

Research on the Status Quo and Countermeasures of Resident Waste Classification in Hefei City

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ABSTRACT

With the acceleration of economic development and urbanisation, the amount of waste in cities around the world has surged, and Hefei City is also facing pressure on waste management. Between 2018 and 2024, Hefei City has achieved remarkable results by promoting the policy of residential waste classification through three phases, including policy initiation, deepening promotion and consolidation and optimisation. However, there are still problems such as low awareness of residents' classification, insufficient facilities, outdated technology and ineffective supervision. For this reason, it is recommended to strengthen publicity and education, improve facilities, enhance technology, strengthen supervision and promote multi-party co-operation. By optimising the measures, it will promote the in-depth development of waste classification and management in Hefei, improve resource utilisation and promote the development of the circular economy.

KEYWORDS

Resident waste classification; Status Quo; Countermeasures.

1. BACKGROUND

With rapid economic development, population growth and accelerated urbanisation, there has been a surge in the volume of municipal waste globally, which is estimated to be around 2 billion tonnes per annum, placing enormous pressure on municipal solid waste management systems[1]. The United Nations predicts that by 2050, 68 per cent of the world's population will live in cities, exacerbating this pressure. Resource consumption and waste generation are particularly significant in developing countries due to rising living standards[2]. The Global Solid Waste Management Outlook report points to this trend. The increase in volume and complexity of resident waste, a major component of municipal solid waste, poses new challenges to management systems and requires proper management and disposal to safeguard the human environment and the health of the population[3].

The '3R' strategy (Reduce, Reuse, Recycle) is seen as an effective way to address this environmental issue, with source separation of waste being crucial for recycling. Hefei, as the capital of Anhui Province, has a population of 9.853 million, and the average growth rate of municipal resident waste production between 2011 and 2023 is 11.15%, increasing from 778,200 tonnes to 3.1725 million tonnes[4]. Therefore, the study of Hefei city residents' living waste classification has theoretical value and practical significance, which helps to crack the urban waste siege dilemma, realise the organic linkage of the whole chain of waste classification and governance, and promote the realisation of the Sustainable Development Goals (SDGs)[5]. The United Nations Sustainable Development Goals (SDGs), which aim to comprehensively solve social, economic and environmental problems and shift

to the path of sustainable development between 2015 and 2030, provide macro-guidance for the work of waste classification in Hefei City.

2. THE DEVELOPMENT OF SEPARATION AND MANAGEMENT OF DOMESTIC WASTE IN HEFEI CITY

As one of the 46 pilot cities for waste classification in the country, Hefei City responded to the call of the Party Central Committee and the State Council in March 2018 by issuing the ‘Implementation Plan for the Classification of resident Waste in Hefei City’, and selecting nine demonstration areas to promote the work.

2.1. Policy initiation and preliminary implementation stage (2018-2020)

Hefei City actively responded to the national waste classification policy, incorporated waste classification into the city's development agenda, and formulated a series of plans and implementation programmes to lay a solid foundation. At the same time, waste classification drop-off facilities are set up in residential neighbourhoods, commercial districts and other public places to guide citizens to develop good habits. Through this series of initiatives, Hefei City has gradually built up a scientific, reasonable and efficient waste classification system, injecting new vitality into the city's sustainable development.

2.2. Policy Deepening and Comprehensive Promotion (2021-2022)

On 1 March 2021, the Implementing Rules of Hefei Municipal resident Waste Classification Management Regulations came into force, which is an important symbol of Hefei City's waste classification work entering a new stage. The Implementing Rules stipulate in detail the classification standards, placement requirements, collection, transport and treatment of resident waste, providing scientific and operable guidance for waste classification work. Among them, the implementation of the ‘four classifications’ standard, i.e., resident waste is divided into four categories: recyclables, hazardous waste, food waste and other waste, which is not only in line with the unified requirements of the country, but also takes into full consideration of the actual situation in Hefei City, ensuring that the classification standard is reasonable and practical.

In order to ensure the smooth promotion of waste classification, Hefei City has made clear provisions on staffing. In the early period of mandatory waste classification into the track, the streets (townships, towns) should be configured at least 3 supervisors responsible for the classification of living waste supervisory work; community (grid) at least 1 configuration of living waste classification of the special supervisor; the district is configured according to each 300 ~ 500 households instructors and volunteers 2, instructors need to be professionally trained and then take up their duties. This staffing programme forms a complete waste classification workforce. After professional training, these personnel are not only responsible for supervising and guiding the work of waste classification, but also actively participate in the publicity and promotion of waste classification, which effectively improves the public's understanding of and participation in the work of waste classification.

In terms of facility configuration, Hefei City will set up classification collection points in unenclosed neighbourhoods as well as in open places such as shops along streets, back alleys and rural areas, and explore methodological measures such as door-to-door collection. At the same time, the community living waste classification collection facilities are also set up to give full consideration to the residence, service radius, the daily output of waste and other factors, as well as high-rise, multi-storey, villas and other different situations. In principle, a separate collection facility is set up for every 300 to 500 households, usually between buildings, taking into account the wind direction, but also in a reasonable location, so that it is easy to put out and facilitate collection and transportation. In addition, it is encouraged to adopt the form of closed clean house to set up a centralised drop-off point for the

classification of household waste in the district, and the drop-off point should be constructed as a closed frame structure waste room, the exterior design should be compatible with the existing architectural style of the district, adapted to the local conditions, with an area of about 10 to 30 square metres[6].

In terms of waste collection and transport, Hefei City has implemented classified collection and transport. Urban catering services, units for meals produced by the municipal bidding enterprise door-to-door collection, the implementation of bus transport mode; family food waste, other food waste and other waste by the district level is responsible for the front end of the classification of the collection and transported to the transfer station transit or directly to the terminal treatment plant for disposal, the municipal level is responsible for the transfer station to the end of the treatment plant of the waste classification and transportation work. This separate collection and transport system not only ensures the effective separation and treatment of various types of waste, but also improves the efficiency and quality of waste disposal.

In terms of waste disposal, Hefei City is pushing forward the construction of facilities such as food waste treatment projects and waste incineration power generation projects to meet the growing demand for waste disposal. At the same time, counties (municipalities) and development zones are also exploring renovation and bulky waste recycling modes in conjunction with the actual situation, and constructing renovation and bulky waste treatment plants to meet the disposal needs of their jurisdictions. This initiative not only helps to reduce the amount of waste going to landfill and increase the utilisation rate of waste resources, but also promotes the development of a circular economy.

In addition to the configuration of hardware facilities and the formulation of policies, Hefei City has also carried out simultaneous work on the configuration of waste classification facilities and the creation of an atmosphere. It has gradually set up centralised drop-off stations for household waste and equipped them with waste classification instructors and volunteers to strengthen bucket-side guarding and supervision and guidance. Through organising waste classification publicity activities and distributing publicity materials, the public's awareness of and participation in waste classification work has been raised.

At the provincial level, the General Office of the People's Government of Anhui Province also issued an implementation programme on further promoting the work of resident waste classification, requiring all parts of the province to accelerate the construction of classification facilities, strengthen the management of the whole chain, and promote the participation of all people. The introduction of this provincial policy has provided Hefei with more powerful support and protection for waste classification work.

In terms of implementation results, Hefei City has achieved remarkable results in waste classification. The system of waste classification, collection, transport and treatment is getting better and better, the public's awareness of and participation in waste classification is increasing, and the accuracy and coverage of waste classification is continuously improving. These results can not be achieved without policy support and active participation of the public, but also the joint efforts and collaboration of governments and departments at all levels. In the future, Hefei City will continue to deepen the work of waste classification, constantly improve the waste classification policy and facilities configuration, increase the awareness and participation of the public in waste classification, and contribute more to the sustainable development of the city.

2.3. Policy Consolidation and Continuous Optimisation (2023-2024)

During the period from 2023 to 2024, Hefei City continues to increase the construction and investment in waste classification facilities. By the end of 2023, the city had built 4,814 high-standard timed and fixed-point centralised drop-off stations in residential areas, 14 resident waste classification transfer stations, and 648 classification vehicles. The construction and investment of these facilities have provided citizens with more convenient and efficient waste classification services. In addition,

Hefei City also actively promotes the intelligent upgrading of waste classification facilities, improving the efficiency and accuracy of waste classification through the introduction of intelligent recycling equipment and other means.

To raise public awareness of and participation in waste classification, Hefei City will continue to strengthen its publicity and guidance work during the period from 2023 to 2024. The importance and methods of waste separation have been popularised through the organisation of waste separation publicity activities, distribution of publicity materials and lectures on waste separation. In particular, during the period from 22 to 28 May 2024, Hefei successfully held the Second National Urban Living Waste Classification Publicity Week. During the event, Hefei City fully launched the ‘Garbage Classification in Ten Thousand Homes’ and other thematic activities, including Garbage Classification in Ten Thousand Homes, Classification Microclassroom, Classroom Classroom Classroom, etc., which further promoted the popularisation of waste classification knowledge and the enhancement of citizens' participation.

In the process of waste classification and management, Hefei City focuses on promoting the resourceful use of waste. Through the construction of a recycling system for renewable resources and the promotion of recycling of waste materials and other measures, the recycling rate and the level of resourcefulness of waste have been improved. According to the Hefei Waste Material Recycling System Construction Implementation Plan, by 2025, Hefei City will have accumulated 2,000 regulated recycling outlets (including intelligent recycling equipment), 16 transfer stations and 4 comprehensive sorting centres, and will achieve the goal of 100% coverage of recycling outlets in urban areas and 70% coverage of recycling outlets in rural areas.

Hefei City continues to explore innovative governance models in the process of waste classification and governance. For example, through the introduction of social capital to participate in the recycling of waste materials, the promotion of the ‘Internet + recycling’ model and other means to improve the efficiency and effectiveness of waste classification governance. In addition, Hefei City also actively promotes the in-depth integration of waste classification with community governance, urban management and other fields, forming a good situation of multi-dimensional common governance and collaborative promotion[7].

Hefei's resident waste classification policies from 2018 to 2024 have gone through three stages: initiation and initial implementation, deepening and comprehensive promotion, and consolidation and continuous optimisation. With the promotion of these policies, Hefei City has achieved remarkable results in waste classification, providing a more livable living environment for the public.

3. PROBLEMS OF RESIDENT WASTE CLASSIFICATION IN HEFEI CITY

Although Hefei City has made some progress in the management of resident waste classification, there are still some problems, and these problems and their causes can be summarised as follows:

3.1. Low awareness of waste classification

Residents do not know enough about the importance of waste classification, and their willingness and enthusiasm for classification are not high. In their daily life, many residents still put all kinds of waste together, which seriously hinders the smooth implementation of waste classification and treatment.

3.2. Inadequate waste classification facilities

Garbage classification bins are not reasonably set up, with unclear classification markings and confusing colours, and are not marked for use in accordance with the unified national standards. In addition, some communities have not yet improved their waste classification management systems

and lack effective publicity and guidance measures, resulting in insufficient awareness and participation of residents in waste classification.

3.3. Upgrading rubbish sorting and treatment technology

The improvement of rubbish classification treatment technology is an important guarantee for rubbish classification work. Hefei City should encourage and support the research and development and application of rubbish classification treatment technologies, especially efficient treatment technologies for food waste and hazardous waste. At the same time, it should accelerate the construction and upgrading of waste classification and treatment facilities, such as food waste resource utilisation facilities and hazardous waste safe disposal facilities, so as to improve the efficiency and effectiveness of waste treatment. In addition, recycling will be promoted, and the development of the waste recovery and recycling industry will be encouraged and supported, so as to increase the resource utilisation rate of waste.

3.4. Inadequate regulation and law enforcement

The penalties for waste classification violations are weak, and an effective waste classification governance mechanism has not been formed. Government departments face practical difficulties in the implementation of waste classification, such as inadequate regulation and law enforcement, and unstrict penalties[8].

4. COUNTERMEASURES AND SUGGESTIONS FOR OPTIMISING THE CLASSIFICATION AND MANAGEMENT OF RESIDENT WASTE IN HEFEI CITY

With the acceleration of urbanisation, the amount of resident waste generated in Hefei City has increased year by year, and waste classification and management has become an important issue in urban environmental governance. However, at present, Hefei City still faces many challenges in waste classification governance, such as residents' weak awareness of classification, imperfect classification facilities, lagging treatment technology, and inadequate supervision and enforcement. In view of these problems, this paper puts forward the following optimisation countermeasures and suggestions, with a view to promoting the in-depth development of waste classification governance in Hefei City.

4.1. Strengthen publicity, education and public participation

Popularising knowledge of waste classification is the key to raising residents' awareness of classification. Hefei City should make full use of TV, radio, internet, community announcements and other channels to widely publicise the importance of waste classification and specific classification methods to ensure that the information covers every resident. At the same time, by organising practical activities such as lectures, workshops and community activities on the theme of waste classification, residents can experience the process of waste classification first-hand and enhance their practical skills. In addition, a waste classification point system has been established, whereby residents can earn points for correctly classifying waste, which can be used for exchanging daily necessities or participating in community activities, thus stimulating residents' motivation to participate in waste classification.

4.2. Improve waste classification facilities and labelling

Uniform classification standards are the basis of waste classification. Hefei City should follow the national waste classification standard strictly, and set up four types of bins for recyclables, hazardous waste, wet waste (food waste), and dry waste, with clear labelling, so as to avoid confusion among

residents due to unclear classification standards. At the same time, the layout of facilities is optimised, with additional waste separation drop-off points set up in densely populated areas such as communities, schools and commercial districts, to ensure that the distribution of facilities is reasonable and convenient for residents to drop off their waste. In addition, the quality of facilities should be upgraded by adopting durable and easy-to-clean bins, and regular maintenance should be carried out to keep the facilities clean and tidy and improve the efficiency of their use[9].

4.3. Upgrading waste separation and treatment technology

The improvement of waste classification treatment technology is an important guarantee for waste classification work. Hefei City should encourage and support the research and development and application of waste classification treatment technologies, especially efficient treatment technologies for food waste and hazardous waste. At the same time, it should accelerate the construction and upgrading of waste classification and treatment facilities, such as food waste resource utilisation facilities and hazardous waste safe disposal facilities, so as to improve the efficiency and effectiveness of waste treatment. In addition, recycling will be promoted, and the development of the waste recovery and recycling industry will be encouraged and supported, so as to increase the resource utilisation rate of waste[10].

4.4. Strengthening Regulation and Law Enforcement

Effective supervision and law enforcement is the key to the smooth promotion of waste classification. Hefei City should formulate and improve the laws and regulations related to waste classification, and make clear the responsible subjects and penalties for waste classification, so as to provide legal protection for the work of waste classification. At the same time, the establishment of waste classification supervision system, strengthen the supervision of waste classification of all aspects of the placement, collection, transport, treatment, to ensure that the work of waste classification is carried out in an orderly manner. Violations of waste classification regulations should be severely punished according to the law to form an effective deterrent.

4.5. Promote multi-party co-operation and shared construction

Waste classification requires the participation of the government, enterprises, communities and other parties. Hefei City should play the leading role of the government in formulating waste classification policies and providing financial support to promote the smooth implementation of waste classification. At the same time, enterprises are encouraged to participate in waste classification work, such as providing waste classification services and technical support, so as to achieve a win-win situation between enterprises and the society. In addition, play the important role of the community in the work of waste classification, establish community waste classification self-governing organisations, guide residents to actively participate in the work of waste classification, and form a good atmosphere of common construction and sharing.

5. CONCLUSION

In summary, the optimised countermeasures and suggestions for the governance of resident waste classification in Hefei City involve a number of aspects, such as publicity and education, improvement of facilities, technological upgrading, supervision and law enforcement, as well as multi-party cooperation. Only by comprehensively strengthening these aspects can we promote the in-depth development of waste classification and governance in Hefei City and achieve the sustainable improvement of the urban environment. To sum up, optimising the classification and management of resident waste in Hefei requires the joint efforts and collaboration of the government, enterprises, communities and residents. Through measures such as strengthening publicity and

education, improving facilities, upgrading technology, strengthening supervision and promoting co-operation, it is possible to promote the continuous improvement and upgrading of resident waste classification and governance in Hefei. All manuscripts must be in English, also the table and figure texts, otherwise, we cannot publish your paper.

CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest.

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