The Impact Analysis of Waste Plastic Trade between China and Japan－From Policy View

Xiangfeng MENG[1] and Tokuhisa YOSHIDA[1]
[1]Graduate School of Environment and Energy Engineering, Waseda University, Japan
E-mail:mengxiangfeng@toki.waseda.jp

Abstract
The 3R policy in Japan promoted the recycling of waste resources; however, at the same time, it also triggered a rapid increase in the export of waste plastics to China. As a result, domestic material recycling (MR) of waste plastics generated in Japan has been declining, which may lead to a hollowing out of Japan's waste plastic recycling business. In this study, we conducted a macro analysis of the effects of the 3R policy in Japan and the economic situation of Japan and China on the flow of waste plastics by following changes in trade volume of waste plastics between the two countries from the 1990s through 2010. From the results of this analysis, it can be seen that waste plastics exports from Japan have continued to increase, driven by the legal structure related to the 3R policy in Japan and the rapid increase in the demand for plastics in China. However, the export from Japan seems to be already reaching a limit. On the other hand, when viewed from China's perspective, China has been importing waste plastics not only from Japan but also from about 120 countries around the world. Total imports in 2009 amounted to approximately 7.3 million tons, while imports from Japan (1.35 million tons) accounted for only about 20% of total waste plastics imports. The immediate cause is the rapid economic growth of China; however, various policies in China have also further increased the demand for plastics. Therefore, the demand for waste plastics in China is expected to continue increasing in the future. In addition, among waste plastics imported to China, inappropriate items included among the waste plastics have been on the rise in light of the Basel Convention, and there are concerns about the effects of environmental pollution resulting from the recycling business in China.

Keywords:
waste plastics, waste trade, material recycling, 3R policy, the Basel Convention

INTRODUCTION

Currently, many countries in the world are pursuing their own policy of promoting the cyclical use of waste resources, with the aim of forming a sustainable society. As an initiative to promote the formation of a cyclical society in Japan, the Containers and Packaging Recycling Law was enacted in 1995, while at the same time, the demand for plastics has continued to increase in China due to its rapid economic growth. In particular, waste plastics including waste PET (polyethylene terephthalate) have been exported in vast quantities from Japan to China, starting at the beginning of this century.

Simultaneously, domestic material recycling in Japan, which is the highest priority in the three kinds of recycling methods (material recycling (MR), chemical recycling (CR) and thermal recycling (TR)) for the formation of a cyclical society in Japan (3R policy), has been gradually faded out, and material recycling has been maintained by exports to China.

On the other hand, China has imported vast quantities of waste plastics from around the world backed by its resource policies. As a result, however, improvement of the safety inspection of imported waste plastics and measures for prevention of environmental pollution at recycling plants are becoming important issues.

In this study, we analyze in detail the process of expanding trade in waste plastics between Japan and China after 1997 based on statistical trade data from Japan and China, and also, work to understand the state of nonconformity of waste plastics China imported from around the world to standards based on customs statistics. Through this analysis, we clarify the actual state of cyclical use of waste plastics between Japan and China, straighten out issues concerning international cyclical use of resources from an environmental, economic and political viewpoint, and consider how to deal with the issues that exist in the future.

1. STUDY METHOD

Based on export and import statistical data of waste plastics in both Japan and China during the period of 14 years from 1997 when the Containers and Packaging Recycling Law was enforced to 2010, we clarify a macro trend in the secular changes in waste plastics trade between Japan and China. In addition, we identify and

M. Matsumoto et al. (eds.), *Design for Innovative Value Towards a Sustainable Society*,
DOI 10.1007/978-94-007-3010-6_46,

count the cases of nonconformity among waste plastics imported from Japan to China during the period from 2003 to 2009 in light of the "Environmental protection control standard for imported solid wastes as raw materials - Waste and scrap of plastics" based on the materials released by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China to consider legally inappropriate waste plastics trade cases. Furthermore, based on the development of policies related to the promotion of cyclical use of waste resources in both Japan and China and economic trends in both countries, we give an analytical consideration of factors to promote waste plastics exports from Japan to China and clarify environmental protection-related issues.

2. BACKGROUND ON THE INCREASING DEMAND FOR WASTE PLASTICS IN CHINA

Currently, China has set environmental protection management standards for waste plastics recycling plants; however, the standards have not been fully complied with on site. China has promoted recycling waste plastics by offering preferential treatment such as tax breaks; its prior policy is to save the oil consumption and manage the price of plastic products. According to the observation analysis report of China Customs Statistics "Increase in Waste Plastic Imports via Tianjin Port in January 2011," recycling one ton of waste plastics saves about five tons of oil [1]. This is because the production of one ton of plastic requires nearly four tons of oil, if waste plastics are recycled once and ultimately used as fuel, it will save five tons of oil. The total amount of waste plastics recycled in China in 2009 was approximately 17 million tons, including imports. This translates into savings of about 80 million tons of oil. Therefore, recycling waste plastics has a significant meaning to China's national strategy.

2.1 Changes in the amount of plastic used in China

In China, demand for virgin plastic materials has been increasing since 1994. From 1995 to 2000, in particular, the annual growth rate of demand reached about 20%. Although the growth rate somewhat slowed thereafter, demand has continued to grow by about 10% annually after 2000. Imports of virgin plastics increased to meet demand until 2002; however, reflecting an increase in the domestic production capacity, virgin plastics imports have decreased since 2003. Meanwhile, waste plastic imports have rapidly increased since 2000, and their imports have maintained an upward trend throughout the period to date in spite of the global recession in 2008. Since around 2002, a surge in oil prices has further increased the demand for waste plastics.

Fig. 1 shows changes in the amounts of China's domestic procurement and imports of virgin plastic materials and

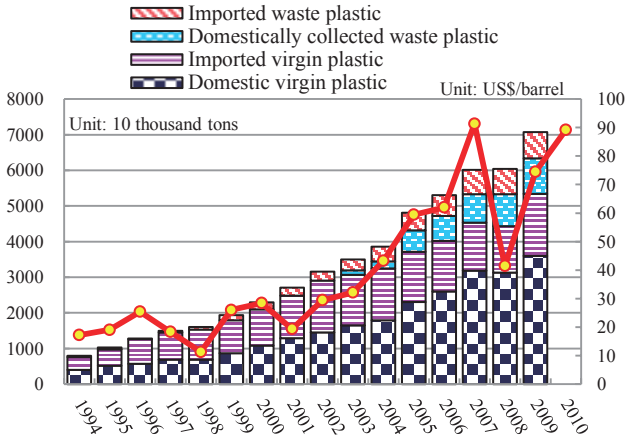

Fig. 1: Changes in the Amount of Plastic Used in China
* Data on the amount of domestically collected waste plastics is from 2003
Source: China Statistical Yearbook, China Customs Statistics, Changes in WTI Crude Oil Prices[2]

waste plastics and changes in oil prices (WTI crude oil prices) during the 15 years from 1994 to 2009. China's demand for plastics reached an all-time high of about 70 million tons in 2009, when the amount of domestic production was 36 million tons and imports of virgin plastic materials were 17 million tons. Meanwhile, imports of waste plastics totaled 7.3 million tons and the amount domestically collected totaled 10 million tons. Thus, waste plastics satisfy 25% of China's total current demand for plastics

2.2 Status of China's waste plastics imports

Imports of waste plastics totaled 3.02 million tons in 2003 and doubled to 7.3 million tons in 2009. China is now the largest importer of waste plastics in the world, and about 70% of total waste plastics shipped worldwide are imported by China. Of the 117 countries, the major countries and regions (Hong Kong, European countries, US, Japan, Taiwan, and South Korea) account for about 80% of total waste plastic imports [3]. However, as shown in Fig. 2, annual increase rate of waste plastic import in China dropped from the average of about 20% during 2003-2007 to 2% in 20008. In 2009, the rate slightly recovered to 4%.

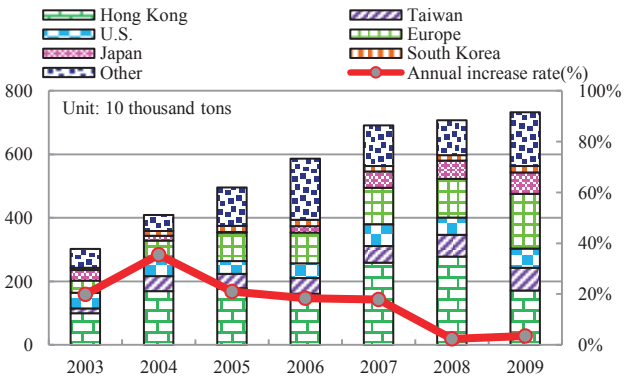

Fig. 2: Changes in Waste Plastic Imports by Country during 2003–2009
Source: Calculated from World Trade ATLAS

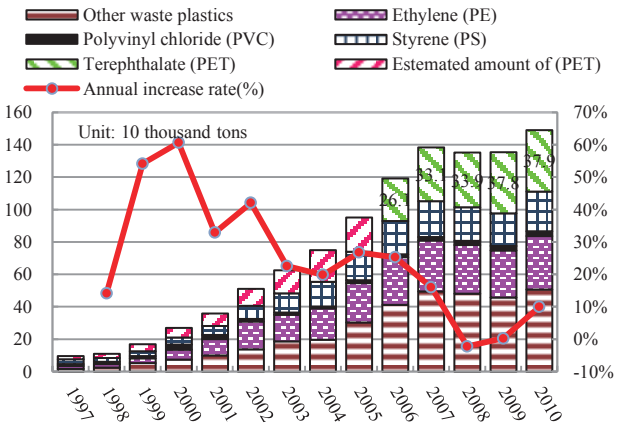

Fig. 3: Changes in Waste Plastic Exports from Japan to China
Source: Trade Statistics of Japan, Ministry of Finance, Government of Japan[4]
Note: Figures above differ from those in Figure 2 as they include exports through Hong Kong.

Furthermore, in 2009, the percentage of waste plastics imports through Hong Kong decreased, while there was an increasing trend in direct imports from overseas to the inland China. This is because direct shipments save time and reduces transportation costs more than import via Hong Kong as there are many waste plastics recycling plants in the inland China.

2.3 Import of waste plastics from Japan

As shown in Fig. 3, exports of waste plastics from Japan to China have rapidly increased since 2000, but due to the impact of the financial recession at the end of 2008, the demand for waste plastics in China temporarily decreased because of a decline in the export of Chinese plastic products to overseas markets, such as the U.S. and Europe in particular, and as a result, exports of waste plastics from Japan to China showed a slight decline. Along with the economy recovering in China in 2009, exports to China once again created an upward trend to reach a record high of 1.49 million tons in 2010, exceeding the record of 1.38 million tons in 2007 [4]. Among waste plastics, exports of only waste PET to China have maintained an upward trend in spite of the recession. However, it seems that plastic consumption has already peaked in Japan, and no substantial increase in the generation of waste plastics can be expected in the future. Therefore, the market of material recycling in Japan is expected to diminish further.

3. POLICIES OF BOTH COUNTRIES ON THE INCREASE IN THE FLOW OF WASTE PLASTICS

3.1 Factors attributable to the system of Japan's Containers and Packaging Recycling Law

The Containers and Packaging Recycling system imposes obligations on citizens to separate their waste, and municipal governments to carry out sorted collection and separate storage of waste and deliver the separated waste to the Japan Containers and Packaging Recycling Association free of charge. The Law also provides a system to impose obligations on producers and users to conduct recycling and pay recycling fees (commission). Furthermore, the Law imposes obligations on municipal governments to pay costs of sorted collection and separate storage as well as to pay commissions on behalf of small businesses. For this reason, the number of cases has been increasing where municipal governments that have to bear high costs sell the waste PET bottles they collected to China (Chinese buyers) for a fee in response to strong requests from China, without delivering them to the Japan Containers and Packaging Recycling Association.

Meanwhile, for recycling business operators, business conditions have worsened because of a rise in procurement costs due to a recent increase in exports to China and the sluggish growth in demand due to a rise in prices of products recycled from waste PET (flakes or pellets). According to interviews from the Containers and Packaging Recycling Association and some PET bottle recycling plant in Kawasaki Prefecture, Japan, although the company has world-class recycling technology, it is difficult for them to secure the product market because pellets recycled from waste PET bottles are more expensive than virgin materials.

To maintain the waste PET recycling market, a commission system for recycling business operators and a contribution scheme for municipal governments has been introduced as a result of a revision to the Law in 2006 [5]. However, because costs including those related to the collection of waste PET still remain high, the market for recycled products cannot expand in Japan. The immediate cause is that the cost of recycled products is relatively high compared to that of products made with competing virgin materials. Thus, it can be considered that high recycling costs are a major factor that hinders the growth of Japan's recycling system. The 3R policy has placed an emphasis on maintaining a stable recycling market without leaving it entirely to the highly fluctuating market. However, the growing waste plastics market in China is putting pressure on the management of Japan's waste plastic recycling businesses.

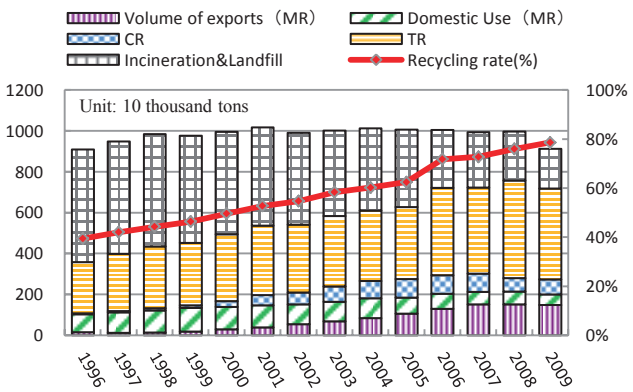

Fig. 4: Breakdown of Waste Plastic Treatment in Japan
Source:Plastic Waste Management Institute

Table 1 China's Policies to Promote the Use of Waste Plastics

Year	Policy	Contents
2006	The 11th Five-Year Plan	The plan to promote the use of plastic as an alternative material to steel and wood materials
2008	Corporate Income Tax Concessions for Enterprises Engaged in Comprehensive Resource Utilization [6]	This treatment imposes an obligation of 100% use of waste plastics, and provides the enterprises that have achieved the target with concessions for corporate income tax on 10% of their sales
2009	Circular Economy Promotion Law of the People's Republic of China	This law was enforced with the aim of minimizing the impact on the environment and improving resource efficiency by reducing and recycling waste
2010	Easing of Import Restrictions	Restrictions on the import of PET bales (plastic waste in the form of PET bottles) were lifted
2011	The 12th Five-Year Plan	The economic development policy was transformed from a traditional export-led policy to a domestic-demand expansion policy

Recent trend of waste plastic treatment, including recycling in Japan is shown in Fig. 4. Total recycling ratio is apparently very high, but, thermal recycling (TR) and chemical recycling (CR) are dominant and material recycling (MR) stays only about 20%. Material recycling within Japan is declining steadily since 2000, and in 2008, 75% of material recycling is conducted overseas, mostly in China. In other words, Japan actually depends on China for its material recycling, and as a result, the domestic material recycling industry for waste plastics is hollowing.

3. 2 China's resource recycling promotion policies

Besides the aforementioned economic reasons, China's recent policies shown in Table 1 serve as factors that accelerate China's demand for plastics and imports of waste plastics. The reason for this is that it will be more difficult for China to procure resources in the future. In concrete terms, policies to promote the use of plastics and import of waste plastics are as follows : (i) in the Circular Economy Promotion Law enacted in January 2009, China set a basic policy which prioritizes "reducing," "reusing," and "recycling" in the same way as in Japan [7]; (ii) in addition to the policy to increase the use of plastics announced in the 11th Five-Year Plan, a transformation from export-led economic revitalization to domestic demand expansion was announced in the 12th Five-Year Plan launched this year. This will further accelerate the use of plastics in China [8][9]; and (iii) in 2008, tax reduction measures were set forth to promote the use of waste plastics, and last year, it was approved to import waste PET bottles in the form of bales [10]. This enables direct import of bales to mainland China, which used to be imported through Hong Kong, and reduces transportation costs. According to the observation analysis report of China Plastic On Line "Plastics Market" [11], in the future 5 to 10 years, the demand for waste plastics is expected to grow at 10% to 20% annually.

4. ENVIRONMENTAL ISSUES ASSOCIATED WITH TRANS-BOUNDARY MOVEMENTS OF WASTE RESOURCES

4.1 Basel Convention and cross-border flow of waste plastics

Trans-boundary movements of waste resources such as scrap iron, waste plastics (excluding part of polyvinyl chloride (PVC)), waste textiles, waste rubber, etc. are not subject to the regulations of the Basel Convention. Polyvinyl chloride is also permitted for export if the percentage of lead content is 0.1% or less by weight [12]. For the past 21 years from 1988 to 2009, Japan exported PVC to 28 countries such as China, South Korea, Taiwan, and the U.S.A. When exported to contracting states such as China, a preliminary inspection is conducted based on the domestic law in Japan as an exporting country corresponding to the Basel Convention. In the same way, an inspection is also conducted of the trading partner based on its domestic laws. In the case of China, inspections are conducted based on the "Environmental protection control standard for imported solid wastes as raw materials - Waste and scrap of plastics" as well as the standards of the Basel Convention. The status of conformity to the standards of the Basel Convention and the domestic laws in China for waste plastics imports in China can be summarized as follows.

4.2 Cases of non-conforming waste plastic imports rejected by China

According to the materials released from the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China, the number of waste plastics imports which failed to meet standards has been on the rise, as waste plastics imports by China have increased.

According to the report from China's Waste Resources Import Management Symposium held in Tokyo in 2008, the total number of lots of recyclable resources (scrap iron, waste paper, waste plastics, etc.) imported by China in 2007 totaled 287,602 [13]. As a result of random checks, 735 lots of waste resources failed to meet the "Environmental protection control standard for imported solid wastes as raw materials - Waste and scrap of plastics," which was approximately 0.26% of the total lots. Of the 735 non-conforming lots, 409 lots were waste

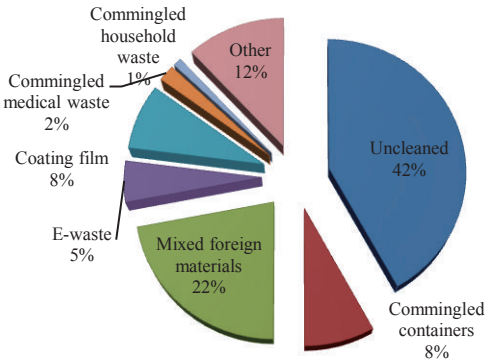

Fig. 5: Breakdown of 409 Lots of Non-conforming Waste Plastic Imports in 2007
Source: General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China[14]

plastics, which accounted for 56%, the largest percentage of the total.

As shown by the breakdown of reasons for the rejection of waste plastics imports in Figure 5, the number one reason for the lot being rejected was uncleaned plastic waste (42%), followed by mixed foreign materials (fibers, papers, etc.) (22%), coating films unremoved (8%), commingled containers (8%) (until restrictions on the import of waste PET bales were lifted in 2010, only the import of waste plastic scraps (flakes) were permitted), commingled electric and electronic parts (E-waste) (5%),

Table 2 Some Cases of Rejected Waste Plastic Imports

Importer	Year	Exporter	Reason for rejection
Shandong	2003	Japan	Commingled household waste
Liaoning	2004	South Korea	Radioactive materials in excess of standards
Liaoning	2006	South Korea	Commingled medical waste
Guangdong	2007	Hong Kong	Commingled medical waste
Shandong	2007	Japan	Mixed foreign materials in excess of standards
Guangxi	2008	Unknown	Commingled E-waste
Zhejiang	2009	U.S.	Commingled E-waste

Source: General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China[14]

commingled medical waste (2%), commingled household waste (1%), etc. Imports from the U.S. contained the largest number of non-conforming waste plastics totaling 150 lots, which was followed by 70 lots imported via Hong Kong, and 54 lots imported from Japan. The major non-conforming cases are shown in Table 2.

5. TRANS-BOUNDARY MOVEMENTS OF WASTE RESOURCES AND ENVIRONMENTAL POLLUTION

According to the Chairman's Summary Report of the Senior Officials Meeting on the 3R Initiative held in March 2006 in Tokyo, it was asserted that for the establishment of rules of trans-boundary movements of hazardous waste agreed in the international community (the Basel Convention), additional rules to restrict trans movements of recyclable resources were necessary [15].

However, obligatory restrictions should be left to each country. In addition, according to "Invisible Flow" and a Study Report on Recycling and Exports by Atsushi Terazono (2007), although the Basel Convention restricts trans-boundary movements of hazardous waste, it is currently easy to export such waste as long as there is an agreement between the seller and the buyer. It was also pointed out that even if a problem occurred, it would be difficult to ask who was responsible, and to what extent, for the problem [16].

The Basel Convention designates E-waste, PCB, residual agricultural chemicals, waste oil, medical waste, lead batteries, etc. as critically restricted items; however, it imposes no restrictions on waste resources which are not subject to the regulations of the Convention such as waste plastics, and the waste resources are being exported to many developing countries. Furthermore, in the recycling process of resources such as waste plastics, not a few countries may not have adequate technologies and economic capacities for environmental protection, which cause concerns about environmental pollution. Therefore, regarding such waste items mentioned above whose trans-boundary movements are increasing at a rapid pace, it would be desirable to inspect whether or not the Basel Convention is functioning effectively for the prevention of environmental pollution. In order to promote environmentally sound recycling of waste resources on an international basis, it must be said that exporting countries are required to thoroughly control their quality, and developing countries as well are also required to have a certain level of management ability as importing countries. When we visited an independently-operated small plant in Zhejiang Province, China in (August) 2010, where PVC pellets were recycled and processed, they had a low awareness for measures against environmental pollution. Sufficient environmental measures have not yet been implemented in the recycling and processing of waste plastics in China compared to Japan. In addition, adverse effects of environmental hormones such as plasticizers, including phthalates and bisphenol-A have been pointed out by many scientists of the world since 1990s. Although the scientific evaluation of their effects on human health has not been completed, the use of such substances for children's toys, etc. is restricted in Europe and other countries, and it has been pointed out that such restrictions may have an impact on the export of plastic products from China. In addition, there are some experts who point out the issue of "precocious babies" in China in recent years [17]. From the viewpoint of promoting

environmentally-sound 3R policies on an international basis, an examination is considered to be necessary to prevent effects of such scientifically uncertain chemical substances on human health and ecology. In addition, administrative efforts will be increasingly important in the future to ensure that environmental regulations are properly implemented at recycling sites of waste plastics.

6. SUMMARY

i) Reason for the rapid increase in demand for waste plastics in China

(a) Due to reasons such as rapid economic growth in China and economic disparities between Japan and China, as well as the promotion of 3R policies in Japan, the outflow of waste plastics from Japan to China has been rapidly increasing in recent years, especially after 2000. China has been importing waste plastics not only from Japan but also from all over the world.

(b) Chinese government's circular economy promotion policies are serving as an underlying cause of the increase in the demand for waste plastics.

ii) Changes in waste plastics recycling in Japan

(a) Due to the obligation to separate and collect waste by citizens and municipal governments under the Containers and Packaging Recycling Law, material recycling of waste PET proceeded smoothly for a while after enforcement of the Law. However, the outflow of waste plastics to China has been putting pressure on the management of waste plastic recycling business operators in Japan and pressure to rationalize their management. As a result, some operators have gone bankrupt or closed business.

(b) The amount of material recycling of waste plastics generated in Japan is only 20% of the total, and more than half is recycled by thermal recycling. Moreover, the portion of material recycling set aside for exporting has risen year by year, and currently only 25 percent are for domestic use and 75 percent are exported to China and processed there.

(c) With the increase in demand from China, exports of waste plastics to China have been increasing. Although Japan exports 20% of its waste plastics imported by China at present, when the market size of Japan is compared with that of China, Japan's supply capacity of waste plastics is already reaching its limit.

iii) Basel Convention and concern about environmental pollution

(a) The Basel Convention prohibits trans-boundary movement of hazardous materials; however, it is questionable if it effectively functions to address the environmental pollution caused by the trans-boundary movements of resource materials which are not subject to the Convention such as waste plastics. Thus, it is necessary to further study the environmental pollution involved with the recycling process of waste plastics.

(b) Some specialists point out concerns over the effects of environmental hormone substances on human health, which requires a separate scientific study, in particular.

REFERENCE LIST & FOOTNOTES

[1] Increase in Waste Plastic Imports via Tianjin Port in January 2011(in Chinese).

[2] National Bureau of Statistics of China (in Chinese) Refer to http://www.stats.gov.cn/tjsj/

[3] Ziqiang SUN(2010) Academic papers : Japan's Trade Review of Waste Plastics (in Chinese).

[4] Trade Statistics of Japan, Ministry of Finance, Government of Japan Exports Data by Commodity and Country 1997–2010 Refer to http://www.customs.go.jp/toukei/srch/index.htm (April 30, 2011)

[5] Containers and Packaging Recycling Association: Refer to http://www.jcpra.or.jp/words/index.html

[6] Corporate Income Tax Preferential Treatment Policy for Combined Use of Resources (2008 version) (in Chinese).

[7] Circular Economy Promotion Law of the People's Republic of China, Article 30 (in Chinese).

[8] 11th Five-Year Plan (in Chinese).

[9] 12th Five-Year Plan (in Chinese).

[10]Waste Management Regulations concerning import PET bottle bale 2010 (in Chinese)

[11] The observation analysis report of China Plastic On Line "Plastics Market (2010) Vol.8 No.564, pp4-5

[12] Basel Law of Japan: Refer to http://www.meti.go.jp/policy/recycle/main/admin_info/law/10/index.html

[13] China's Waste Resources Import Management Symposium Report (2008).

[14] General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China Re to http://www.aqsiq.gov.cn/

[15] Chairman's Summary Report of Senior Officials Meeting on the 3R Initiative held in Tokyo from March 6 to 8 in 2006.

[16] Atsushi TERAZONO (2007): Online Magazine of the Recycling Society and Wastes Research Center of the Overseas Export International Institute, "Invisible Flow" and a Study Report on Recycling and Exports(in Japanese).

[17] Plastic Monthly Magazine (in Chinese), September 2010, 576th period "Damage the Plastic Industry in China Receives by Cases of Precocious Babies Arising from Plasticizers" (in Chinese).