Management Innovation of the Sorting and Treatment of the Public Hygiene Garbage under the Synergetic Governance-A Case Study of Zhengzhou

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Abstract. With the advent of the era of high-quality social development, people's living standards and consumption power are gradually improving. But there are also a series of problems such as waste. In this regard, if the government does not pay attention to and deal with it in time, it will cause the chaos of the life of the community residents and the stability of the community, and will also lead to social contradictions and social problems. When dealing with the problem of waste and garbage in communities, the government should formulate relevant policies of waste and garbage treatment in a timely manner, publicize relevant knowledge of waste and garbage treatment, and plan how to supervise and assess it in a timely manner. In addition, actively encouraging residents and third parties to participate in waste management is also an effective way to manage waste. In this regard, this paper puts forward the relevant concepts of waste management in Zhengzhou City, and puts forward specific suggestions such as clarifying the main responsibilities of multiple parties, combining various policy tools, improving the implementation and supervision mechanism, and cultivating a good external policy environment, so that all parties can fulfill their duties and responsibilities in waste management practice, form a strong joint force, and take the initiative to carry out waste management actions. Only in order to ensure the beautification of the urban environment, high quality and sustainable development of the society.

Keywords: Synergetic Governance; public hygiene; garbage sorting and treatment; management innovation

1 Introduction

With social progress and high-quality economic development, residents have higher requirements for a better living environment. However, the problem of urban waste is becoming more and more serious, which seriously affects urban residents' pursuit of high-quality and beautiful life. The Chinese government began to implement the pilot waste sorting policy in 2000, but because the implementation of the waste management

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policy is a complex systematic project, the waste sorting and waste management is still in the initial stage. Therefore, it is urgent to study the problem of waste management in Zhengzhou City. In terms of policy subjects, the burden of the government is heavy, and the participation of social forces is insufficient. At the same time, the public's participation in waste classification is insufficient, and there is a lack of detailed and specific normative guidelines. In addition, the implementation of waste management policies is not ideal. Only when all parties fulfill their duties and responsibilities in waste management practice, form a strong joint force, and take the initiative to carry out waste management actions, to ensure the beautification of the urban environment, and to promote the high-quality sustainable development of society.

2 Necessity analysis of the garbage treatment

2.1 Improve the quality of the Resident life

The level of urbanization has not only improved people's living standards, but the amount of solid waste generated is also increasing. An Hongyu (2022) believes that solid waste will cause certain pollution to water bodies, including surface water pollution, air pollution caused by industrial solid waste, and soil pollution caused by solid waste [1].

Data show that the amount of waste production increased from 136.5 million tons in 2002 to 242.0619 million tons in 2019, an increase of 77%, and the environmental pollution problem brought by this cannot be ignored, and the development of waste management is imperative.

2.2 Need for the sustainable development

The classification and treatment of domestic garbage is an important part of social public services and a quasi-public good. Solid waste management needs the cooperation and participation of the government, enterprises, non-governmental organizations and community residents, emphasizing the mutual cooperation of thevarious subjects. Li Huandi (2022) believes that the comprehensive treatment and comprehensive utilization of urban solid waste can effectively strengthen the protection of China's ecological environment and promote the sustainable development of China's social economy [2]. Classification and treatment of solid waste in Zhengzhou is of great significance to local sustainable development.

2.3 It lays a foundation for the green and low-carbon development of Zhengzhou City

Waste control work should be guided by the scientific concept of development, with the purpose of protecting public environmental health and residents' health and preventing and controlling environmental pollution. In Zhengzhou's garbage management, the government should play a leading role, attract the participation of diverse social forces,

adopt a comprehensive treatment technology route, strengthen targeted research and practice of garbage management, learn from advanced technology and equipment at home and abroad, and lay the foundation for the realization of green and low-carbon development of Zhengzhou.

2.4 Create a law enforcement environment for the garbage classification and treatment

Based on the advanced experience of raw waste classification and treatment at home and abroad, combined with the current situation of garbage treatment in Zhengzhou City, the relevant countermeasures and suggestions are put forward. In order to improve the effect of the implementation of garbage sorting and treatmentpolicy in Zhengzhou City, improve the garbage classification policy system, improve the execution of the main body of the implementation of garbage classification policy, improve the participation of residents in garbage classification and governance, improve the optimization combination in the process of policy implementation, and improve the law enforcement environment of garbage classification and governance.

3 Related research literature

3.1 Foreign research status of solid waste treatment

James D et al. (1994) argued that "the market mechanism has greatly promoted the classification and recycling of garbage, and household garbage disposal services should be evaluated and charged according to the quantity of waste, so as to encourage the recycling and utilization of domestic garbage" [3]. Kikuchi R et al pointed out that "neighborhood avoidance is the biggest obstacle in waste disposal projects and will cause the decline of government credibility. Therefore, modern waste management should fully consider the issue of social acceptance, while taking into account socio-economic, technical efficiency and other factors" [4]. Khetriwal D S (2009) et al emphasized that "enterprises, as producers of products, have extended responsibilities for the products they produce, and the success of a waste management system should be based on the clear responsibilities of the government, enterprises and the public" [5]. Hasegawa K (2006) believes that "non-profit environmental protection organizations have a huge influence in Japan, and should create opportunities for different factions to enhance mutual trust, and integrate the government, communities, social organizations, and the public into collaborative governance cooperation to achieve common goals" [6].

3.2 Domestic research status of the solid waste management

Zhang Liping and Zhang Zhonghua (2016) believe that domestic garbage classification is a social behavior based on individual behavior, and the problem faced by garbage source classification in China is essentially a collective action dilemma of residents. Residents seeking self-interests will not take actions to realize collective interests, and

there is a phenomenon of "free riding". Only through the organic combination of independent governance, selective incentive measures, full use of social capital and third-party enforcement can this problem be effectively solved [7]. Duan Jingjing (2021) proposed that the lack of public participation was an important reason for the difficulty in improving the effectiveness of solid waste management, and the state should enhance the level of public participation in solid waste management by encouraging and supporting laws [8]. Du Chunlin and Huang Taozhen (2019) pointed out that the government-led domestic waste classification model has institutional defects: The government overundertakes the management work of domestic waste classification, ignoring the status and role of the market and society as participants in the classification of domestic waste. Only by including the government, market and society in the macro system of garbage classification work, guiding multiple subjects to participate in garbage classification and promoting the coordinated development of all aspects of garbage classification. Only in this way can we effectively resolve the current management dilemma of domestic waste classification [9]. Dong Hongsheng (2023) believes that resource utilization of solid waste is mainly through resource classification to achieve solid waste energy recycling, reduce solid waste pollution, and reduce the destruction of ecological resources. Such resource utilization can create the economic value of solid waste and reduce energy consumption, thus improving the sustainability of natural resources and energy [10]. Zhou Qinwei (2018) pointed out that public participation is not only an important way to improve urban environmental governance, but also an important way to implement co-construction and sharing [11]. Ma Xueling et al. (2022) pointed out that the current publicity and promotion of urban solid waste classification and treatment in China is still in its initial stage, with limited participation of citizens and insufficient awareness of solid waste classification [12]. Zhao Chen et al. (2023) built a solid waste sorting center based on the actual situation to sort and collect solid waste, recycle recyclable solid waste, and reduce the harm caused by solid waste [13]. When Shi Dandan (2022) analyzed and studied the classification and treatment of domestic waste in Harbin, he pointed out that in the current classification and treatment of domestic waste in Harbin, the coordination effect among the management organizations was poor, which was mainly reflected in the deviation of responsibility positioning and the imbalance of political ecology [14].

3.3 Synergistic governance theory

The term synergistic governance first appeared in the 1990s. According to the documents of the United Nations, synergistic governance refers to "the process of using various formal and informal institutions to reconcile different stakeholders to take joint actions in the process of handling public affairs" [15]. According to Gao Ming et al., regional collaborative governance refers to "the process in which interdependent organizations influence and supervise each other on the basis of realizing their own interests, complement each other's advantages, promote the construction of regional integration, and realize coordinated regional development" [16]. Li Zhengsheng et al. believe that the collaborative treatment of water pollution should start from the aspects of management system, governance structure and policy tools, enhance the consensus

among stakeholders, establish unified and coordinated watershed management institutions, and improve the environmental performance evaluation system of local governments [17]. Shen Feiwei et al. (2016) believe that the theory of Synergetic Governance is a new theory constructed by previous scholars on the basis of critically absorbing and subjugating the theories of government regulation and market liberalism. Its core is to establish a diversified governance model to solve cross-regional and cross-departmental public problems, emphasizing the establishment of a common front by multiple subjects such as government, market and society. Work closely together to achieve a shared vision and take collective action to achieve the common good [18]. Yu Haishan (2019) believes that Synergetic Governance is a governance model in which decisions are made and responsibilities are shared on the basis of equitable distribution of power and resources [19]. Emerson et al believe that Synergetic Governance refers to the process in which many stakeholders make collective decisions and design systems to achieve common goals, formulate unified codes of conduct and realize common interests [20]. O'Leary R and other scholars believe that Synergetic Governance refers to the means and process by which the public sector, the private sector and citizen groups join together to make decisions and take joint actions. The basic subjects involve three parties: the government, the market and the society. In the process of dealing with complex public issues, more diverse subjects are involved [21]. Wang Dianli (2015) believes that in the process of environmental governance, the supervision of various environmental pollution involves multi-regions, multi-departments and multi-entities [22]. Guo Chengzhan (2023) believes that the comprehensive benefits of economy, ecology and society can be enhanced by strengthening the synergistic utilization of various solid wastes, cross-industry technology application and mutual collaboration among industrial chains [23]. Jing Nghe Jia (2014) and other scholars pointed out that power sharing is the first essence of Synergetic Governance. True Synergetic Governance requires all participants to voluntarily and fully express their will and take equal actions, and the government is only a participant [24]. Wang Weiquan (2014) believes that multi-dimensional cooperation between various departments within the government, the government and multiple subjects of society is needed in cross-domain environmental governance [25]. It can be seen that Synergetic Governance includes not only the cooperation at all levels of government, but also the cooperation between regional governments and the cooperation between the government and the diverse subjects of society.

4 Analysis of the main body behavior of the waste and garbage sorting and treatment

For the actors of waste management, it should include policy makers, policy implementers, residents and related enterprises. Only by tripartite collaboration can it be possible to properly manage community waste. See Figure 1.

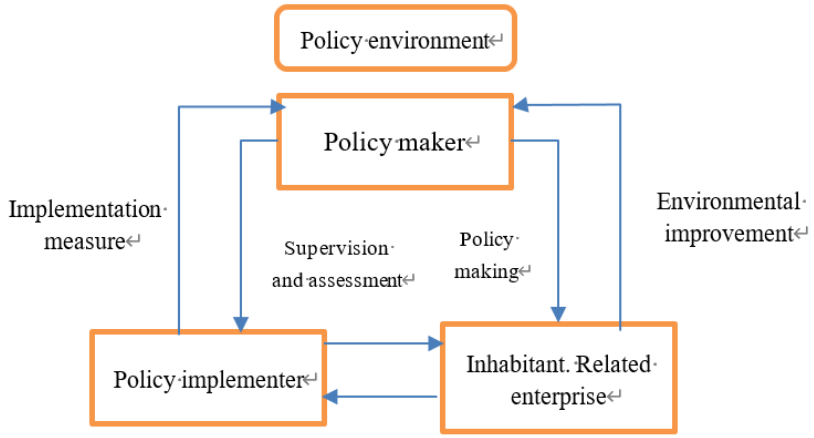

Fig. 1. Community waste. The tripartite cooperative relationship is shown

4.1 Behavior analysis of the policy makers

The policy maker is the government to formulate laws and regulations and related management systems according to environmental protection needs. Scientific and reasonable policies can effectively alleviate the resistance in the process of policy implementation, have strong implementation, and promote good progress in waste classification. Taking Zhengzhou City as an example, its waste classification policy is more general, the policy lacks pertinency, some provisions are vague, and the setting of policy objectives is also eager to achieve, lack of rationality.

4.2 Behavior analysis of the policy implementers

Policy implementers refer to the government environmental protection management department, which is the implementers of the waste classification management policy. In the stage of policy implementation, there are differences in the intensity, coverage and continuity of policy implementation in different cities. Although some places have carried out waste classification work, due to the imperfect supervision and management mechanism, some policies and measures cannot play the expected role of governance and punishment, and waste source classification and treatment have failed to achieve the expected effect.

4.3 The Behavior analysis of residents and related enterprises

Residents and enterprises are the target groups of the implementation of the waste classification policy, and are also the influencers of environmental protection policies, and will also give suggestions and feedback to the formulation and implementation of

the policy. Some residents and enterprises have gradually changed to pro-environment characteristics under the guidance of reasonable policies and the implementation of the whole process for a long time.

4.4 Analysis of the mutual influence of behaviors among various subjects

Based on the above analysis, in the waste classification and waste management, policy makers play a driving and regulatory role, formulate capital, manpower, material distribution plans, determine the classification standards and implementation rules; Policy implemutors are mainly responsible for the implementation of the program, effective and timely guidance and management of residents, including rewards and fines; Residents and enterprises should respond to the call and cooperate with policy makers and executors to participate in waste classification. The active participation and positive interaction of several parties can form a stable waste classification situation. The choice of a negative strategy by one of the parties will have a negative impact on the other two, which is not conducive to the promotion of waste classification and the formation of a long-term mechanism.

5 The current situation and the existing problems of the waste and garbage sorting and treatment in Zhengzhou City

5.1 To Analysis the Current Situation

5.1.1 To survey the satisfaction about the waste and Garbage Treatment

In order to realize the satisfaction of waste disposal in Zhengzhou City, we selected a total of 500 people for investigating, and the satisfaction of residents is not high on the current garbage disposal methods.

In the survey, people's satisfaction with the current garbage disposal methods in Zhengzhou City, the proportion of the choice of "general" is the largest, accounting for more than 67.50%, "very satisfied" accounted for more than 12.50%, there are also dissatisfied situations, up to more than 20%, which shows that Zhengzhou City's current garbage disposal method satisfaction needs to be improved. See Figure 2

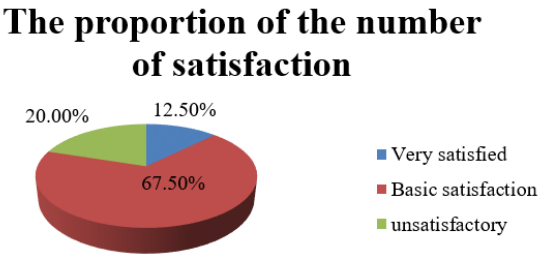

Fig. 2. Satisfaction survey on garbage disposal methods

5.1.2 To survey on the awareness of the garbage classification

In this survey, we asked questions about the number of waste incinerators in Zhengzhou City, and gave out a total of 500 points. Among people's understanding of garbage classification knowledge, "general" accounts for the largest proportion, reaching 73.60%; "Don't know" followed closely at 14.00%; "Very understanding" accounted for the least, 12.40%, which indicates that the publicity and education of garbage classification knowledge are not enough, and it is necessary to further promote the education of garbage classification knowledge for all. See Figure 3

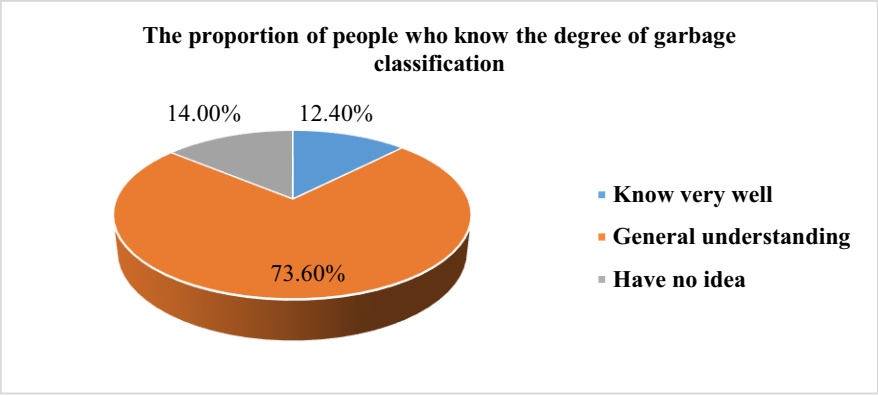

Fig. 3. Number of people with knowledge of garbage classification

5.1.3 Investigation on the impact of the improper waste disposal

In the investigation of the impact of improper waste disposal, a total of 500 points were issued to the multi-option question survey. It is found that most respondents care about and understand this. The survey results are shown in Table 1 below:

Table 1. Survey of the effects of improper waste disposal

Serial number	Matters of influence	Options	Percentage of events %
1	Polluting the air	415	83
2	Contaminating nearby water sources	375	75
3	Contaminating the soil	320	64
4	Damage to human health	385	77
5	Affecting one's mood	150	30
6	Make no difference	86	17.2

5.2 The Problems of the waste and garbage sorting and treatment in Zhengzhou City

5.2.1 Insufficient investment in infrastructure funds

In the investigation, we found that Zhengzhou City's infrastructure investment is insufficient. Waste incineration treatment sites are few and the distribution distance is unreasonable. As far as we know, there are three waste incineration power plants in Zhengzhou, including county-level areas, of which there is only one in the main urban area, which is not conducive to the realization of efficient waste disposal.

5.2.2 Inadequate supervision and regulation of waste and garbage management.

There are many self-employed households in Zhengzhou City, and there will be too much waste and garbage in the operation process, which is not sorted and not cleaned up, resulting in street waste and garbage on the ground, causing street congestion to a certain extent, affecting the environment and traffic. In addition, the management of sanitation agencies is not enough, there is slack in work, and the supervision of urban or rural sanitation work is not in place.

5.2.3 The government does not publicize enough knowledge about waste sortinge.

In the investigation of the respondents' understanding of waste classification knowledge, we found that a large proportion of people do not have a deep understanding of waste classification knowledge. When the relevant government departments carry out publicity, most of them will only stay in the urban population, and for some areas such as rural areas, the publicity of waste classification knowledge will be reduced, resulting in the unbalanced and inadequate absorption of waste classification knowledge by residents.

5.2.4 Waste sorting is not sufficiently detailed.

At present, most waste is classified into two subdivisions: recyclable and non-recyclable, but for most people, when they throw waste, they do not pay attention to where to throw, which is related to their unclear concept of recyclable and non-recyclable. This phenomenon will also appear in many cities, and it is necessary to further subdivide the waste classification.

5.2.5 Residents have low awareness of garbage classification.

In the survey, the respondents do not have a deep understanding of the knowledge of waste classification, which is also the key to solving the problem of waste classification in our country. It is necessary to increase the national knowledge reserve of waste classification. At the same time, residents lack a certain understanding of the implementation of waste disposal measures by relevant government departments. As shown in Figure 3.

6 Experience and enlightenment of world waste management

6.1 World waste classification

At present, the world's waste classification treatment is the same, there are three main categories: no classification, simple classification, fine classification. It can be seen from the table that the countries with relatively perfect garbage classification are Japan, Germany, Finland, Denmark, Sweden and so on. See Table 2

Table 2. Garbage classification in some countries

Classification situation	Fact sheet	State representative
No classification	Mixed discharge of domestic waste, Confusion of management	India, Ukraine, Kazakhstan, Pakistan, Nigeria, etc
Simple classification	Divide household waste into two or three categories for disposal	China, USA, Brazil, New Zealand, Australia, etc
Fine classification	The classification of domestic waste is more detailed, precision management	Japan, Germany, Finland, Denmark, Sweden, etc

source from: The author collated according to relevant data

6.2 The way of solid waste disposal

6.2.1 Germany: Pay attention to waste reusing and improving the waste disposal system

At present, Germany attaches great importance to the recycling of garbage and realizes the recycling of garbage. Although most of Germany's waste is recycled, much is disposed of in landfills, and the rest is incinerated to generate electricity. According to relevant data, Germany produces more than 60 million tons of waste every year, of which 35 million tons are recycled, 10 million tons are incinerated, and the other 15 million tons are landfilled, with recycling, incineration and landfilling accounting for 57%, 18% and 25% respectively[26]. In recent years, Germany has adopted a series of measures to strengthen the environmental protection and effective disposal of waste. Since the mid-1980s, the management concept of waste disposal in Germany has been established as "reduction, recycling and reuse". In the mid-1990s, Germany began to implement the Closed Circulation and Waste Management Act. By 2005, Germany was treating waste more efficiently and recycling more efficiently.

6.2.2 Japan: To incineration, to establish the strict disposal system of the garbage

As we all know, Japan covers an extremely small area, but it does not affect Japan's efficient waste disposal, adhere to the concept of environmental protection, has been insisting on reducing waste through landfills, and clearly put forward the "3R" principle, that is, reduction control (reduce), recycling (reuse) and recycling (recycle). At present, nearly 80% of the domestic waste produced in Japan is treated by incineration,

about 5% of the domestic waste can be recycled, and the remaining 15% is landfill[26]. In Japan, in order to realize garbage recycling, almost every household has a garbage collection schedule posted on the wall, so that various kinds of garbage can be sorted and recycled. First of all, domestic waste can be divided into combustible, non-combustible, large waste, other types of waste and electronic waste, classified level by level, and then divided into small categories below the big category. After all kinds of garbage are transported to the garbage disposal station, they will go through very strict classification and finally be transported to the terminal garbage treatment plant.

6.2.3 United States: Transfering the domestic waste, to achieve recycling

All along, domestic waste in the United States has been run through a business model to realize the recycling and reproduction process of waste, that is, a strict recycling system for the collection, recycling, treatment, processing, and finally sales of domestic waste. At present, there are three main ways to dispose of household waste in the United States: recycling, incineration and landfilling. Recycling accounts for 30 percent, incineration for 14 percent, and landfill for 56 percent. Compared with other countries, landfill treatment of domestic waste in the United States is still the largest method of disposal. However, compared with the past, its general trend has declined[26]. At present, incineration is still an important means of disposal of domestic waste in the United States.

6.3 Inspiration from foreign waste disposal experience

The reason why foreign countries can efficiently deal with all kinds of waste garbage and realize the transformation of waste into treasure, behind which we need to learn something. The first is to establish a reasonable waste disposal system; The second is the protection and support of the government and relevant laws and regulations; Finally, we must have a sound management system and experience.

We need to learn from this: relevant government departments and the people to take joint action, actively participate in it, and cooperate with each other, in order to receive the expected effect.

7 Waste disposal methods and related suggestions in Zhengzhou City

7.1 Waste disposal method

At present, the treatment of solid waste in most cities in China is mainly open landfill, which not only has a small amount of solid waste, but also has a low degree of resource utilization, and also causes pollution to soil, water and atmosphere. Under such circumstances, the main treatment technologies suitable for solid waste in Zhengzhou include incineration, landfill, thermal decomposition, lime solidification, etc[27]. After

the waste is sorted, it is processed according to different garbage. Waste disposal methods are shown in Table 3

Table 3. Application scope, advantages and disadvantages of main solid waste treatment technologies.

Processing technology	Scope of use	advantage	shortcoming
incineration	Industrial solid waste that cannot recover its useful components and has a certain calorific value	Reduce solid waste volume by 80%~95%; Burning generates a lot of heat	Produce secondary pollution; Need to set up purification device
landfill	Sanitary landfill is suitable for general industrial solid waste; Safe landfill is suitable for hazardous industrial solid waste	Large processing capacity, strong adaptability, low operating costs	The pollution lasts for a long time, the land area is large, and the site selection of landfill is difficult
Thermal decomposition	Organic waste residues, waste plastics, rubber products, waste oil, sludge, etc	Good for energy recovery, less smoke, less fly ash	The pyrolysis efficiency is poor, the cost is high, and the catalyst accumulates carbon
lime solidification;	Waste acids, oxides, heavy metals, etc	Wide source of raw materials, low cost, simple operation	The curing time of the cured body is long and the volume is expanded

source from: The author collated according to relevant data

7.2 Countermeasures and Suggestions

7.2.1 To establish and improve the rules and regulations

First, establish a sound waste management system. Detailed relevant processes and job responsibilities, clear authority, responsibility to the person. Promote the classification of waste and improve the reuse rate of solid waste resources. The second is to establish a solid waste treatment research and development system. Deng Chanjuan (2020) believes that the state should give strong support to relevant technical research, provide financial support to relevant research units, and accelerate the research on the treatment methods of hazardous waste with low pollution and high efficiency [28]. Third, we will improve the reward and punishment system. Improve the enthusiasm of employees, implement waste management into practice, and advocate waste reuse.

7.2.2 Increase publicity efforts for garbage classification and treatment

Garbage classification and treatment With the help of environmental protection publicity platforms and channels, innovative publicity methods, in addition to establishing fixed signs and warnings, but also use new media and other ways to carry out publicity, encourage the people to participate in environmental protection and solid waste treatment, improve the efficiency of urban solid waste treatment. In addition, enterprises are encouraged to reduce solid waste emis-

sions, promote the recycling of waste waste, and promote the sustainability of urban green environmental protection.

7.2.3 Properly classify and comprehensively utilize solid waste

After the centralized discharge of a large number of solid wastes, we must first strictly do a good job of classification and collection. Sorting and recycling can improve the amount of industrial solid waste treatment, solid waste has a variety of ways to reuse, extract valuable components. Classification recycling not only regenerates solid waste, but also protects the ecological environment [29].

7.2.4 Implement flat management of the environmental protection industry

Strengthen the construction of the environmental protection industry's industrial solid waste management information center, simplify the environmental protection approval process, implement flat management, and establish and improve the emergency and early warning mechanism for industrial solid waste. Introduce a third-party evaluation mechanism, and evaluate the comprehensive utilization of industrial solid waste according to the detailed rules issued by government departments to improve the efficiency of solid waste treatment.

7.2.5 To Establish a sound and complete system for Garbage collection, transportation, storage, and management

Recycling directly reduces carbon emissions, resulting in fewer emissions than remanufacturing and landfilling. Actively introduce social funds, explore market-oriented operation channels for garbage collection and transportation, and improve and optimize the mode of large garbage collection and transportation. Data show that compared with traditional fuels, the use of new energy electric transport vehicles can effectively reduce carbon emissions by 28% [30].

8 Conclusion

First of all, the classification and treatment of solid waste in Zhengzhou City is conducive to the protection of the ecological environment and promote the sustainable and high-quality development of China's social economy.

Secondly, collaboration is an effective way to classify and manage solid waste. The government, regulatory authorities, residents and enterprises should pay more attention to the status quo of hazardous waste treatment. Only the participation of the government, management departments, residents and enterprises can form a strong joint force and achieve remarkable results.

Finally, improve the reuse of waste to achieve sustainable development of resources. In the long run, waste treatment and its comprehensive utilization is an inevitable development trend, which can achieve the maximum of social economy.

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