tons (an increase of 23% over the previous year) and this represented a resource-recovery rate of 24.9%.

Japan Polystyrene Foamed Sheet Industry Association

Tokon Bldg., 26 Higashi Konya-Cho, Kanda, Chiyoda-Ku Tokyo 101
Tel: 81-3-3257-3334 Fax: 81-3-3257-3339

Collection project

In FY1995, priority will be placed on (1) achieving a reduction in costs in the collection project for trays, etc. that is scheduled to start during the fiscal year in cooperation with the Ryusen-en Union (a cooperative organization between Higashi Kurume and other cities), Hamura, Kakegawa, Nara and other municipalities, (2) achieving greater efficiency by making use of compacting machines, and (3) achieving technological developments for the effective utilization of reclaimed resources.

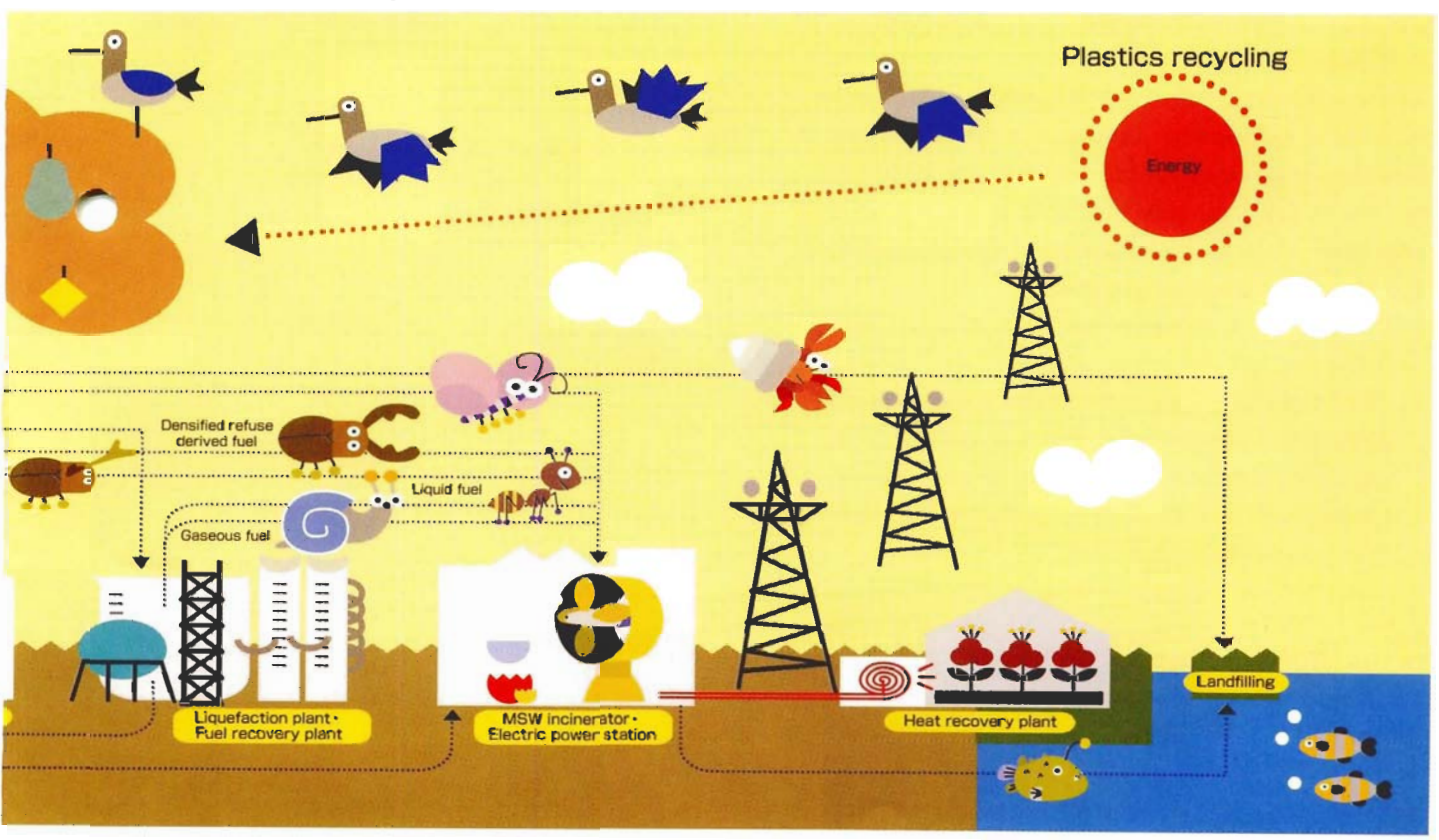
Municipalities will be required to provide storage yards where compacting machines will be placed.

Past Collection Records and Target for FY1995 (metric tons)

FY1991	FY1992	FY1993	FY1994	FY1995
33	147	220	280	300

Resource-recovery project

The Association plans to strengthen the management of both the Kanto and the Kansai Recycle Centers and PR activities aimed at the guests who visit the Centers. And it also intends to promote the use of reclaimed products by securing cheap resources and expanding the range of applications for these products.



Sorting Systems for Waste Plastics Employing Near Infrared Spectroscopy

Goal of Practical Application Achieved for New Weapon in Battle for Better Plastic Recycling

by Kazuo Ohashi, Deputy General Manager, R&D Dept., Plastic Waste Management Institute

The Plastic Waste Management Institute (PWMI) has developed sorting systems for plastic wastes that possess accuracies approaching almost 100% through the use of near infrared spectroscopy. Progress is being made in achieving the practical applications of these systems by next year in operations to be conducted by local governments such as municipalities and other processors of plastic wastes.

The new systems were developed in a national project that was commissioned primarily by the New Energy and Industrial Technology Development Organization (NEDO) and was jointly carried out by PWMI and TOA Electronics Ltd.

R&D work was launched in FY1992 and has involved the development of measurement technologies as well as identification analysis software, results analysis, etc.

At present, practical applications of various methods for the sorting of plastic wastes make use of specific-gravity selection, solvent selection, X-rays for polyvinyl chloride, etc., but a sorting technology for all types of resins has not yet been developed.

Advances have been realized in technologies that sort plastics by means of near infrared spectroscopy in the U. S. A. and elsewhere, but the developmental work conducted by PWMI has been the first in the world to result in successful practical applications. Three types of systems have been developed to meet specific applications and objectives.

1) Plant-type system for the automatic sorting of waste-plastic bottles

This system is designed for use by local governments and processors of plastic wastes. Prototype machines have already been built and orders will be accepted after the completion of field tests to prove the system. These tests will continue until March of 1996.

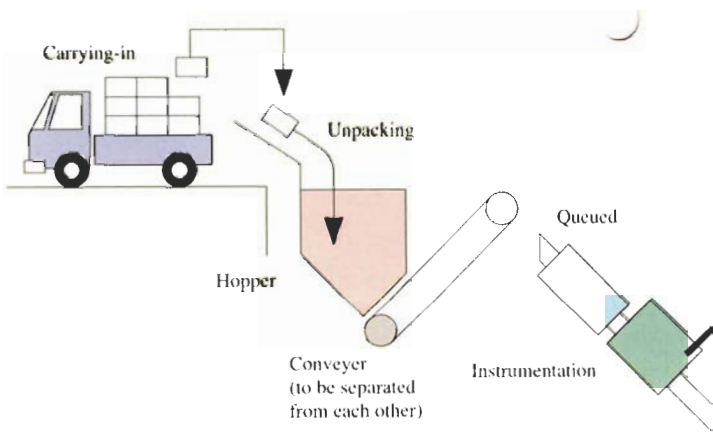
Plant-type system

2) Store-installable system for the sorting of waste-plastic bottles

This system can be installed on the premises of supermarkets, convenience stores, etc. The trial manufacture of a model machine was completed in September of 1994 and preparations to start accepting orders for this system are now in progress.

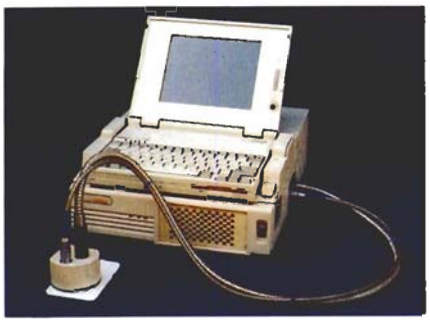
Store-installable system

Outline of Waste Plastics Segregation/Separation System



3) Portable-type system with material-identifying meter

This system is used to identify various types of waste-plastic materials. Model meters will be manufactured by March of 1996 and the acceptance of orders is scheduled to begin from April of that year.



Portable-type system

These systems include the following features:

1) In the conventional methods, it has been difficult to sort resins that contain different kinds of materials. But these new systems achieve a sorting accuracy of almost 100%.
2) Sorting can be performed despite the presence of labels, different colors, dust and dirt, etc.
3) Adjustments can be made to accommodate various sizes and configurations of plastic wastes.

For further information, please contact:

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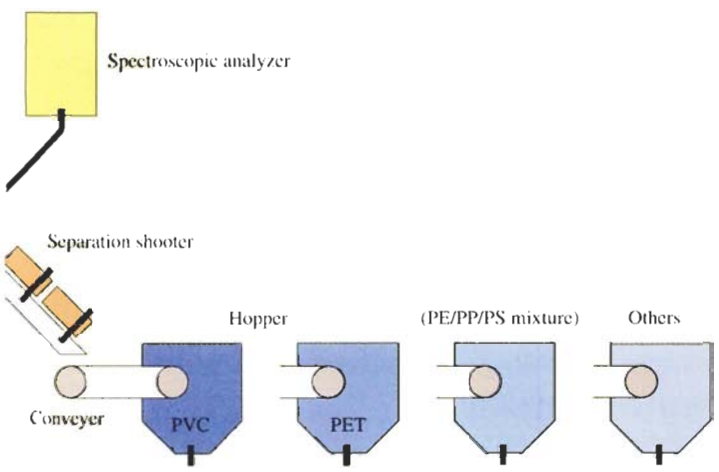

Waste Plastic Recycling Topics in Asia

By Akira Okawa,
Deputy General Manager, Surveys Dept.
Plastic Waste Management Institute

Law Promoting Re-utilization of Materials in Republic of Korea Limits Usage of Plastic Packaging and Throw-away Toothbrushes, etc.

In 1992, the Republic of Korea started a system that requires manufacturers and importers to deposit funds to defray the expenses of collecting and treating plastic products, containers, etc.

This strict restraint on usage through the enforcement of the law was made necessary by the increasing volume of plastics used in the Republic of Korea in recent years.

More recently, the details of another law that promotes the saving and re-utilization of resources were announced early this year. These regulations ban the use of certain products that contain plastics as well as some other materials and thus are a headache for the industries concerned.

This law came into operation in December of 1993, but the latest enforcement regulations that were announced contain the following restrictions:

- Bags made of synthetic resin, such as plastic bags for packaging, cannot be used in department stores, shopping centers, wholesale districts, etc. when products (excepting fish, meat, and other items containing moisture) are sold;
- The use in any industry of plastic-coated materials for one-time-only advertising or publicity purposes is prohibited;
- The use of throw-away paper cups, toothbrushes, toothpaste containers, splittable chopsticks, etc. is banned in any restaurant having a size of 33m² or larger, in any place of lodging having seven or more rooms, in public resting rooms, bath houses, etc. Toothpicks, however, may be offered at eating establishments at their entrances and exits where cash registers are placed.
- The use of plastic throw-away containers by manufacturers in the box-lunch industry has been banned since from August . The only exception to this is that plastic containers may be used by guests who have been invited to weddings and certain other types of ceremonies.

Persons found in violation of these regulations will receive a warning to redress upon a first offense, an order to redress upon a second offense, and a fine of up to 3,000,000 won for a third offense.

Taiwan Uses Past Experience to Plan for Total Collection of Packaging Containers

A law for the collection and treatment of waste containers that was enacted in Taiwan in June of 1994 marked the beginning of an effort to achieve the total recovery of containers by overcoming the loopholes in former laws and the lack of collecting experience that had made it impossible to improve on inadequate past results.

This legislation was enacted after two years of discussions in the Executive Yuan's Environmental Protection Administration. The law has as its subjects one group of materials consisting of aluminum, aluminum foil, steel, paper, plastics, etc. and another group consisting of composite materials. It prescribes that persons and companies who handle these materials must apply and register at a central government office in charge of such matters. They must establish an obligatory system of pledged payments if collection targets are not achieved.

In regard to the collection of pledge money, industry has set up a Collection Fund Committee to strengthen management methods and the auditing of accounting records. Furthermore, the Environmental Protection Administration has formed a Joint Fund Committee to promote the overall control, monitoring and planning for the general collection of containers. In addition to containers, this committee also concerns itself with scrapped automobiles and toxic municipal solid wastes.

A look at the situation in respect to the collection of plastic waste in Taiwan reveals that the record is best for PET bottles. The collection rate for these has exceeded the target of 65% and has approached the level of approximately 70%. A problem that must be faced now, however, is the disposition of the reclaimed materials. There is a substantial market for colorless reclaimed materials but no buyers for colored products.

The collection rate for expanded polystyrene (EPS) packaging materials, on the other hand, has not yet reached 20% although the target is 55%. This being the case, the Environmental Protection Administration at the end of 1993 prohibited the use of EPS containers in governmental administrative offices, schools, and all organizations under public management. Moreover, a movement has started in Quemoy Province that calls for the banning of the use of EPS as a packaging material for foodstuffs throughout the country.

In Taiwan, approximately 30,000 metric tons of EPS products are manufactured annually and 80% or more of this production volume is used as packing material for products that are exported. Under these circumstances, following the Paris Conference in April 1994, Taiwanese makers of EPS have participated in international organizations dealing with the recycling of EPS and progress has been made in promoting the idea of the duty to collect and reclaim EPS on a worldwide basis.

TRENDS IN THE WORLDWIDE PRODUCTION OF PLASTIC MATERIALS

		1990	1991	1992	1993	1994	94/90
Asia	Japan	12,630	12,796	12,580	12,248	13,036	1.032
	Republic of Korea	2,935	3,731	5,169	5,777	6,300	2.147
	Taiwan	2,752	3,076	3,519	3,465	3,847	1.398
	Total for all of Asia	23,339	24,878	27,327	28,014	30,353	1.288
	Worldwide total	98,916	100,256	104,066	105,683	111,088	1.123

NOTE: Units are in metric tons. SOURCE: Plastics (monthly)