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Abstract: To understand the collection, transportation, disposal, management and supervision, and other processes involved in the handling of food waste in small urban areas, a survey of food waste handling in many small urban areas in Henan province was conducted. Questionnaires, random interviews, communications with catering industry personnel, transportation of individual household food waste and other measures were adopted to collect the data, and several suggestions were made for the improvement of food waste handling processes.

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1. Introduction

Food waste is a generic term for remnants of food (not to be confused with garbage) produced from, for example, households, hotels, and restaurants. Food waste has characteristics of high moisture content, organic matter, fat and salt content. It is perishable and rich in nutrients. Due to food waste's high moisture content, it does not meet the requirements of waste incineration; due to its decomposition, it is not fit to be directly disposed by landfills because it can cause pollution to groundwater and the surrounding environment. Meanwhile, pig slop and gutter oil are examples of products derived from food waste, which could seriously endanger human health by re-entering the food cycle. Food waste that is directly discharged into the sewer system significantly impacts city life and leads to other issues. Therefore, food waste processing is gaining attention, and numerous city managers, experts, and scientists have been working on new and refined processes, technologies, and methods for food waste treatment^{[1][2][3]}.

2. Methods

The survey focused on multiple small urban areas in the Henan province; the researchers designed

individualized questionnaires for the green department, restaurant owners, the garbage cleanup crew and the community conducting field research about environmental protection. Department heads, restaurant employees, food waste collection and transportation workers, and the general citizens filled in more than 200 copies of the questionnaire. Data were collected from investigators who interviewed local environmental protection department heads and sanitation workers; general citizens were also randomly interviewed. Fieldwork was conducted according to the regulations and policies established by each region. Specific measurements included public perception, the generation of food waste for each restaurant, the collection, transportation, and processing of food waste, and other parameters. Qualitative and quantitative analysis (mainly qualitative analysis), comparative analysis, comprehensive analysis, and the scientific method were utilized in the consolidation and analysis of the obtained data. Practical recommendations were made regarding policy development, food waste generation, and the current methods of handling food waste, and existing problems were statistically analyzed^{[4][5]}.

Table 1. Main responsibilities or roles of various research objects in food waste processing

Research object	Main Content
Green department heads	Take the main processing measures; urge the regulations and policies to implement
Restaurant owners	Food waste's production and collection
Garbage cleanup crew	Food waste's collection, transportation and process
General citizens	Citizen's consciousness, view

3. Results and problems

Through analysis of the questionnaire, we found that all levels of the Henan provincial government have introduced several major policy measures for the management of food waste treatment and invested partial funds for scientific research, which have played a positive role in food waste treatment. At the same time, a number of problems remain and are outlined below.

3.1 Lack of specialized food waste handling equipment

Currently, almost all restaurant food waste is collected and stored directly in kitchen rubbish bins, which are unsealed and placed in an unsanitary location. This storage causes the breeding and attraction of mosquitoes, flies, rats, cockroaches, and other pests, resulting in the direct deterioration of the immediate environment and affecting the diet and health of the population. Moreover, the refuse collection and transportation vehicles are mostly unsealed agricultural tricycles or small vans, which can easily leak food waste, thereby impacting the appearance of the city, delaying traffic, and causing considerable harm to the environment^{[6][7]}.

3.2 Common simple handling methods

The first method: households, several small restaurants, and mobile food carts pour the liquid portion of the food waste directly into the sewer drains or on the curb, which eventually leaks into the sewage treatment systems; due to the high COD, BOD₅ content of the liquid waste, the burden on the city's sewage treatment plant is increased. The remaining food waste and ordinary rubbish are mixed into the district general public rubbish bin by household, and community health staff are responsible for the transportation and cleanup; small restaurant and food cart waste flows into the public food rubbish bins or rubbish stations, which are later emptied by sanitation workers, eventually being mixed with other refuse after being transported to the landfill. The impact on the landfill and surrounding area is enormous; due to the high organic content of the food waste, it decays, seriously polluting ground and surface water and forming a breeding ground for microorganisms^{[3][8][9][10]}.

The second method: several hotels and restaurants, including institutions, enterprises, and school canteens, produce more food waste that is commonly placed in kitchen rubbish bins. The waste management is then carried out by the individual institutions, which often contact suburban farmers or food waste traders (they provide organic-rich, fat, and other nutrients from food waste to the farmers in

nearby areas who can save on farming costs). This food waste, which may not have been handled in a sanitary manner, is collected directly for pigs (pig slop), which then becomes a relevant risk in the transmission of disease. Even unscrupulous traders motivated by profit will collect and process waste cooking oil into low-quality refined oil (i.e., "gutter oil") and sell it at low prices, illegally allowing the waste to re-enter the food market; such practices can pose a serious public health risk^{[1][2][11]}.

3.3 Lack of specific policies and regulations

Relevant government departments issued a number of laws and regulations at a macro level. However, this approach has only resulted in food waste management confusion and has perpetuated the use of simpler food waste handling methods because the laws and regulations are broadly stated, and lack specific procedures and policies for handling food waste within the food waste treatment system. In addition, there is a lack of management structure and no dedicated management team.

3.4 Inadequate publicity of food waste management methods

According to the collected data, most people poorly understand the scope and seriousness of the problems regarding the current food waste handling methods, mainly due to the lack of education resources on the subject. This implies that development of food waste treatment regulations and policies are not sufficient. The relevant government departments should also focus on publicity of food waste handling methods through newspapers, radio, television and other media to educate them on the importance of proper waste disposal, and they have the responsibility to encourage the general citizens to actively participate in the food waste treatment^{[12][13]}.

3.5 Lack of funds

While food waste management has many social benefits, many companies are reluctant to become involved in this industry because there are not many overreaching economic benefits to attract them. Therefore, food waste funding mainly comes from state and local finances, which places greater pressure on the government; the waste disposal-funding gap is large and continues to grow.

This problem could be ameliorated by introducing handling fees for food waste. Collecting food waste treatment fees from enterprises and residents may help compensate insufficient funding in the municipal solid waste disposal process and may relieve pressure on government finances. Additionally, charging garbage fees could establish strong

environmental awareness in communities, emphasize waste pollution problems, and promote waste reduction, thus strengthen the public concept of "Those who pollute pay". Meanwhile, this approach would provide an economic incentive to attract several companies to become involved in the removal and processing of municipal solid waste.

3.6 Lack of mature processing technology

Currently, food waste is primarily used as organic fertilizer. Because of its high production costs and other reasons, the produced fertilizer is not competitive in market; other food waste treatment technologies are developing, but in the whole, the country lacks mature food waste processing technology.

4. Recommendations

4.1 Strengthen the system, increase publicity and education

First, the government should improve the management regulations of food waste processing requirements from an institutional policy standpoint. From waste discharge to separation and recovery to a final disposal system, there must be assurances of timely and effective treatment. For the policies to be effective, the public must be aware of the significant relationship between food waste and the harm impact that improper waste handling has on each individual. The use of a variety of media tools to promote related knowledge of food waste processing to the community in novel ways is essential. This will gradually improve the environmental quality for the people, and they will consciously take the initiative to meet food kitchen standards and waste processing standards.

4.2 Strengthen management

A universal principle of international environmental governance is "Those who produce are responsible and those who pollute pay", and food waste processing should also follow this principle. The main responsibility for food waste production is to identify ways to reduce waste and handle waste, such as through the purchase of biochemical processors. People without a biochemical processor can pay for additional off-site processing unit for collecting and transporting waste.

4.3 Multiple channels to raise funds to strengthen food waste recycling research, accelerating technology development

In addition to higher levels of financial investment from the government, the relevant government departments should introduce policy guidance measures, provide tax incentives and financial support, and develop other initiatives to

garner enthusiasm and participation to mobilize all sectors of society actively. It is important to focus on finding multiple methods to raise funds for the research and development of new technologies, high efficient equipment, reduction of secondary pollution, and better resource recycling.

4.4 Efforts toward market development

Because the source of food waste is relatively specialized and concentrated, food waste is not suitable to be removed and treated by the traditional rubbish handling model due to the waste characteristics. With stronger systematic support through policies, taxation, economic aid and other methods, the local government can fully mobilize the market and select qualified enterprises for food waste storage and transportation, and development of equipment for production and processing technologies. The government can also introduce personnel training to gradually develop the market; after forming a buyer's market, food waste generating institutions would be free to choose storage and processing units.

5. Conclusion

Food waste is one kind of living garbage, it has heavy pollution effect on the environment; its handling should be implemented by a unified management team for its collection, transportation, and disposal. The city should be fully involved in monitoring the distribution of waste sources, select appropriate technology for their process according to the characteristics of the local food waste to ensure a scientific and rational food waste process is followed.

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