A Survey on Current Situation of Rural Household Waste Treatment and Disposal in Guangdong Province

Ying Tang¹ and Chengyang Hong²*

¹Guangdong Polytechnic of Environmental Protection Engineering, Foshan 528216, P.R.China
²South China Institute of Environment Sciences. Ministry of Ecology and Environment, Guangzhou 510655, P.R.China
*Corresponding author’s e-mail: hongchengyang@scies.org

Abstract. The categories, collection and disposal method of rural household wastes in Guangdong Province as well as related intentions were collected and investigated through the questionnaire survey method, in an effort to figure out the current situation of rural domestic waste disposal in this area. A total of 169 valid questionnaires were collected in the questionnaire survey, which included 169 administrative villages in 17 prefecture-level cities. The survey results showed that when the respondents were listing the main components of household wastes, the probability for kitchen wastes to rank the top reached as high as 87%. 84% of the 169 surveyed administrative villages implemented the standardized management of household wastes, among which only 18 ones disposed the wastes after classified collection. In the current phase, the equipment of collection facilities was evidently better than that of terminal treatment facilities in the administrative villages. The intention survey results indicate that the ordinary people not only show the subjective willingness, but also are glad to take an active part in protecting the environment.

1. Introduction
With the rapid socioeconomic development and continuous improvement of farmers’ living standard, rural household wastes are seriously threatening the rural ecological environment in China as the main constituent part of rural solid wastes [1]. Rural household wastes include kitchen waste, lime earth, feces, rubber and plastic, metals, paper, glass, ceramics, bamboo, textiles, etc. [2]. Rural household wastes are hard to collect and dispose due to their high dispersity and diversity. The household waste treatment and disposal in the vast rural areas generally is still backward and at low levels in China. Moreover, the rural household waste pollution is continuously deteriorating the rural ecological environment, thus influencing the rural economic development, and the improvement of farmers’ living standard and rural environment.

The economic booming in Guangdong Province, a strong economic province in China, brings about nonnegligible environmental pollution problems. As indicated in the bulletin of the first nationwide pollution source census in 2010, the total number of pollution sources in Guangdong Province reached 600,200, accounting for 10.1% of nationwide total number and taking the first place in China [3]. The rural environmental pollution problems have been especially prominent in recent years, which have aroused extensive attention in all walks of life. GAO H S et al. surveyed 256 administrative villages in 33 counties (cities, districts) of Guangdong Province, and the results showed that household wastes accounted for 60.13% in rural wastes in Guangdong Province [4]. DUAN X W et al. further investigated

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.
Published under licence by IOP Publishing Ltd
the physiochemical properties and pollution status of rural household wastes in different areas of Guangdong Province. According to their statistical results, the component proportions in rural wastes in Guangdong Province were sorted in a descending order as: components of agricultural applicability (mainly including dusts and grass leaves in kitchen wastes), flammable substances (wood and bamboo, paper, cloth, plastic, etc.) and nondegradable substances (metals, glass, bricks, tiles and stones, etc.), which accounted for 62.62%, 29.97% and 6.61%, respectively [5]. Detailed survey and statistical analysis were carried out for the current situation of rural household waste treatment and disposal in different areas in Guangdong Province in 2018, and the optimization plan for rural household waste governance was further discussed, expecting to provide a scientific basis for formulating the related rural household waste management strategies.

2. Survey and analytical methods
The questionnaire survey method was mainly used to investigate the students majored in environmental evaluation and consultation service in Guangdong Polytechnic of Environmental Protection Engineering, among which 95% were from Guangdong Province, and all of the respondents had certain professional qualities in environmental protection. The question design of the questionnaire form was mainly based on the categories, collection and disposal method of rural household wastes, and related intentions in Guangdong Province. The questions were divided into two major types: choice questions and declarative questions. Valid paper questionnaires were screened out, and then typed in to establish an Excel database, followed by a statistical analysis via Excel.

3. Results and analysis

3.1. Basic information
According to Guangdong Statistical Yearbook 2010, Guangdong Province has the jurisdiction of 21 prefecture-level cities, 23 county-level cities, 41 counties, 3 autonomous counties, 54 municipal districts, and 1,150 towns and villages [6]. A total of 400 questionnaire forms were given out in this survey, non-rural students were excluded, and the students from the same administrative village were merged. In the end, 169 valid questionnaires were formed through such screening, involving 6 prefecture-level cities in Pearl River Delta, 6 ones in eastern Guangdong, 4 ones in western Guangdong, and one in northern Guangdong, and 169 administrative villages were totally included specifically as seen in Table 1. Based on the survey results, the respondents placed the main components of household wastes in a descending order as: kitchen wastes, waste daily necessities, ashes and dusts, feces, and others.

| Administrative areas | valid questionnaires |
|----------------------|----------------------|
| Pearl River Delta    |                      |
| Dongguan             | 6                    |
| Foshan               | 14                   |
| Guangzhou            | 16                   |
| Huizhou              | 10                   |
| Jiangmen             | 6                    |
| Zhaoqing             | 8                    |
| Heyuan               | 29                   |
| Chaozhou             | 8                    |
| Jieyang              | 7                    |
| Meizhou              | 10                   |
| Shantou              | 16                   |
| Shantou              | 7                    |
| eastern Guangdong    |                      |
western Guangdong: Maoming: 8
    Yunfu: 7
    Zhanjiang: 5
    Yangjiang: 8
northern Guangdong: Qingyuan: 4

Total number (villages): 169

3.2 Current situation of household waste disposal

The statistical results of the collected valid questionnaires suggested that the current household waste disposal methods were relatively standardized in most of the surveyed villages, where transportation to designated sites after collection was the most common management mode in local functional departments (Figure 1), and it accounted for the largest proportions in Pearl River Delta, eastern Guangdong and western Guangdong (41%, 47% and 53%, respectively). The survey data collected in northern Guangdong were quite concentrated with a small data size, so the rural household waste disposal methods in this area could not be comprehensively presented. Moreover, the respondents mainly came from Qingyuan City in this area, and all of the 8 surveyed administrative villages in this area implemented the standardized management of household wastes. The above data manifested that the rural waste problems were gradually improved under the guidance of national policies in recent years. However, there was no lack of villages which maintained stagnant. 28 among the 169 surveyed administrative villages failed to carry out the standardized management of household wastes, and they occupied as high as 16%. Even among those having implemented the standardized management, only 18 administrative villages managed to dispose the household wastes after collection (11%).

Figure 1. The current household waste disposal methods

The information about the environmental protection facilities equipped in the administrative villages, which already implemented the standardized management, was further consolidated in this survey (Table 2). 46% of the 169 surveyed villages were equipped with garbage pools, 43% with waste transfer stations, and 18% with garbage houses. Nevertheless, refuse landfills were constructed in only 23 administrative villages (14%), indicating poor equipment status of terminal disposal facilities. 19 administrative villages were in possession of garbage incinerators, accounting for 11%. The survey results showed that the proportion of household waste treatment facilities equipped in the administrative villages was reduced with the increase of input cost, and this result was identical with the survey results obtained in other areas in China [7,8]. The proportions of the final whereabouts of the household wastes in the administrative villages implementing the standardized management are displayed in Figure 2, where those transporting household wastes to cities and counties for collective treatment accounted for 58%, those implementing local landfill treatment for 16%, and those implementing local incineration treatment for 25%. Through a comparative analysis of Table 2 and Figure 2, the disposal capabilities of landfill and incineration were both stronger than the exiting supporting facilities, meaning that the simple landfill and open burning adopted in some administrative villages would both give rise to
secondary environmental pollution around the disposal sites, and fail to effectively mitigate the environmental pollution imposed by household wastes, so high potential environmental safety hazards existed.

Table 2. The environmental protection facilities equipped in the administrative villages

|                      | garbage pools | waste transfer stations | garbage houses | landfills | garbage incinerators |
|----------------------|---------------|------------------------|----------------|-----------|---------------------|
| Pearl River Delta    | 24            | 30                     | 11             | 4         | 3                   |
| eastern Guangdong    | 34            | 34                     | 11             | 16        | 14                  |
| western Guangdong    | 17            | 8                      | 8              | 3         | 2                   |
| northern Guangdong   | 3             | 1                      | 0              | 0         | 0                   |
| Total proportion (%) | 46.2          | 43.2                   | 17.5           | 13.6      | 11.2                |

Figure 2. The final whereabouts of the household wastes in the administrative villages

3.3 Discussion about disposal countermeasures
In the initial practical application phase, the rural waste treatment & disposal has improved the environmental problems in a minority of villages in China. According to the statistical results of the intention survey (Figure 3), the villagers from 55% of the administrative villages expressed dissatisfaction with the current situation of household waste management, and the dissatisfaction with the current sanitary environment was expressed by those from 50% of the administrative villages. When asked about whether being willing to cooperate in the household waste management and treatment under governmental policies, 27% of the respondents were willing to cooperate if the waste management and treatment were totally funded by the government. 68% stated that they were willing to cooperate even if each household had to pay the management fee while the government was responsible for the main portion. 4.5% of the respondents said that they were willing to cooperate under the integration of resident fund contribution with governmental subsidy providing. Only one respondent among the 169 respondents expressed nonparticipation and noncooperation. In recent years, the Chinese government has paid higher and higher attention to environmental problems, continuously perfected the corresponding laws and regulations system, established the popularized environmental management system, strengthened the infrastructure construction of various environmental protection facilities, and
reinforced the environmental protection-themed publicity and education. The environmental awareness of the general public is considerably enhanced thanks to this multi-dimensional top-down impetus, which is well proved by the intention survey results. To be specific, ordinary people not only show their subjective willingness to protect the environment but also are glad to take an active part in this process.

Figure 3. The statistical results of the intention survey

In 2019, the principle of classified management for household wastes was effectively put into force, which marked a reform of the traditional waste collection and disposal method. Although the implementation subjects of household waste classification are still cities in the current phase, it will certainly realize full coverage across China from the long run. As revealed by the current survey data, only 11% of the administrative villages implemented classified collection, disposal and management. The proportion of the respondents who were willing to and acted out to collect recoverable articles in household wastes was 64%. The statistical results of recycled household wastes manifested that the recycled proportion of packing papers and bags, which constituted the second major component of rural household wastes, was 90%, but that of kitchen wastes, the principal component of household wastes, was only 10% (Figure 4). Therefore, the classified collection and disposal measure is a relatively feasible path which can easily take effect out of the consideration for the current situation of rural waste treatment and disposal in Guangdong Province.

Figure 4. The statistical results of recycled household wastes

4 Conclusions

(1) A total of 169 valid questionnaires were collected in the survey, which included 169 administrative villages in 17 prefecture-level cities in Guangdong Province. The survey results showed that the main components of household wastes in Guangdong Province were sorted in a descending order as kitchen wastes, waste daily necessities, ashes and dusts, feces, and others.

(2) 141 of the surveyed administrative villages implemented the standardized management of household wastes, where only 18 disposed the household wastes after classified collection. The
equipment status of collection facilities was obviously better than that of terminal disposal facilities in the administrative villages at present.

(3) Restricted by the input cost, the equipment status of terminal disposal facilities in the administrative villages was apparently more unsatisfying relative to collection facilities, indicating high potential environmental safety hazards of simple landfill and open burning implemented in some administrative villages.

(4) The recycled proportion of kitchen wastes was only 10% as the principal component of household wastes. Given this, the classified collection and disposal countermeasure is a relatively feasible remediation path which can easily yield results. As forcefully verified by the intention survey results, the ordinary people are not only subjectively willing to protect the environment but also express their willingness to actively participate in the environmental protection.

References

[1] MIN Chao, AN Da, WANG Yue, et al. Progress of rural solid waste resource utilization in China[J]. Journal of Agricultural Resources and Environment, 2020, 37(2):151-160.

[2] LI Dan, CHEN Guan-yi, MA Wen-chao, DUAN Ning. Characteristics and treatment status of rural solid waste in China[J]. Environmental Science, 2018,38(11):4187~4197

[3] The Environmental Protection Department of the People’s Republic of China, National Bureau of the People’s Republic of China, Ministry of Agriculture of the People’s Republic of China. The first national census communique of pollution sources[R]. 2010.

[4] GAO Hai-shuo, CHEN Gui-kui, LI Hua-shou, et al. Composition of solid waste and its disposition methods in rural area of Guangdong province, China[J]. Journal of Agro-Environment Science, 2012, 31(7):1445-1452.

[5] DUAN Xiong-wei, GAO Hai-shuo, LI Hua-shou, LUO Shi-ming, CHEN Gui-kui. Component Analysis and Pollution Characteristics of Domestic Waste in Rural Area of Guangdong Province, China[J]. Journal of Agro-Environment Science, 2013, 32(7):1486-1492

[6] Statistics Bureau of Guangdong Province. Statistics yearbook in 2010 of Guangdong province[M]. 2011.

[7] LIU Xiao-yan, DANG Jing, ZHAO Peng-xu, ZONG Xiao-yu, JIN Bao-rong, CAO Xiao-wen, SUN Yan-dong. Research on the Classification and Treatment of Rural Garbage in Zaozhuang city [J]. Technology and Economic Guide, 2020, 28:73-74+86.

[8] WANG Yu-meng, ZHOU Xin-yu, SONG Yong-he. Problems and Countermeasures of Rural Garbage Control in Heilongjiang Province [J]. Foreign Trade, 2019, 305:35-39.