Present Situation and Future Development Trend of Domestic Waste Treatment Technology

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Abstract: With the development of economy in China, many kinds of exquisite packaging are produced to improve the appearance of products and protect the integrity and neatness of products. Moreover, with the improvement of people's living standards and the rapid development of urban construction, people's demand for and choice of various products are also increasing. At the same time, more and more domestic waste is being generated, the random stacking of a large amount of household garbage not only takes up a large amount of land resources, but also pollutes the environment and breeds a large number of mosquitoes, flies and bacteria. Over time, it will also cause harm to people's physical and mental health, it causes enormous pressure and pollution to people's living environment. The problems brought by domestic waste have become one of the top ten environmental problems in the world today. Recycling and reducing the amount of domestic waste is an important measure to promote environmental management and energy conservation and emission reduction, and it is of great significance to improve the ecological environment and sustainable development. In order to solve this problem, garbage classification and recycling is imperative. In order to realize the recycling economy, the state puts forward the concept of waste recycling and takes some measures to improve the management and efficiency of waste recycling. Garbage classification and recycling management is an important part of circular economy. On the one hand, the disposal of garbage can reduce the discharge of garbage from the source, on the other hand, it can also be solved by the reuse of resources. At present, China's waste treatment technology is gradually mature, but the classification of waste management is still relatively inadequate. In this paper, the current situation of domestic waste and the problems in the treatment process are analyzed, and the recycling of waste and other solutions are discussed. At present, China's domestic waste treatment is relatively simple, mainly landfill-based, and the next few years will not be much change. In order to realize the goal of harmless, reduction and resource utilization of garbage, it is an inevitable trend to improve the treatment technology and combine various treatment technologies.

Keywords: Domestic garbage, Garbage classification, Garbage recycling.

1. Introduction

With the continuous growth of economy and the improvement of people's living standards, the process of urbanization is also accelerating, accompanied by worsening environmental problems, especially the treatment of domestic waste. At present, China's domestic waste production is still growing at an annual rate of 8% - 10%, but the harmless treatment capacity is obviously insufficient, the treatment rate is only 63.5%. A large number of domestic waste is transported to the suburbs for bare stacking, occupying up to 5×108m² of the land area. As of 2012, the domestic waste clearing and transportation capacity of 657 cities in China is 170 million tons, with 701 domestic waste treatment facilities and a treatment capacity of 446000 t/a. Among the 701 domestic waste treatment facilities, there are 540 landfills with a treatment capacity of 310000 t/a and an actual treatment capacity of 105 million t/a; There are 138 municipal solid waste incineration plants (including comprehensive treatment plants), with a treatment capacity of 123000 t/a and an actual capacity of 35.84 million t/a; There are 23 municipal solid waste composting plants (including comprehensive treatment plants), with a treatment capacity of 12700 t/a and an actual treatment capacity of 3.93 million t/a[1]. In recent years, more and more attention has been paid to waste classification in China, especially since Shanghai took the lead in implementing the compulsory classification system of domestic waste. In July 2019, the garbage classification in Shanghai has become the focus news for a while, which is widely considered as an important sign of the development of garbage classification in China. However, after several months of practice, the phenomenon of littering is still serious. In fact, our country has been committed to the treatment of a large number of garbage, but often with little effect. With the increasing amount of domestic waste and commercial waste, the dump has finally become a "mountain piled" state, which not only causes serious pollution to the surrounding environment and brings harm to human health, but also is not conducive to the orderly progress of urban development [2]. In these garbage, about 60% of them can be reused. It can be seen that garbage is actually the resources put in the wrong place. In order to make full use of garbage resources or reduce the generation of garbage, the premise is to classify the garbage. China's garbage classification still has a long way to go.

2. Domestic Domestic Waste Treatment Technology

At present, the domestic waste treatment technologies in China mainly include landfill, composting, incineration and stacking, accounting for 61.4%, 2.3%, 21.1% and 15.2% respectively [3].

2.1. Landfill technology

As one of the earliest waste treatment methods in China, landfill is still the most important way of domestic waste treatment in China, which has less investment, simple process...
and large capacity. Landfill technology can be divided into simple landfill, controlled landfill and sanitary landfill. Simple landfill is a relatively backward landfill method, because this kind of landfill method basically does not take corresponding engineering measures according to the environmental protection standards; Some engineering measures have been taken for controlled landfill, but they are not complete; Compared with the former two, sanitary landfill has more perfect environmental protection measures, and can meet the environmental standards of landfill technology. Landfill technology has no strict requirements on the composition of waste, but it is not suitable for the waste with high moisture content, because it is easy to cause the increase of landfill leachate, which will pose a threat to soil and groundwater. In some places, the COD of landfill leachate is as high as more than 100000. After it seeps into the groundwater, the nitrate, ammonia nitrogen, total number of bacteria and other items in the groundwater exceed the standard, and some items even exceed the standard hundreds of times. So too much landfill leachate will cause great harm to the surrounding environment. Landfill is easy to cause secondary pollution. The landfill waste is not treated harmlessly [4]. The landfill leachate will pollute the groundwater resources and soil, making it unable to cultivate for a long time, and can not be used as construction land. There are also hidden dangers of biogas and heavy metal pollution, and the possibility of fire and explosion. Moreover, the capacity of the landfill is limited. Therefore, it is necessary to build new landfills. Xi'an jiangcungou landfill, the largest landfill in China, has been closed; Hangzhou landfill, which was expected to last 24 years, has been filled up in 12 years.

2.2. Composting technology

Composting technology is under controlled conditions, the use of natural microorganisms to degrade the organic matter in garbage, make it into a stable humus, can be used as organic fertilizer or soil conditioner in agricultural production and other industries, high-quality fertilizer is conducive to improving soil fertility. This technology requires high purity of waste, and is only suitable for perishable organic waste such as kitchen waste and kitchen waste. Domestic waste without classification often contains some substances that are not suitable for composting, which will affect the normal operation of waste composting technology and the quality of composting products [5]. Therefore, although China has a long history of traditional composting technology, the quality of composting products is not high and the treatment rate can not keep up with the waste generation rate due to the lack of effective waste classification. Moreover, most of our city's domestic waste belongs to mixed waste, which needs to be pretreated before composting. The quality of composting products is not high, and the amount of residue is large, so the domestic waste in our country is less treated by composting. At present, the proportion of waste disposal by composting is gradually decreasing.

In addition, these wastes can also be anaerobic fermented to obtain biogas, which can be used for power generation. The residue after fermentation is a good fertilizer after treatment. The resource utilization rate of food waste and kitchen waste is very high, often up to 90% - 95%. Only some tableware and sundries mixed in this kind of garbage, such as chopsticks and garbage bags, can not be used, and others can be recycled through biochemical treatment. Composting technology also has environmental problems. Ammonia, hydrogen sulfide, methane and other gases produced during composting can not be reasonably controlled, which will pollute the surrounding air, and even cause fire, explosion and other disastrous accidents. This treatment method is widely used in rural domestic waste treatment, the main disadvantage is that the treatment object is mainly kitchen waste, so before treatment, we need to classify the urban waste.

2.3. Incineration technology

Incineration technology is about 800 ~ 1000 °C high temperature conditions, the combustible components of domestic waste after combustion, release energy, produce high temperature gas and a small amount of stable solid residue. High temperature gas can be used for power generation or heat recovery, and the stable residue can be directly landfilled. The incineration technology has the advantages of large capacity, fast speed, small land occupation, and can achieve the goal of reduction, harmlessness and resource utilization[6]. At present, it has been widely used by some coastal cities in Southeast China, and the proportion is on the rise. However, in China, there are still some limitations in the use of incineration technology to treat garbage. For example, the minimum calorific value of garbage incineration should be more than 3360kj / kg. If the calorific value is too low, it is necessary to add fuel for auxiliary combustion, resulting in higher operating costs. China's waste classification and recycling is not ideal, many domestic waste mixed collection, composition is more complex, calorific value is also low. Moreover, the investment in incineration technology and the operation and maintenance of equipment are relatively expensive, which is hard to bear in some economically underdeveloped areas. This is also the reason why incineration technology is widely used in some economically developed coastal cities. The second is the dioxin produced by incineration of garbage. Because of its stable structure and long half-life, it can be stored in the body for a long time after only one exposure. Long term exposure can cause accumulation in the body, which has great harm to human health. Moreover, if the waste incineration facilities are not equipped with flue gas treatment facilities, heavy metals and organic pollutants may be discharged into the environment again, causing secondary pollution. The investment cost of waste incineration is high, and many wastes are not suitable for incineration, such as those with high moisture content and low calorific value.

2.4. Stacking technology

Due to the large amount of garbage and the lack of treatment capacity, some local and urban domestic garbage can not be treated in time and effectively, some of which are piled up in the urban-rural fringe, occupying a lot of land resources. At present, about 200 cities in China are surrounded by garbage. The harmful components in the garbage leach out and then seep into the soil or groundwater, which poses great harm to the environment.

3. Present Situation and Problems of Domestic Waste Treatment in China

Based on China's large population base, the amount of domestic waste is also extremely large. According to the statistics of the Ministry of ecological environment, the domestic waste output of 202 large and medium-sized cities
in 2017 was 201.944 million tons. This is only the amount of domestic waste produced in 202 large and medium-sized cities in China, while the large number of small towns and rural areas are not included in the statistics. By the end of 2017, "the urban permanent population is 813.47 million, accounting for 58.52% of the total population (urbanization rate of permanent population)", which means that the remaining 41.48% of the non-urban permanent population and the amount of domestic waste generated by small cities and towns other than the above-mentioned large and medium-sized cities can not be underestimated. With the continuous growth of population and the gradual improvement of people's living standards, the total output of domestic waste and the daily output of domestic waste per capita are also relatively increasing. In the case that a large amount of domestic waste is inevitable, how to deal with this large amount of domestic waste is the focus[7]. According to the data released by the National Bureau of statistics, in 2017, the amount of domestic waste was 215.209 million tons. In 2017, although the domestic waste removal and transportation volume exceeded the domestic waste production volume of 13.265 million tons in 202 large and medium-sized cities in China, compared with the domestic waste production volume in small towns and rural areas, it may seem insignificant.

3.1. Waste classification standards are not unified

At present, China's urbanization rate and residents' consumption level are increasing year by year. So the types of waste become more complex. In 2008, we made a certain classification of domestic waste, including recyclables, hazardous waste, bulky waste, compostable waste and combustible waste. We also hope that each region can classify the waste according to its own actual situation. Therefore, it also leads to the introduction of waste classification measures in various regions, leading to different standards in various regions. In addition, at present, the garbage collection methods in most cities of our country are still in mixed collection, although there are two categories of recyclable and non-recyclable, they are basically in vain. Residents will still throw away garbage at will, and when collecting, some staff will still collect garbage in a mixed way, which also affects the enthusiasm of residents to participate in garbage classification to a certain extent. This kind of behavior causes waste of waste resources, increases the cost of waste end treatment, and may even cause secondary pollution to the environment.

3.2. Garbage collection system is not standardized

For the recycling of garbage, in addition to reducing the amount of garbage, it can also realize the reuse of resources. At present, the garbage recovery rate in China is relatively low. The front line of garbage collection is mostly private small workshops, the environment is relatively poor, and the income can not be guaranteed. The second-line recyclers are usually used in the second-hand goods trading market. The operation on recycling is relatively simple, or they will simply process some waste goods, and then give them to the recycling enterprises for processing and production. Therefore, this recycling mode in China is relatively passive, so the recycling rate can not be effectively improved, which also requires us to gradually enhance the residents' awareness of recycling and develop the awareness and habit of garbage classification and recycling, so as to effectively improve the garbage recovery rate[8].

3.3. Residents' awareness of garbage collection and classification is weak

Garbage collection and classification, especially the classification and recovery of urban garbage, can not be separated from the active participation of residents. However, at present, many residents do not know much about the waste classification standards, and the social publicity still needs to be further improved. At present, most of the residents have little awareness of waste classification and recycling, and the government lacks strong constraints and management, so the concept of waste classification and recycling has not been well implemented. Most of the residents are still not fully aware of the impact of waste on our lives and the necessity of waste classification and recycling. Although some residents pay more attention to the living environment, there is a lack of garbage classification and understanding, and there is no targeted guidance.

3.4. The facilities of waste treatment plant are not up to standard and the government supervision is not effective

At present, in order to save costs and pursue higher interests, many waste treatment plants do not strictly follow the standards in the process of waste treatment. In addition, the government also lacks effective supervision and management. For example, the access system of waste treatment plant and the quality management of project operation need to be coordinated and supervised by different departments, but at present, it is obviously insufficient in execution, which also affects the effective classification and recycling management of waste.

4. Current Situation of Domestic Waste Treatment in Foreign Countries

4.1. Domestic waste treatment in Japan

(1) Since the 1970s, Japan's rapid development has been accompanied by high waste output. At that time, domestic waste treatment methods were single and lack of sufficient environmental protection awareness. At the same time, the "NIMBY effect" caused by domestic waste disposal seriously affected public life and seriously damaged the actual interests of the public. The public began to spontaneously pay attention to related issues and actively seek to participate in social affairs. The mode of public participation in the development of domestic waste classification is gradually rising. In order to seek to participate in social affairs, community residents' self-government Committee has become an important organizational form of public participation. The model of residents' self-government Committee in nishiko Prefecture of Nagasaki, Japan, uses the form of public participation to treat domestic waste from the source, so as to reverse the chaotic situation of domestic waste treatment.

(2) Domestic waste treatment in Japan has the characteristics of fine and high resource utilization. Located in the mountainous area of Tokushima Prefecture, Japan, the "zero waste" town of shangsheng town has been using a single incineration method to treat domestic waste before 2000, which seriously pollutes the local natural environment and damages the interests of the community. Since 2000, the
municipal solid waste incinerator has been shut down in Shangsheng Town, and a set of strict and meticulous classification system for municipal solid waste has been implemented. The public's cognition of the classification system has experienced a change from being unaccustomed to being recognized and actively practiced. At present, it has been persisted for 20 years. Shangsheng town vigorously promotes the fine classification and treatment of garbage, guides residents to use environmentally friendly and degradable products as much as possible, exchanges idle goods, makes goods from waste and builds houses. These measures are in line with the characteristics of 3R circular economy, making the local garbage recovery rate as high as 80%[9]. At the same time, the local government should vigorously develop the ecological industry, such as tourism, gradually restore the natural environment and realize the green development of economy.

4.2. Other domestic waste treatment technologies abroad

In addition to the landfill, composting, incineration and stacking mentioned above, there are other high-quality technologies abroad, especially waste gasification and anaerobic digestion.

1) Waste gasification treatment

MSW Gasification is a process in which organic components (mainly carbon) in MSW react with gasifier in reducing atmosphere to produce gas (CO, CH4, H2, etc.). In general, the endothermic effect of other gasification reactions is provided by exothermic reaction of partial combustion. The products of gasification reaction are gas and ash, and the target products are single gaseous gas. Ideally, the gas contains all the energy in the gasification raw material, while the actual energy conversion rate is 60%~90%. Pyrolysis and gasification process is carried out in oxygen deficient or anoxic atmosphere, which reduces the formation of dioxins in principle. At the same time, most heavy metals dissolve into ash during pyrolysis and gasification, which reduces the emission. At present, there is no direct waste gasification furnace with business model in China, while Germany, Switzerland and other countries have formed waste gasification technology, with typical representatives of Texaco, nowe KRC and other companies.

2) Anaerobic digestion (fermentation)

Anaerobic digestion (fermentation) technology is a promising method for waste treatment abroad, which has been strongly supported by many governments in recent years. Strictly speaking, landfill gas produced by landfill is also produced by anaerobic digestion technology, but the methane content in landfill gas is lower than that of ordinary biogas [10]. Mixed fermentation of organic waste (such as expired food, kitchen waste, etc.) and other organic waste (such as livestock manure, organic wastewater, energy crops, etc.) is the mainstream technology abroad. Because mixed material fermentation is better than single material fermentation.

Compared with the landfill method, the mixed fermentation of MSW in the fermentation tank has higher gas production, higher methane content and less methane emission, which is convenient for the centralized and efficient utilization of biogas. Many countries have formulated special subsidy policies for biogas production from anaerobic digestion of municipal solid waste to encourage the mixed fermentation of municipal solid waste and other organic wastes. Although the development momentum of biogas projects in China is very strong, and the national support is also very strong, but they are all aimed at agricultural waste, and there are almost no biogas projects aimed at urban organic waste.

5. Development Trend and Suggestions of Domestic Waste Treatment Technology

The development of MSW treatment technology in China is restricted by many factors, such as the composition of MSW itself, treatment technology, public awareness, and so on. The treatment capacity is also closely related to the economic development of cities. Therefore, in order to achieve the goal of "three modernizations", it is necessary to develop corresponding treatment technologies for different cities, Make the garbage from "the burden of the city" to "the secondary resources of the city".

5.1. Waste classification is essential

(1) Improve the policies and regulations of waste classification management, and form a complete system of domestic waste classification management.

Waste classification and treatment is a complex and huge project, including classification, delivery, collection, transportation, treatment and other links. Problems in any link will weaken the effect that should be achieved. Only when perfect policies, regulations and operation guidelines are established, including responsibility subjects, detailed classification standards, transportation links and follow-up treatment, can each link be operable. The Shanghai Academy of Social Sciences proposed that the waste reduction and resource utilization in Shanghai should take "the whole life cycle management of waste" as the main line, and establish a complete set of systematic system in line with the current situation of Shanghai, which is coordinated by the technical path and the organizational path, from the aspects of source classification, separation, transportation, terminal disposal and resource reuse. Taking Chongming district as an example, the mechanism is introduced in detail.

(2) Strengthen the government's financial investment and allocate waste sorting facilities

Each link of waste classification and treatment needs to be equipped with different treatment facilities. For example, in the front end of garbage disposal, optimize the design and quantity of garbage cans on urban roads; At the end of waste treatment, terminal treatment facilities should be equipped. When necessary, we should introduce foreign advanced technology and increase the input of human resources.

(3) Implement market mechanism and cultivate recycling industry of renewable resources

It is unrealistic to rely on the government to solve the problem of waste treatment capital or technology. We should introduce the market competition mechanism to promote the improvement of local waste treatment efficiency, plan and cultivate the recycling industry of renewable resources, form a complete industrial chain and reduce the burden of the government. In terms of specific implementation, we can refer to the "regeneration bank" of the United States. At the same time, the introduction of market mechanism and good management of waste industry will also produce economic benefits.

(4) Strengthen supervision and management

Our country is still in the initial stage of waste classification,
in this process, there will be a variety of problems, such as residents' different mastery of classification standards, inevitably there is the problem of putting in the wrong; Whether the secondary classification is carried out in the waste transfer station; Whether there is a situation of first dividing and then mixing; The effect of waste treatment technology and so on need to be supervised. Huang Wentong proposed to integrate the existing resources and develop a digital supervision platform for waste treatment by means of information technology, so as to realize the scientificity and accuracy of waste treatment supervision. The establishment and implementation of reward and punishment system can promote the implementation of municipal solid waste classification measures.

(5) Strengthen publicity and education for the public
The masses are the main body of waste classification, so we should strengthen the publicity and education of the public to enhance the masses' awareness of environmental protection. We should let the people fully understand the knowledge of waste classification, such as the method of waste classification, the reasons for such classification, and the reward and punishment measures. The popularization of garbage classification publicity and education knowledge should start from children, so that the majority of children fully understand the garbage classification knowledge, and can classify garbage in life.

(6) Waste reduction is controlled from the source, and source control is the key.
Reduce the use of disposable products, such as disposable plastic bags, disposable plastic cups; The product packaging should be as simple as possible, and biodegradable materials should be selected; Civilized dining table "CD-ROM action", reduce the production of kitchen waste; It is suggested to reduce the use of disposable slippers, toothbrush, toothpaste, comb, soap and bath fluid in hotel rooms.

(7) Waste classification and reduction target
All major cities should set goals and plans for domestic waste classification and reduction, and subdivide the goals into districts, enterprises and factories. All departments should establish and improve corresponding systems and measures, including assessment methods, that is, daily work of waste classification and reduction should be included in the annual assessment.

(8) Enforce waste classification
In China, the exploration of waste classification began as early as 1995, and eight cities including Beijing, Shanghai and Hangzhou were selected to carry out the pilot project of waste classification and recycling in 2000, but none of them achieved the expected results. One of the important reasons is that in the past, it mainly relied on propaganda and advocacy, and lacked of coercive force. On the basis of the improvement of relevant laws and regulations, the compulsory implementation of waste classification and the formulation of reasonable reward and punishment measures will be conducive to the development of waste classification work. The collective or individual who does not carry out waste classification according to the regulations will be punished to make them feel the constraints of the law.

5.2. Improve the treatment technology level
The development of high-dimensional landfill technology and the application of bioengineering in the construction of landfills can greatly reduce the concentration of leachate, improve the service life of landfills, reduce the landfill space and save land resources by controlling some parameters inside landfills to adjust the biological reaction speed inside landfills and accelerate the degradation process and the stabilization of waste, Reduce the risk of environmental pollution. Through the waste crushing, ventilation and other pretreatment, improve the calorific value of waste, and then improve the incineration power generation system through thermophysical heat transfer technology, improve the power generation capacity of waste incineration. The combined technology of cement kiln and waste incinerator can also be used to treat municipal solid waste. The technology does not need secondary fuel addition, and the flue gas temperature is controlled above 850 °C and the residence time is more than 2s to prevent the formation of dioxin [11]. China is a large agricultural country, the demand for fertilizer in agricultural production is very large. Nowadays, chemical fertilizer is widely used, soil fertility is getting worse and worse, so it is imperative to develop efficient composting technology, such as fermentation bin system, reactor system and so on. The production of high-quality organic fertilizer can not only improve the soil condition and increase the output value, but also recycle the organic matter in municipal solid waste and return it to nature.

5.3. From single treatment to diversified treatment
Any kind of waste treatment technology has its own advantages, but due to the complex composition, high moisture content, high organic content, less recyclable content and low calorific value of municipal solid waste in China, it is difficult to achieve the best effect by using a single treatment technology. Therefore, the diversified treatment methods of composting, incineration and landfill will become an inevitable trend [12]. However, no matter what technology is used to treat municipal solid waste, there will be a certain amount of residues that can not be treated or reused, or can not be treated or reused under the technical conditions at that time, so it is necessary to landfill them, so landfill technology will still coexist with the treatment of municipal solid waste for a long time.

5.4. Improve garbage disposal capacity
The construction of garbage treatment plants with comprehensive treatment capacity can reduce or eliminate the waste of land resources caused by the lack of treatment capacity and technology. The comprehensive treatment is the whole process of classified collection, recycling and final treatment from the source of waste generation, so as to reduce, recycle and harmless the waste, and form a comprehensive waste treatment system based on recycling [13]. Garbage contains some semi-finished products and material raw materials. Through classification and recycling, some daily necessities can be produced again. The production cost is much lower than smelting from ore raw materials, and many processes are reduced. It not only saves natural resources and economic expenses, but also indirectly processes and uses garbage resources. Its economic benefits are very objective, It has a huge role in promoting the development of the city.

6. Conclusion
Garbage classification has become a necessary thing for human beings. However, at present, garbage classification in China is chaotic and has not been implemented. Single
domestic waste treatment technology has been unable to meet the needs of the current urban development. With the acceleration of urbanization and the increase of national environmental protection, it is inevitable to find the optimal way of waste treatment according to local conditions. In addition, waste classification and treatment is a huge project, publicity and education to the public, improve public awareness and quality is the premise, learn from the successful experience of foreign countries, configuration of perfect waste classification and treatment facilities is the foundation, strengthen supervision and management and perfect policies and regulations and system is the guarantee, the introduction of market mechanism, compulsory classification is the means. Only when the government and the public participate in the daily work of waste classification, can we achieve the expected effect of waste classification - waste recycling and reduction.

Compared with some developed countries, there is still a big gap in many aspects, mainly in waste treatment technology and talent reserve. At the same time, the residents’ awareness of environmental protection and waste recycling needs to be strengthened. So we have a long way to go.

References