

Research on Disposal Mode of Typical Rural Domestic Refuse in Northern Region of China

Tegang Deng, Di Wu

Tianjin Urban Construction Design Institute, Tianjin, 300012, China

Abstract: In the northern region of China, the treatment of rural domestic refuse generally lags behind that of urban areas. There are phenomena such as untimely refuse removal and disordered stacking of refuse, which affect the appearance of villages, and pollute the environment and water resources. According to the administrative system, the rural domestic refuse generally follows the mode of “village collection, town clearing and transportation, and county (district) centralized treatment”. Taking the villages in a typical county in northern China as an example, this paper analyzes the disposal mode of rural domestic refuse, analyzes its feasibility and optimization mode from the aspects of capital and operation, and puts forward the importance and economy of refuse classification and on-site composting disposal. By improving the public’s environmental awareness and refuse classification awareness, improving the refuse treatment level, the reduction, resource and harmlessness of refuse treatment will be realized, and the construction of beautiful villages will be promoted.

Keywords: Rural; Domestic Refuse; Disposal Mode; Refuse Classification; Beautiful Village

1. Introduction

“Green trees surround the small village, and the green hills outside the walls of the village are continuous.” The beautiful and fresh landscape and pastoral environment is the simplest pursuit and sustenance of the Chinese people for thousands of years. However, with the rapid development of the economy and population, people’s activities have had a great impact on the environment. Especially in the case of refuse, the phenomenon of refuse dumping and refuse surrounding villages has become more prominent. The soil, air and water pollution caused by the disorderly stacking of refuse have affected the production and living and sustainable development of the villagers to some extent. In September 2018, the Central Committee of the Communist Party of China and the State Council issued the “Strategic Planning for Rural Revitalization (2018-2022)”, in which the focus is on accelerating the improvement of rural environment, focusing on the treatment of rural refuse, sewage and the upgrading of villages appearances, carrying out rural human settlements environmental improvement actions. Promoting the treatment of rural domestic refuse is an important part of realizing the beautiful villages, and it is also a top priority. How to solve the problem of rural domestic refuse economically, ecologically and effectively is a subject for practitioners in the industry.

2. Characteristics of Rural Domestic Refuse and Its Disposal Status

Through many rural surveys in northern China, it is found that rural areas are usually underdeveloped areas, which mainly focus on agricultural activities. Some rural areas have relied on local resources and geographical location to develop some processing industries. With the development of rural economy, the amount of rural domestic refuse has increased, and the types of refuse have increased gradually with the development of economy and logistics, especially in clothing, food and packaging. Rural domestic refuse stacking and disposal are quite different because of the economic situation of the villages. Villages close to urban areas and with better economic conditions usually have unified planning and management of domestic refuse, with refuse stacking ponds and regular clearance; while other villages have no systematic “refuse collection-transshipment-treatment” system for domestic refuse disposal, and the common treatment method of village refuse is to transfer to the roadsides, riversides, pits and ponds outside the villages, without any reduction and harmless treatment, affecting the outlook and environment.

In the aspect of refuse classification, it is generally not involved. Villagers’ awareness of refuse classification is weak, and all the refuse generated is mixed in a refuse pool. For some of the refuse (such as refuse paper, glass bottles, metals, etc.) which has recycling value and is recycled by someone, it is collected and sold to the waste recycling personnel separately.



Figure 1. A unified planned refuse pool



Figure 2. Refuse dumped outside the villages

3. Current Mode of Refuse Disposal

At present, refuse treatment is mainly dominated by the government. The county government formulates refuse control objectives and systems. The County finance provides financial support, arranges special funds for equipment and personnel input, and the villages and towns coordinate and invest appropriately. The refuse disposal mode generally advocated is: village collection, town clearing and transportation, and county (district) centralized treatment. However, the mode involves huge system work, which requires professional teams and large amounts of funds. In order to solve the existing problems, in recent years, the government began to explore the mode of purchasing services. Through bidding, the government selected qualified state-owned or private forces to carry out construction and provide refuse disposal services. The government pays fees to them annually according to the contract. Thus, to a certain extent, it can relieve the funds pressure of government and improve operational efficiency.

Table 1. Equipment purchase fee schedule

Number	Name	Quantity	Unit price (yuan)	Total price (ten thousand yuan)
1	Refuse hopper (Match with airtight transfer vehicle)	564	4200	236.88
2	Compression transfer vehicle	94	260000	2444.00
3	Electric three-wheel refuse collection vehicle	990	4000	396.00
4	Trash bin (240L)	3300	150	49.50
5	Total			3126.38

Table 2. Operating Expenses Calculation Table

Number	Project	Project classification	Quantity	Expenditure standard	Annual expenditure (ten
--------	---------	------------------------	----------	----------------------	-------------------------

4. Discussion on a Typical Case

Taking the rural domestic refuse treatment in a county in the north China as an example, there are 16 towns and 409 administrative villages in this county, with a total number of 99,000 households and a total number of 359,000 people. The terrain is mainly mountainous, and the natural villages are scattered. The villages mainly focus on agricultural farming, with a small number of industrial and mining processing enterprises and agricultural products processing enterprises. At present, all villages have fixed refuse dump sites, and there is no uniform end treatment of refuse. Some villages have cleaners and transporters to transport refuse to the county landfills for disposal, but the frequency of cleaning is low. In order to cooperate with the global tourism and the construction of beautiful villages, the county government plans to treat the villages refuse in the whole county. Now the refuse treatment modes are analyzed and demonstrated.

Considering the factors of the regional economic development level and the planning and construction of supporting sanitation facilities, the per capita production of domestic refuse in villages and towns is 0.8 (kg/person.d). Regardless of refuse classification, the average amount of refuse is 287.2 t/d, and the density of natural stacking refuse is 0.35 t/m³. A landfill site is planned in the north and south of the county separately.

Mode 1: Refuse is not classified and each village is equipped with cleaners. Every 100 households is equipped with a cleaner and an electric three-wheel cleaning vehicle, and the refuse is collected by the village cleaners and transported to the village centralized refuse dump sites every day, and refuse bins are set up. Then it is transported to the landfills by refuse compression trucks to avoid secondary pollution caused by setting up the refuse compression transfer stations. After calculation, considering a certain margin and seasonal fluctuation of refuse, according to the fluctuation coefficient of 1.3, It is equipped with a total of 94 units of 5 cubic compression vehicles. There is a 240L trash bin for every 30 households in the villages.

					thousand yuan)
1	staff salary	Manager	40	2000 yuan / person • month	96.00
		Village Cleaner	990	1000 yuan / person • month	1188.00
		Driver of Compression transfer vehicle	122	3000 yuan / person • month	439.20
2	Labor insurance appliances, Social insurance, accident insurance and others		1152	According to local standards	252.72
3	Electric three-wheel vehicle	Maintenance fee, electricity fee	990	According to local standards	41.08
4	Compression transfer vehicle	Maintenance fee, vehicle insurance	94	According to local standards	65.80
5	Total operating cost (1-4)			2082.80	
6	Management cost			104.14	
7	Total cost (5-6)			2186.94	

Note: The fuel cost of the compressed transfer vehicle is calculated based on the amount of refuse and the actual distance.

Mode 2: Refuse is classified. According to the survey and related statistics, recyclable refuse accounts for about 20%, organic refuse accounts for 40-50%, non-recyclable refuse and other refuse accounts for 20-30%. In the project, recyclable refuse accounts for about 15%, organic refuse accounts for 45%, then about 40% of refuse needs to be transported and disposed of. The number of cleaners and matching electric three-wheel vehicle remains unchanged, 80 refuse classifiers need to be added. And 20 kitchen refuse collection vehicles and refuse composting equipment need to be equipped, a total of 38 units of 5 cubic compression vehicles need to be equipped. At the same time, it is equipped with classified trash bins.

From the above two disposal modes, it can be seen that: In order to solve the rural refuse problem in the county, the initial investment is higher, and the annual operating expenditure is also higher, mainly reflected in the human cost. If each village can solve the cleaning costs in the village itself, the county finance can save a lot of money. In this respect, villagers need to have a good sense of sanitation and organization to maintain the village environment themselves.

If the means of refuse classification is publicized and made good use of, the amount of recyclable refuse can be reduced by at least 15% at the source, and then we can make use of the characteristics of rural refuse which has more organic matter and is conducive to composting to adopt near-by composting treatment and reuse it for agricultural and forestry land. This mode can reduce the amount of outward proposal refuse by 60% and improve the rural soil fertilizer power.

If the average density of the daily refuse generated in the villages of this county is 0.85t/m³ after landfill, it needs 123,000 m³ of landfill space every year, which takes up a large amount of land resources. If the refuse can be clas-

sified and disposed, about 60% of the space can be saved, and the service life of landfill can be prolonged by one time.

The case can adopt the mode of government purchasing service, and the professional operation company can optimize the refuse disposal links, fully mobilize the enthusiasm of villagers, reduce the cost of refuse disposal and improve efficiency.

5. Conclusions

The rural areas of northern China are wide, with complex terrain and large amounts of domestic refuse. In order to promote the construction of beautiful villages, refuse disposal should be paid attention to. So, it is necessary to promote refuse classification and on-site composting treatment according to local conditions, reduce the amount of transported refuse and work intensity, and realize the reduction, resource and harmlessness of refuse. Also, rural areas have a large population. It is necessary to strengthen publicity and work guidance on environmental awareness and refuse classification awareness, reduce fiscal pressure, improve environmental governance level, and realize rural revitalization strategies.

References

- [1] Jin Q., Yue B., Wang Q. Status Quo of the Generation and Management of Rural Domestic Refuse in Different Regions of China. *Environmental Engineering*. 2018, 36, 97-101.
- [2] Tian J. W. Study on Disposal Mode of Domestic Refuse in Northern Rural Areas. *Journal of Shijiazhuang University*. 2017, 19, 93-98.
- [3] Liu Z. L., Wu G. Y.i, Luo H. L. Study on the Influence of Source Classification on the Local Treatment of Rural Domestic Refuse. *Environmental Sanitation Engineering*. 2018, 26, 70-76.
- [4] Zhu S. Y. Landfill Density of Municipal Domestic Refuse and Its Distribution along Depth. *Environmental Sanitation Engineering*. 2010, 18, 53-56.
- [5] Wang X. P., Ge D. B. Analysis on the Classification Model of Rural Domestic Refuse and Its Existing Problems. *Journal of Hunan Environment Biological Polytechnic*. 2017, 4, 45-49.