中国における都市生活系廃棄物処理の現状と課題
Current Situation and Issues on Municipal Residential Garbage Disposal in China

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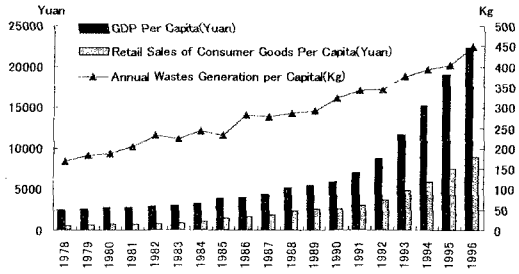
1.Introduction

Only less than 2% of municipal solid waste (MSW) generated in China is properly treated (sanitary landfill, compost and incineration). The rest is being transferred to rural areas, and dumped in open air. The dumped waste in open air has amounts to 60 billions tons, occupied 5 billions m^2 cultivated land, and made more than 200 cities get stuck in surrounding of garages. With rapid development of economy and improvement of living standard, volumes of the MSW continue to increase, and, at the same time, the sites for dump and landfill are becoming scarcer and more expensive. How to deal with MSW in China has become a very urgent problem. This paper aims at illustrating current situation and clarifying problems on the MSW treatment.

2. Current Situation

(1) Management System: In urban areas, the MSW is collected by environmental sanitation bureau of municipal authorities, but all of the families in rural areas have to deal with their garbage by themselves. Wastes Recovery Stations are collecting recyclable wastes such as waste metal, glass, plastic, cloth, and paper. However, waste generated from households, commercial facilities, road cleaning, and factories are collected without classification, and most of them are transferred from urban areas to rural areas and bumped in open air without sanitary treatment.

(2) **Change of Amount and Composition:** The total amount of the MSW in China has been increasing rapidly. The amount of collected MSW increased by 8% to 10% every year from $3,132\times10^4$ tons in 1980 to $8,791\times10^4$ tons in 1993. It is estimated that it reached 1 billion tons in 1996 and will further increase up to 1.5 billion tons by the year 2000. The increase of wastes generation per capita, municipal population and the declining of waste recovery system can be thought to be the main reason. At present, per capita generation of the MSW has reached to 440 kg/year. In 1996, that in Shanghai was 450 kg/year, while that in Kitakyushu (excluding the collected resource wastes and bulky wastes) and in Fukuoka (including collected resource wastes and bulky wastes) of Japan were 319kg/year and 556 kg/year, respectively. The figure left shows the relation between the per capita generation of MSW and growth of economy or consumer level. The annual waste generation per capita in Shanghai increased from 167 Kg/year in 1978 to 450 Kg/year in 1996 as well as the GDP per capita increased from 2498 yuan to 22275 yuan, the Retail Sales of Consumer Goods per capita increase from 495 yuan to 8913 yuan.



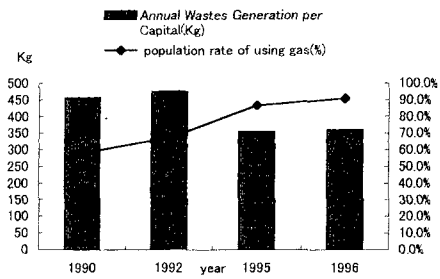
Annual Wastes Generation, GDP and Retail Sails of Consumer Goods Per Capita in Shanghai

Because of improvement of life level and other reasons, recover stations, which ever played an important role in recovering recyclable wastes on the base of buying and selling, have been decreasing rapidly. For example, the number of them in urban area of Shanghai has decreased from over 5000 to about 100, and half of them are suffering from semi-standstill.

Kitchen garbage and coal ash is the major component of the Chinese MSW. In Shanghai, the MSW generated from families using gas includes 71.7% kitchen garbage, 11.2% plastic and 6.5% paper; while that from families using

coal includes 62.5% coal ash, 17.4% kitchen garbage, 6.9% plastic and 6.2% paper. The population rate of using gas in Shanghai has reached 98.8% in 1996 so that 60 percent of total amount of residential garbage in the whole Shanghai is kitchen garbage.

Normally, the share of coal ash in the MSW in northern areas is higher than that in southern areas due to more consumption of coal. For example, in northern municipality Tianjin, although the economic level is lower than that of Shanghai, the annual waste generation per capita was 456Kg in 1990 and 474 Kg in 1992, respectively higher than that of 323 Kg and 344 Kg in Shanghai. The lower population rate of using gas and cooler climate resulted in a lot of consumption of coal. And as the effect of popularizing gas on decreasing coal ash exceeds the effect of economic growth on increasing waste, the per capita generation amount of waste appears a decreasing trend. In Tianjin, with the popularization of gas from 57.3% in 1990 to 90.8% in 1996, the annual waste generation per capita decrease by 21% from 456 Kg to 360 Kg as well as the GDP per capita in Tianjin increase by about 3.4 times from 3621 yuan to 12270 yuan.



Annual Wastes Generation and GDP Per Capita in Tianji

(3) Disposal Technology

China mainly uses landfill and composting to dispose MSW. As an agricultural country, composting is a traditional and popular method. Yet, with the increase of plastic and some toxic substances in MSW, the efficiency of composting and the quality of compost are becoming lower and lower. It is reported that only one incinerator is operating in Shengzheng City, two 1000 tons/day incinerators and one 1200 tons/day incinerator are being built in Shanghai and Suzhou respectively. However, there is a tendency of using capital-intensive incinerator to dispose MSW in order to mitigate land short when capital condition become mature. That incineration poses significant threats to public health and the environment, for example, the long-term effect on the human body of Dioxins and furans, seems not to be paid enough attention to.

3. Measures

In order to treat MSW properly, China should consider the following measures: **(1) Segregation:** It not only decreases the technological difficulty and disposal cost but also facilitates recycling and energy recovering. The effect of wastes recovery system should be strengthens through the reform on price system, organization mechanism and policy. **(2) Introduction of fee system:** Charging waste disposal discourages waste generation, and alleviate the shortage of fund. **(3) Assessment and management of landfill sites:** Current dumping waste in open air or filling up ditch and pit probably adversely affect soil, underwater, and air. To assess and improve management of landfill sites is urgent, particularly in the regions with high population density and intensive distribution of rivers and lakes.

4. Conclusion

It is necessary and urgent for China to reform and improve waste management system, technologies. Providing more gas service and "clean vegetable" play important roles on decreasing amount and changing the quality of MSW. Establishment of waste segregation is crucial for waste reuse, recycle and recovery. Introduction of charging system and strengthening recovery system should come into force. As to incineration, its negative effect on environment and public health should be paid attention. In addition, flexible finance and operation mechanism can promote the disposal of residential garbage.