# Enlightenment of China's Waste Classification Based on German Experience

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*Abstract*—**Waste classification refers to a series of activities in which garbage is classified, stored, put and transported according to certain regulations or standards, and thus transformed into public resources. In recent days, waste classification has become a hot topic in China, and the work of waste classification in Germany has a history of more than 100 years. Starting from the present situation of waste classification in China, this paper draws lessons from the successful experience of waste classification in Germany, so as to provide inspiration and guidance for waste classification in China.**

*Keywords—waste classification; Germany; China; experience*

## I. INTRODUCTION

China is a big garbage producer. At present, the annual output of domestic garbage in China is about 400 million tons, and it is increasing by about 8% every year. In recent years, with the increasingly serious environmental pollution, waste classification is imminent. If we do not do a good job in sorting and disposing of garbage, we may throw away a piece of garbage, which will lead to the extinction of marine life. The ultimate goal of waste classification is to recycle and save resources.

At the meeting of the Central Leading Group of Finance and Economics held by General Secretary Xi Jinping in 2016, he emphasized that the general implementation of the waste classification system requires strengthening the establishment of waste treatment systems for classified delivery, collection, transportation and treatment.

This year, Shanghai took the lead in the implementation of waste classification legislation. In the Notice on the Comprehensive Development of Domestic Waste Classification in Cities at and above the National Level, it decided to start the work of waste classification in 46 key cities from 2019. China's waste classification work has entered the right track.

## II. CURRENT SITUATION OF WASTE CLASSIFICATION IN CHINA

The work of waste classification in China began in the 1990s, and started later than other developed countries. At the beginning of the 21st century, the Ministry of National Construction designated eight cities, including Beijing, Shanghai and Hangzhou, as the first pilot cities for sorting and collecting garbage in China, but there was no substantial breakthrough in sorting domestic garbage. Since 2015, the work of waste classification has been highly concerned by the CPC Central Committee, and the policy has been constantly improved.

The core of waste classification in China is to separate kitchen waste from residents. According to relevant literature, the output of kitchen waste in household waste is expected to be 40-50%, but there is a problem of collection rate of kitchen waste. Referring to the progress of collection in Korea, the United States, Singapore, Japan and other countries, the collection rate of kitchen waste in foreign countries is currently 3%-21%. At the same time, according to the implementation opinions issued by Shanghai in February 2019 on implementing the Regulations on Shanghai Municipal Domestic Waste Management to promote the construction of the whole classification system, Shanghai's target will be achieved in 2019. The average daily control amount of dry garbage is not more than 21,000 tons, and the sorting amount of wet garbage is more than 5,520 tons. The target proportion of wet garbage in total garbage is 21%.

In June 2019, nine departments, such as the Ministry of Housing and Construction, issued the Notice on the Comprehensive Development of Domestic Waste Classification in Cities at and above the National Level, and decided to start the work of domestic waste classification in cities at and above the national level from 2019. According to the notification, by 2020, 46 key cities will have basically built domestic waste classification and treatment systems; other prefecture-level cities will have full coverage of domestic waste classification by public institutions, and at least one street will have basically built demonstration zones for domestic waste classification. By 2022, at least one district of cities at all levels will achieve full coverage of domestic waste classification; at least one street in other districts will be basically built into demonstration zones of domestic waste classification. By 2025, municipal solid waste sorting and treatment systems will be basically built in cities at prefecture level and above. At present, the garbage disposal methods implemented in different cities in China are much the same, for example, the pilot community of waste classification in Beijing, the individuals who have made

remarkable achievements in waste classification in Chongqing are commended and rewarded, the reward mechanism of recycling for gifts in Shanghai and the technical standards of waste classification in Shenzhen are clearly defined. Generally speaking, the work of waste classification in China is progressing steadily, but the residents' awareness of waste classification is still insufficient. The laws and regulations of waste classification need to be improved, and how to effectively realize waste classification according to local conditions remains to be considered.

## III. EXPERIENCE OF WASTE CLASSIFICATION IN GERMANY

Germany is one of the first western developed countries to implement circular economy legislation in the world, and it is also one of the most successful countries to implement circular economy legislation. As early as 1904, Germany began to implement municipal solid waste classification, and now a complete set of waste classification and treatment system has been formed. From the history of waste classification in Germany, in 1965, municipalities in Germany established waste treatment centers, and in 1972, the Waste Management Act was promulgated to close some non-standard waste treatment centers. After more than one hundred years of development, Germany has the highest recycling rate of waste in the world, with a recycling rate of about 65%.

- From the standpoint of waste classification, Germany is not like Shanghai using waste classification quarterly method, but a more detailed method, which can be divided into biological garbage, waste paper, packaging bags, old glass bottles, special toxic garbage, other garbage and large-scale waste. Although this classification method is more detailed, it also makes garbage recycling and utilization better. At the same time, different garbage corresponds to different colors of garbage cans to facilitate people to deliver.

- From the point of view of garbage disposal methods, since June 2005, Germany has stipulated that only the garbage after innocuous treatment can be landfilled to avoid secondary pollution. For the waste that cannot be recycled, Germany uses incineration method to deal with it. By 2018, Germany has more than 60 waste incineration plants and will continue to build them. Moreover, with advanced technology, German waste incineration will not emit any harmful substances or noise. In 2013, Germany achieved a domestic waste recovery rate of 835, 65% of which was recycled and 18% of which was energy recovery through incineration. Japan's waste classification is more detailed, but its utilization rate is lower than Germany's.

- In Germany, waste classification has become a habit. From kindergarten, children need to learn waste classification. Vocational schools take waste classification as a compulsory course for students. At the same time, Germany has a large number of volunteers to publicize waste classification knowledge to the public. Moreover, Germany also has time requirements for garbage disposal, but it is not as meticulous as Japan. Every German family will have a "garbage disposal schedule". Residents only need to put some kind of garbage can or bag on it the day before the designated date according to the schedule. Moreover, Germany also has corresponding penalties for littering.

## IV. ENLIGHTENMENT OF GERMAN EXPERIENCE IN WASTE CLASSIFICATION TO CHINESE WASTE CLASSIFICATION

### A. Strengthening the Propaganda and Education of Waste Classification, Starting with Dolls

Although waste classification started late in China, it is progressing well at present. However, due to the lack of awareness of waste classification, waste classification in many places, especially in rural areas, is difficult to carry out. Therefore, China must learn from Germany and strengthen the propaganda and education of waste classification, starting with dolls. In kindergartens, teachers can organize knowledge competition and play games on waste classification to cultivate children's awareness of waste classification. As China is an aging country, it is very important to strengthen the guidance of waste classification for the elderly. In the actual process of propaganda and education, China must fully consider the factors such as the slow speed of knowledge acceptance and conceptual achievements of the elderly, and adopt different methods of propaganda and education, such as strengthening memory by playing games, one-to-one guidance, etc. For the new generation of young people, China should consider the working hours of young people and arrange the time of garbage disposal reasonably.

### B. Classification and Treatment of Garbage According to Local Conditions and Rationalization of Waste Classification Standards

China's waste classification can be divided into recyclable garbage, kitchen waste, harmful garbage and other garbage. Even though Shanghai currently divides garbage into recyclable garbage, harmful garbage, dry garbage and wet garbage, the waste classification standard of China is relatively broad from the point of view of the waste classification standard of recyclable part. This reduces the utilization rate of recyclable garbage and makes the work of disposers more tedious when disposing of garbage. Therefore, China can draw lessons from German waste classification standards and subdivide recyclable garbage into paper, plastic, glass and so on. This can effectively achieve the most fundamental goal of waste classification and greatly improve the recycling efficiency of garbage. At the same time, garbage can be classified and disposed according to the characteristics of different regions. For example, Chongqing aims at harmful garbage, perishable garbage, recyclable garbage and other four kinds of domestic garbage, specifically specifying different collection and transportation subjects and modes, so as to eliminate the problem of garbage "divided first and mixed later".

### C. Strengthening Legislation on Waste Classification and Establishing Long-term Mechanism

Waste classification is a long-term process. The final goal cannot be achieved only by establishing temporary waste classification standards and promoting waste classification. Therefore, China must strengthen the legislation of waste classification. Germany adopts penalty measures for waste classification, and the law is relatively perfect. Shanghai Municipal Solid Waste Management Regulations, promulgated by Shanghai, not only determine the criteria for waste classification, but also restrict individuals or enterprises that do not perform waste classification. According to the documents issued by 46 key cities of waste classification in China, 9 cities have legislated on waste classification. In addition, the legislative process of waste classification is accelerating. In the process of sorting municipal solid waste in most of China, incentives are mostly adopted for individuals, such as points exchange prizes, community waste sorting evaluation and so on. To a certain extent, this has promoted the process of waste classification in China. Therefore, China must strengthen the legislation of waste classification and establish the garbage treatment system of classified throwing, classified collection, classified transportation and classified treatment.

## V. CONCLUSION

Waste classification is a matter for the benefit of the country and the people. Therefore, every country must attach importance to the work of waste classification. To classify garbage from its source, the most basic goal is to reduce waste of resources and protect the environment. China's current waste classification is based on Japan's experience, but Germany, as one of the countries with earlier waste classification, deserves our consideration. China must promote the work of waste classification, truly make garbage into treasure, and contribute to the cleanliness and beauty of the earth.

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