

Research on the current situation of harmless disposal and resource utilization of domestic waste in major cities along the Yellow River in Henan Province and suggestions for countermeasures

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Abstract: This paper adopts the method of field research and issuing questionnaires to get the data of the total amount of domestic waste collection and transportation, incineration power generation and recyclables recovery in the major cities along the Yellow River in Henan Province. From the research results, it can be seen that the cities have a single way of resource utilization, and the utilization rate is not high, and the level of resource utilization needs to be improved. We should start from top-level design, publicity and education, infrastructure construction, etc., increase financial investment, adjust the standard of domestic waste disposal fee, introduce advanced resource utilization technology, and open up a road suitable for waste disposal and resource utilization in cities along the Yellow River.

Keywords: Household garbage; Garbage classification; Harmless disposal; Resource utilization; Countermeasures and Suggestions

1. Introduction

The Yellow River, the mother river of China, is the artery of China and cradle of Chinese civilization^[1]. It originates on the Qinghai-Tibet Plateau and splits the Loess Plateau, flowing from Sanmenxia into Henan Province. In 2019, Xi Jinping, general secretary of the Communist Party of China Central Committee, issued a call in Zhengzhou to "make the Yellow River a river of happiness that benefits the people"^[2], giving Henan a major mission to protect and manage the Yellow River. In 2021, the Central Committee of the Communist Party of China and the State Council issued the "Outline of the Plan for Ecological Protection and High-quality Development in the Yellow River Basin", which pointed out that ecological priority and green development should be adhered to, and water conservation should be given priority^[3,4]. It also stressed the need to protect and carry forward Yellow River culture to make the Yellow River Basin an important benchmark for the management of large rivers.

The Henan section of the Yellow River is an important ecological function area with a vast plain in the east, passing through the city and the countryside. In order to vigorously carry out the pollution control work of the Yellow River^[5], the Henan Provincial Party Committee and the Provincial Government have conducted many researches, made decisions and deployed, and the control effect has been remarkable, but there are still certain shortcomings. As a plain area, Henan province has many cities that built along the river, and generated large amount of domestic waste every day^[6]. There are various types of municipal solid waste with complex composition. If not properly disposed of, it will bring enormous pressure to the Yellow River governance work, especially during the flood season. After soaked in the household waste, the rainwater may carries toxic and harmful substances into the Yellow River, which seriously affects the ecological environment in Yellow River Basin.

In order to strengthen the protection of the Yellow River Basin and promote comprehensive governance, this paper investigated the status quo of the harmless disposal and resource utilization of domestic waste in eight cities along the Yellow River, with the perspective of urban domestic waste^[7]. According to the survey results, the current situation of domestic waste in cities along the Yellow River

in Henan Province was analyzed, the existing problems were found out, and countermeasures and suggestions were given based on the syndrome differentiation and treatment. This is of great significance to promoting the high-quality development of the Yellow River Basin, promoting the harmonious coexistence between man and nature^[8], and improving the urban living environment.

2. Analysis of the status quo of domestic waste of eight cities along the Yellow River in Henan Province

In order to explore the current situation of domestic waste in cities along the Yellow River in Henan Province, eight representative cities were chosen, including Sanmenxia, Jiyuan, Luoyang, Zhengzhou, Jiaozuo, Xinxiang, Kaifeng and Puyang, to investigated through field visit and questionnaires. The results are as following:

According to the data obtained from the survey, in the past five years, the volume of domestic garbage removal and transportation in major cities along the Yellow River in our province has increased year by year, and the harmless treatment rate has almost reached 100%. However, in the innocuous treatment, most of the domestic wastes were disposed of by the sanitary landfill method^[9]. At present, the incineration and disposal rates of domestic waste in Kaifeng and Luoyang are up to 100%, so the harmless disposal rate ranks are the top among the eight cities. Xinxiang, Puyang and Sanmenxia have not yet built incineration plants, and all the domestic wastes generated are landfilled^[10]. During the "Thirteenth Five-Year Plan" period, there was no new waste incineration power plant in Jiaozuo City. The original waste incineration power generation project (with a daily processing capacity of 125 tons) was halted for environmental issue, which operated by Jiaozuo Kelin City Environmental Protection Co., Ltd. After 2018, all household waste in Jiaozuo was landfilled. Zhengzhou and Jiyuan use a combination of sanitary landfill and incineration to dispose of garbage, and the amount of incineration in 2020 has increased compared to the previous incineration.

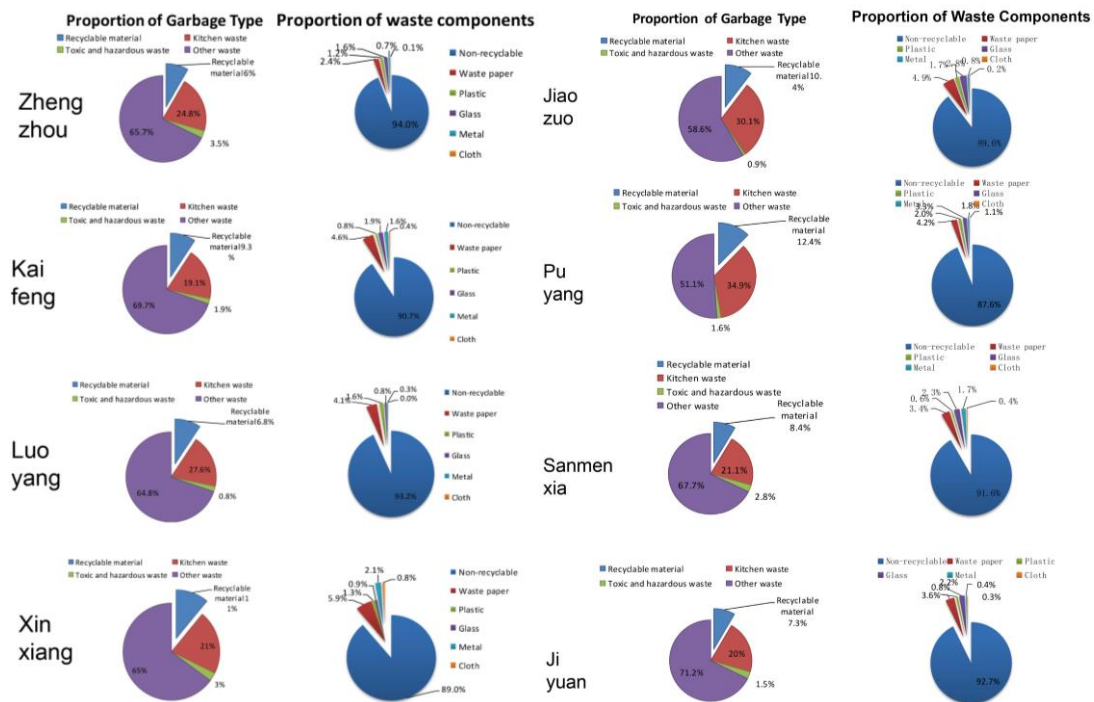


Figure 1: The current situation of domestic waste in eight cities along the Yellow River

The heat generated by waste incineration can be recycled and used to generate electricity or heat, and the ash after incineration can also be used to produce cement and make bricks. Considering the principles of reduction, recycling, and harmlessness, many excellent characteristics of waste incineration power generation are more in line with the objective reality of land and energy shortages in modern society^[11,12]. Therefore, the improvement of social requirements for environmental quality will ultimately be a major driving force for the development of the waste incineration power generation industry. Kitchen waste accounts for a large proportion of domestic waste, and it is extremely harmful if handled carelessly. It is reported that the kitchen waste plant in Henan Province has not yet been built^[13-15]. On the whole, the resource utilization methods of each city are relatively simple, and the

utilization rate is not high, and the level of resource utilization needs to be improved urgently. Fig.1 shows the status of domestic waste in the eight cities along the Yellow River in Henan Province in the past five years.

3. Problems existing in the harmless disposal of domestic waste

Table 1 shows the details of domestic waste disposal in the eight cities along the Yellow River in Henan Province. It can be seen from the table: at this stage, the disposal of domestic waste in the whole province is still dominated by landfill, but landfill has many defects such as large land occupation, secondary pollution, explosion and collapse. At present, the municipal waste disposal work only relies on a few departments to operate, so the coordination and cooperation mechanism of relevant municipal departments needs to be improved. Although almost all cities in Henan Province have formulated relevant laws and regulations on household waste classification^[16], the successfully classified waste ended up with mixed again, due to the lack of public awareness, the incomplete waste classification infrastructure, and the unsound collection and transportation system^[17]. Based on the results, the common problems in the process of harmless disposal and resource utilization of domestic waste in cities along the Yellow River in Henan Province can be summarized as follows:

Table 1: The breakdown of domestic waste disposal in eight cities along the Yellow River in recent 5 years

Cities		Zheng zhou	Kai feng	Luo yang	Xin xiang	Jiao zuo	Pu yang	Sanmen xia	Ji yuan
Total(10ktons)		223.08	30.7	69.24	44.1	28.41	25.6	15.96	19.3
2016	harmless disposal(10ktons)	223.08	30.7	66.07	44.1	27.7	25.55	15.44	19.3
	Landfill	142.77	0	66.07	44.1	24.95	25.55	15.44	19.3
	Incineration	80.31	30.07	0	0	2.75	0	0	0
Total(10ktons)		236.82	32.64	68.38	47.4	28.66	26.34	16.24	19.5
2017	harmless disposal(10ktons)	236.82	32.64	68.38	47.4	28.66	26.34	16.04	19.5
	Landfill	165.89	0	68.38	47.4	25.91	26.34	16.04	19.5
	Incineration	70.93	32.64	0	0	2.75	0	0	0
Total(10ktons)		252.64	35.33	70.05	47.66	28.67	32.56	16.21	19.66
2018	harmless disposal(10ktons)	252.64	35.33	70.05	47.66	28.44	32.56	16.01	19.66
	Landfill	203.56	0	2.34	47.66	25.69	32.56	16.01	19.66
	Incineration	49.08	35.33	67.71	0	2.75	0	0	0
Total(10ktons)		268.9	43.52	70.06	51.81	28.97	33.08	16.16	18.83
2019	harmless disposal(10ktons)	268.9	43.52	67.71	51.81	28.97	33.08	16.01	18.83
	Landfill	178.9	0	0	51.81	28.97	33.08	16.01	15.65
	Incineration	90	43.52	67.71	0	0	0	0	3.17
Total(10ktons)		270.71	44.56	70.38	52.23	29.05	33.21	15.96	18.96
2020	harmless disposal(10ktons)	270.71	44.56	70.38	52.23	29.05	33.21	15.96	18.96
	Landfill	140.21	0	0	52.23	29.05	33.21	15.96	13.62
	Incineration	130.5	44.56	70.38	0	0	0	0	5.34

3.1. Insufficient construction of relevant facilities

Henan Province lacks incineration power generation equipment and kitchen waste treatment facilities. Considering the principles of reduction, recycling, and harmlessness, many excellent characteristics of waste incineration power generation are more in line with the objective reality of land and energy shortages in modern society[18]. Kitchen waste accounts for a large proportion of domestic waste, and it is extremely harmful if handled carelessly. It is reported that most of the urban kitchen waste plants in Henan Province have not yet been built. On the whole, the resource utilization methods are relatively simple, the utilization rate is not high, and the level of resource utilization needs to be improved urgently.

3.2. Lack of garbage classification awareness for public

During the visit, many people pointed out that although some communities require garbage classification, there are still some people who do not classify. In the process of investigation and visit, directly disposing the unopened overdue milk were seen. People may not realize the significance of

garbage classification to the disposal and resource utilization of domestic garbage.

3.3. Insufficient classification infrastructure

Waste sorting infrastructure is the cornerstone of the implementation of the waste sorting policy. The implementation of the policy can be continuously adjusted, and the residents' awareness of waste sorting can be gradually cultivated. But if there was no infrastructure for waste sorting, it would be difficult to build the sufficient governance system for waste sorting.

3.4. Mixed collection transportation after successfully classification

In the process of investigation, it was found that the phenomenon of mixed collection and mixed transportation is serious. If the front-end garbage cannot be classified in detail, it will consume huge manpower and material resources for later sorting. Although the garbage has been classified in the early stage, the garbage is mixed and collected by the trucks as a whole in the later stage, which will greatly reduce the enthusiasm of garbage classification for residents.

4. Countermeasures and suggestions for harmless disposal and resource utilization of domestic waste

At present, Henan Province has a high level of harmless treatment, but the level of resource utilization is lower than expected. The strict garbage classification system is an important guarantee for garbage diversion and resource utilization. In order to better carry out the next step of the province's harmless disposal and resource utilization of domestic waste, the following countermeasures and suggestions are put forward in view of the common problems in the above research and analysis:

Strengthen the top-level design. The cities along the Yellow River should formulate detailed, practical and effective implementation plans for garbage classification according to their own conditions, and mobilize the coordination and linkage of various departments, so that the garbage classification policy can be effectively transmitted to all departments at all levels, and a comprehensive garbage classification system can be constructed. At the same time, it is also necessary to strengthen the governance capacity of the community, including strengthening the management capacity, organizational capacity and service capacity of the neighborhood committee to ensure that garbage classification is in place.

Strengthen publicity and education. Strengthen the role of the Internet in the process of garbage collection and transportation to build an "Internet +" garbage classification and recycling system, and promote the diversion of garbage sources. Utilize the dissemination power of online media, as well as waste classification posters, waste classification mini-programs, waste classification guidance animations and other measures to attract public interest and achieve efficient publicity of waste classification.

Strengthen infrastructure construction and introduce advanced resource utilization technology. Infrastructure construction is the key to the harmless disposal and resource utilization of waste. First of all, the construction of supporting facilities for waste sorting in the community should be accelerated. Secondly, in view of the current situation of low resource utilization of kitchen waste, the construction of a kitchen waste treatment plant should be accelerated, and a complete kitchen waste management, treatment and disposal system should be established.

Adjust the standard of domestic waste disposal fees and improve the treatment of employees. The basis used for the calculation of domestic waste disposal fees has not been changed for 10 years. It is necessary to improve the urban domestic waste classification and reduction incentive mechanism, actively promote the reform of urban domestic waste charging methods, and implement a differentiated charging policy for classified waste and mixed waste. Not classifying, throwing more and throwing less have the same drawbacks. For relevant practitioners, the labor insurance and welfare benefits should be improved, and they should be included in the management of early retirement for special types of worker.

5. Conclusions

There has a large amount of household garbage output, while, due to the complex composition, its

resource utilization is still very poor. Hence, governments and relevant departments should determine the resource utilization route and specific classification standard of the household garbage according to its composition. Relying on a complete resource utilization system of urban household garbage, the resource utilization strategy should be proposed from various aspects, to realize the effective recycling, treatment and resource utilization. And then, environmental pollution will be controlled, resources are effectively saved and core competitiveness of the city is improved. The realistic and urgent demand of realizing ecological protection and high quality development in the Yellow River Basin will be achieved.

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