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한국의 플라스틱포장재의 재활용 기술 동향

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Recycling Facts and Technical Trends of Plastic Packaging Materials in Korea

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요 약

플라스틱 포장재는 소비자들이 생각하는 것보다 환경에 미치는영향이 적으나 플라스틱 제조업체들에게는 플라스틱 폐기물을 위한 재활용시장을 어떻게 활용화하는가는 매우 중요하다. 이것을 위하여 정부는 충분한 규모의 재활용시장을 키워나갈 수 있도록 MRF 등 각종 설비를 지원해야 하며 성공적인 재활용정책을 개발해야 한다. 경제적이고 다양한 재활용기술이 소개되고 있지만 이것은 반드시 잘 정비된 재활용정책이 우선되어야 성공할 수 있다.

Abstract

Plastic packaging generates less problems than most consumers think, but how to develop the recycling market for plastic waste materials will be critical for the plastic manufacturers. To do this, government must provide enough facility in order to balance economics for plastic recycling market and to run successful recycling programs. Various cost effective recycling technologies have been introduced and also have significant role to boost use of recycled plastics, but this could be only with well organized recycling policy.

Key words: packaging, plastics, recycling, Korea

INTRODUCTION

Plastics, their unique properties and characteristics-such as light weight and durability, are often easily forgotten because of their environmental harmness, which does not count on their ability to minimize the raw materials used, energy consumed and

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raw materials used, energy consumed and probably waste generated in the production and distribution of goods ranging from coffee cups to automobiles. Anyway, the matter of plastics waste generated became a coffee shop issue now, and recycling has become a established industry although industry is still experiencing growing pains.(1)

For developed countries such as US, markets for recycled plastics are stable in most areas and expanding in many others. The number of companies handling and reclaiming post-consumer plastics in 1998 (1,792) was nearly six times greater than in 1986(310).(2)

Non-treated landfills and incineration was common plastic packaging waste treatment methods in Korea and no significant researches have done until 1980. In 1992, the 'Act Relating to Promotion of Resources Saving and Reutilization' was declared and the methods are being switched over to comprehensive treatment methods that emphasize eliminating plastic packaging wastes from the origin and converting wastes into resources. Korean Government projects that the rate of household waste recycling will increase from 23.7% in 1995 to 35% in 2001.(Table 1)(3)

Table 1. The National Waste Management Goals

Waste	Management	1995	1998	2001
Household Waste	Recycling	23.7	30.0	35.0
	Landfill	72.3	55.0	45.0
	Incineration	4.0	15.0	20.0
Industrial Waste	Recycling	61.2	65.0	68.0
	Landfill	32.5	25.0	20.0
	Incineration	6.3	10.0	12.0

RECYCLING POLICY DIRECTIONS

Clearly, source reduction is the best way to save environment and Korean government follows the rule. The government plans to minimize the generation of wastes by making it an obligation for manufacturers who produce large quantities of wastes to establish waste reduction plans, by setting environmentally friendly packaging standards, and by firmly anchoring 'the volume-based collection fee system'. This is higher levels of source separated collection system and household waste should be discarded in the officially designated plastic trash bags. However, this regulation does not apply to the recyclables. As of the end of 1997, the total volume of municipal waste had fallen by 30.9% since the system was implemented in 1995, and the volume of recyclable goods collected had increased by 55.8%.(4)

In 1996, Korean government set some fundamentals for achieve 'The National Waste Management Goal Toward 2001'. The first priority is increasing recycling rate while reducing rate of landfills and incineration. promotion of waste treatment facilities and conformation of waste are second. If the final waste cannot be recycled, they want to focus on incineration rather than landfilling.

Additionally, the government plans to promote the reuse of wastes. For packaging wastes, electrical appliances and oversize wastes, the government is building a comprehensive recycling system through the reasonable distribution of responsibilities between producers and consumers. It is also encouraging the growth of the recycling industry

by extending financial support and tax incentives to recycling businesses.

RECYCLING FACTS AND FIGURES

Plastic industry in Korea has grown as fast as many developing countries and it counts more than 30% of total packaging material industry.(Table 2)

Table 2. Domestic plastic consumption breakdown by resins.

Resin	Percent(%)	Resin	Percent(%)
PP	20.6	PS	10.7
PVC	19.0	ABS	5.3
LDPE	18.1	Thermosets	10.5
HDPE	15.2	Others	0.6

※ Source: The 9th Packaging Symposium in the KOPAST, 1998

As shown in Table 3, generally, Polyethylene, Polypropylene, Polystyrene, Polyvinyl Chloride, Polyethylene terepthalate are major materials in plastic packaging waste stream and production rates of those four plastics increase 13% every year.(5)

Most of the plastics collected for recycling come from curbside collection programs where householders separate designated recyclable materials from their trash and place them out for collection in special receptacles or bags. Collected plastics are then regenerated to various products at recycling facilities which are operated either by government or private companies.(Table 4) Average price range of recycled plastics also shown in Table 5.

Table 4. Recycling Companies and Capacities('98)

Recycling companies	Total			
	No. of Facilities	Quantity (ton/year)	Total Production (ton/year)	Total Sales (thousand won/year)
	1,568	23,871,721	27,133,643	1,387,026,791

Table 5. Price of Recycled Plastics

(Unit : Won/Kg)

Recycled Plastics						
Ground			Pellet			PET
PE	PP	PS	PE	PP	PS	
316	263	214	470	460	510	260

※ Source: KORECO(Korea Resources Recovery and Reutilization Corporation), 2000.

Table 3. Plastic Waste Generated and Prediction by Year (units: thousand tons)

Year	LDPE	HDPE	PVC	PP	ABS	PS	PET
1988	301.9	109.2	196.2	180.0	32.0	71.1	21.1
1989	313.5	113.5	179.7	205.7	37.7	44.2	27.2
1990	341.5	159.9	178.6	233.7	50.5	48.1	35.0
1991	345.2	218.7	196.1	294.9	60.0	84.1	42.0
1992	333.7	297.7	244.3	369.2	69.3	143.7	49.0
1993	380.2	392.4	307.0	457.1	56.6	170.5	61.2
1994	441.7	490.0	317.4	538.3	46.4	184.0	63.6
1995	429.0	517.0	329.0	570.3	64.6	204.6	57.3
1996	448.5	582.7	353.4	631.5	68.2	229.1	60.3
1997	467.0	648.3	377.8	692.6	71.8	253.7	63.3
1998	487.4	714.0	402.2	753.8	75.3	278.2	66.5
1999	506.9	779.6	426.7	815.0	78.9	302.7	70.0

※ Source: KORECO(Korea Resources Recovery and Reutilization Corporation), 1996.

The plastics industry and organizations such as the Korea Resources Recovery and Reutilization Corporation have played a role in that growth. In order to help the domestic recycling industry, in accordance with Article 26 of the "Act Relating to Promotion of Resources Saving and Reutilization", KORECO provides loans to private recycling companies to help them construct recycling facilities. KORECO also promotes a nationwide campaign to recycling of wastes and the use of recycled goods. Key functions of KORECO are summarized below.

- O Provision of recyclable goods, with or without charges
- O Construction and operation of waste recycling facilities
- O Construction and operation of storage warehouses and recycling plant complexes for recyclable materials
- O Development of technology for the reduction of waste generation and the facilitation of recycling
- O Support for the recycling industry through the collection and recycling of recyclable resources
- O Surveys on the current state of demand and supply for recyclable resources, provision of information on distribution of recyclable wastes, and arrangement of recycling-related business transactions
- O Promotion of national campaign for reducing waste generation and encouraging the recycling of wastes
- O Execution of government-commissioned projects for recycling and disposal of wastes

TECHNICAL TRENDS

As domestic recycling companies are currently small and weak, advanced recycling technologies for plastics in Korea are not yet much employed. Consequently, Korean market for recycled plastics is still oriented for simple molded products which usually have poor quality. However, it doesn't mean that the researches about recycling technology are lagging. Let me summarize some technological trends in plastics recycling researches in Korea.(6)

- O Mixed waste plastic recycling technology development based on selective melting.
- O Thermal depolymerization of polyolefins and substituted polyolefins into a variety of smaller hydrocarbon intermediates.
- O Chemical Recycling: the depolymerization of certain condensation or addition polymers back to monomers (e. g., PETE, nylon, and polyurethanes)
- O PETE Depolymerization
- O Development of commingled plastic waste recycling technology.

CONCLUSION

In order to achieve the national target in terms of recycling rate, Korean companies need some premises.

1. Establish larger materials recovery facility (MRF). Larger production rate, less production cost.
2. Develop various applications and products by simple production system. Consumer needs quality product at lower cost. They often hesitate to buy recycled products at higher cost.

Table 6. Recycling Cost and Revenue Breakdown(Recycled Polyethylene)

(unit: thousand won)

National	Revenue			Cost		
	Sold (thousand Won)	Sold (ton)	Unit price (Won/ton)	Recycled (thousand Won)	Recycled (ton)	Unit price (Won/ton)
	156,743	1,047.7	149,607	224,855	1,346.2	167,029

※ Source: KORECO(Korea Resources Recovery and Reutilization Corporation), 1996.

3. Separation process must be perfect. Without complete separation process, it will be very difficult to control the color and surface of recycled plastics, technically.

How to develop markets for recyclable or recycled plastic packaging materials is the key element to strengthen recycled product manufacturers and drive successful recycling policy. Capacity to process material, and the market demand for the recovered plastic resin, both currently exceed the amount of post-consumer plastics that are now recovered from the waste stream. Table 6 shows this unbalanced economics for plastic recycling.(7)

Markets can be created by this combination: Development of cost-effective recycling technology, various educational activities by government, municipalities, nonprofit organizations, and private sectors to boost use of recycled materials, and well-organized recycling promotion policies.

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