

Research on the Analysis and Optimization Methods on the Current Situation of Domestic Rubbish Treatment

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Keywords: Garbage, Recycling Economy Industrial Park, Landfill, Optimization Method, Community Research, Sustainable Development.

Abstract: At present, the relevant laws and procedures of garbage disposal in our country is gradually perfect stage. With the increasingly serious waste pollution, so the importance of living garbage disposal is very prominent. Through the "Chaoyang Circular Economy Park" and "Changping Asuwei landfill" and other companies and communities to conduct field research, we can obtain the optimal treatment method of different component waste by using mathematical modeling methods, which is conducive to more convenient and quick to classify the garbage.

Introduction

The composition and characteristics of living garbage is affected by residents living standards, energy structure, seasonal changes and other factors, it has the characteristics of complexity, variability and regional differences. At present, garbage processing technology has three ways to deal with the landfill, incineration and composting in China, but due to the relevant laws and the process are still in the initial, the single a garbage processing technology has some disadvantages, and it will cause secondary pollution and resource waste, therefore it is urgent to find reasonable refuse comprehensive treatment method. From the perspective of energy conservation and recycling economy, garbage can be recycled after sorting, and the comprehensive treatment of garbage is a development trend in the future. The treatment methods of domestic waste are different from the national conditions, therefore in order to find suitable for the garbage disposal technology of our country national conditions, we must make a thorough and comprehensive understanding for the situation and the processing technology of the garbage disposal. Therefore, through the combination method of landfill field investigation and in-depth resident questionnaire survey, we can master garbage treatment technology status and existing problems, and based on actual survey data, we establish better waste disposal model, which can provide theoretical support for the garbage comprehensive utilized.

The investigation of the Garbage Disposal Present Situation in Beijing

The focus of investigation is Chaoyang district and Changping district, these two areas use the combination mode of city life garbage disposal and suburban processing, we analyze the advantages and disadvantages of different modes, which can provide a reference for different area garbage processing mode. Through access to literature, we found that the Beijing city garbage generates 16000 tons every day, the average per person per day produces 1 kg garbage, now garbage occupies more than 20000 acres land in Beijing city, each year shall be accounted for 500 acres land according

to the current waste output. Open dumps not only affect the city landscape, but also pollute the atmosphere, water and soil, which will pose a threat for the health of city residents. It is estimated that each year, the discarded waste value up to 25 billion in an annual output of 1.5 tons of garbage. In order to more detail Beijing waste comprehensive treatment situation, we visit the Beijing Changping district Asuwei waste landfill and Chaoyang circular economy industrial park.

In Asuwei waste sanitary landfill field, its leachate treatment process uses the domestic advanced UASBF+A/O-MBR+NF+RO combination technology, the design capacity is 600 tons per day, the purified water up to Beijing local secondary emission standards, the part of the recycling is used for plant greening and road spraying dust. So, the treatment facilities are able to filtrate N pollutants and suspended matter in leachate, pollutant removal rate reached more than 99%, the treatment facilities make osmotic solution into clear and thorough and in line with national standards water in garbage.

Garbage Comprehensive Treatments

This system uses the comprehensive treatment process based on front sorting system and compost technology, and living garbage first carries out front sorting process. Through mechanical and manual sorting, the waste things (such as plastic, metal, etc.) in the hybrid, inorganic (such as gravel, rubble, etc.), the degradation of organic matter (such as leaves, fruit, etc.) can be completed separation. Available material enters the resource recycling system, inorganic material carries out landfill, the organic matter of composting degradation is made well-rotted manure and organic fertilizer to sell after the two-stage fermentation process, realizing the resources, reduction and harmless of urban domestic waste.

The whole Chaoyang economic industrial park is divided into four projects, and the different projects are responsible for different types' garbage disposal tasks. The whole industrial park not only develops the traditional garbage disposal mode, but also develops or introduces the new garbage disposal method.

The traditional mode of garbage disposal is mainly landfill and incineration.

Gaoantun sanitary landfill field covers an area of 4.164 hectares, the total volume is 892 million cubic meters, and domestic waste landfill can be filled with 1000 tons every day. In the process of garbage disposal, we use the high density polyethylene film and bentonite pad double impermeable material, and the matching facilities include the leachate collection treatment system, the landfill gas collection treatment system, the underground water quality monitoring well and so on. At the same time, the use of landfill gas power can give power and heating for the workshop and office area, in order to achieve energy-saving emission reduction and resource recycling.

In the investigation of waste disposal company, we also investigate and study on the surrounding community school. In order to make our investigation as far as possible comprehensive. Through the investigation of more than 100 residents of Longhua district and Huilongguan district, the 25 years old accounted for 14%, 25 to 40 years old accounted for 30%, 40 to 60 years old accounted for 35%, and 60 years old and above accounted for 21%. The statistical data analysis shows that dweller average per capita daily life trash quantity is about 0.8 kg, and the proportion of all kinds of garbage is shown in Figure 1.

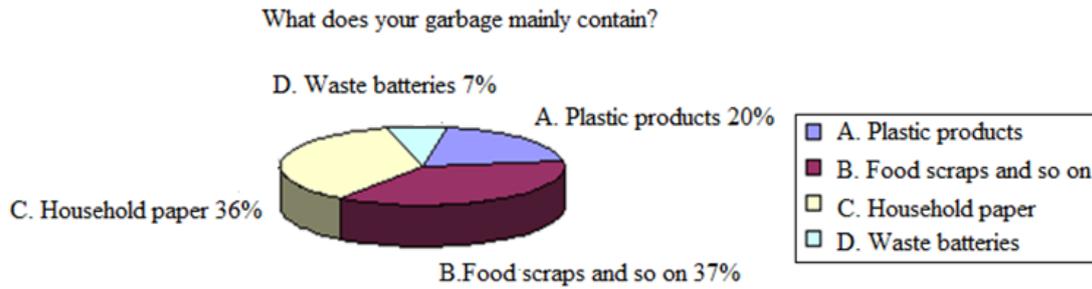


Fig. 1 Composition of garbage

The only 7% people are relatively clear on the garbage specific classification and processing methods, 83% people have an understanding of this, and 10% people do not understand. Residents as the main source of living garbage, 94% are centralized waste treatment package, and few people will litter independent classification after treatment. Although people will carry out classification in the garbage disposal field, and then to carry out processing, but it will greatly reduce the efficiency of garbage disposal. With the development of a variety of garbage disposal technology, residents also have their more agree with the processing method as shown in Figure 2.

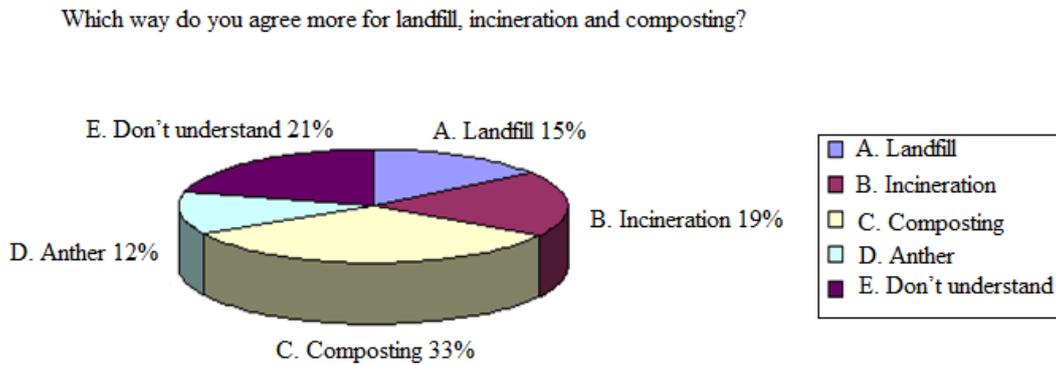


Fig.2 People's public awareness of garbage disposal mode

The garbage should be classified processing, and different methods have advantages and disadvantages. Living garbage pollution is becoming more and more serious, and classification recycling is very necessary. But it is still difficult, thin environmental awareness, weak propaganda, inadequate facilities and other aspects all cause recycling garbage classification difficult reason as shown in Figure 3.

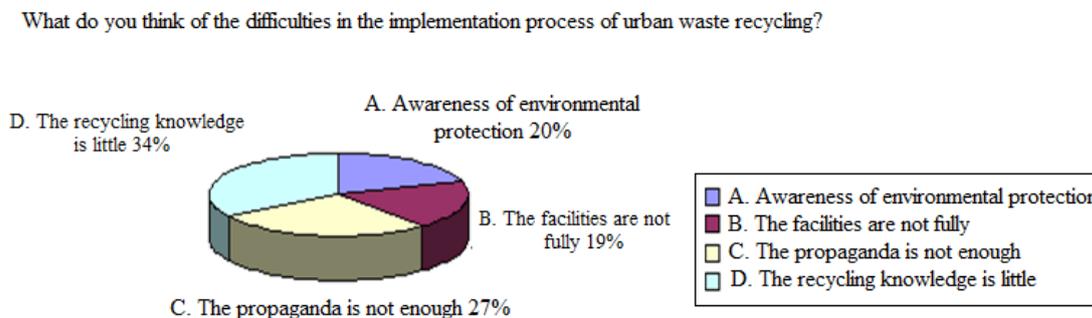


Fig.3 The reasons of resident waste classification difficulties

In investigation, we collect a lot of data, and then carry out a mathematical modeling of the system and science. Based on analytic hierarchy process, we can obtain the different kinds of garbage disposal optimization scheme.

The Influencing Factors of City Garbage Treatment Scheme Selection

Reduction degree. It refers to the amount of waste reduction through the program, and the amount of waste can be reduced the percentage of the total garbage to express. The degree of reduction directly reflects the urban waste treatment program.

Resource utilization. It refers to the use of waste resources, and it can be used as a percentage of the total amount of garbage.

Processing fee. Fee includes the investment of machine maintenance, labor costs and other expenses. The level of running cost is the most important indicator of a scheme.

Operation management. The government is the convenience degree of the management for the urban waste disposal system.

Environmental pollution. In the process of garbage transportation, storage and disposal, it causes the degree of environment pollution.

The degree of people's classification. Residents are lack of knowledge on the disposal of garbage, and it is difficult to realize the classification of garbage in the life.

Domestic and International Several Important Garbage Disposal Method

Incineration. The garbage is sent directly or mixed with a small amount of fuel to be sent to the incinerator to be burned, it produces heat, and then it can be used to make use of the heat energy and the amount of less stable solid residue. Heat can be used, and stable residue can be directly buried. After burning, it can destroy the virus and bacteria in the garbage, organic waste gas is decomposed at high temperature, the volume of waste can also be reduced by 80%-90%, and incineration process garbage can take the fastest speed to achieve the ultimate goal of reduction and harmless.

Compost. The use of a variety of microorganisms can be converted to organic matter degradation to stable humus in waste. According to the different requirements of microorganism in the process of composting, it can be divided into two types of aerobic and anaerobic, and aerobic composting efficiency is relatively higher. At present, people widely use high temperature aerobic composting at home and abroad.

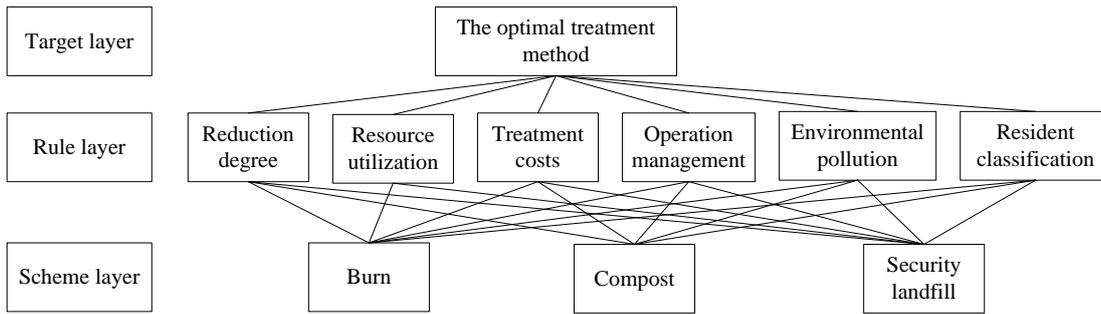
Sanitary landfill. Its garbage is placed in a relatively closed system, to reduce the minimum impact on the surrounding environment. At present, landfill is not only the main waste disposal method present, but also other methods of secondary waste final disposal way are essential.

The Analytic Hierarchy Process to Determine the Optimization Model

In this paper, plastic component as the example is the establishment of the model to obtain its optimal processing program.

Principle Introduction. According to the problem nature and the overall goal, the problem is decomposed into different components. And, according to the interrelated effects between the factors and affiliation factors will carry out aggregation combination at different levels, forming a multi-level structure model.

Establishing Model and Solving. The target layer is the choice of a comprehensive optimal scheme; the criterion layer is the choice of the evaluation index, including B1 reduction, B2 resource utilization, B3 processing costs, B4 operation management, B5 pollution and B6 resident classification degree; scheme layer is optional processing scheme, there are P1 incineration, P2 composting and P3 security landfill.



I. According to the survey data, the matrix is established:

A	B1	B2	B3	B4	B5	B6
B1	1	1/2	1/3	3	1	2
B2	2	1	1/2	3	2	4
B3	3	2	1	7	3	5
B4	1/3	1/3	1/7	1	1/3	1/2
B5	1	1/2	1/3	3	1	2
B6	1/2	1/4	1/5	2	1/2	1

$$B1 = \begin{pmatrix} 1 & 3 & 7 \\ 1/3 & 1 & 3 \\ 1/7 & 1/3 & 1 \end{pmatrix}; \quad B2 = \begin{pmatrix} 1 & 2 & 7 \\ 1/2 & 1 & 5 \\ 1/7 & 1/5 & 1 \end{pmatrix}; \quad B3 = \begin{pmatrix} 1 & 1/3 & 1/6 \\ 3 & 1 & 1/2 \\ 6 & 2 & 1 \end{pmatrix}$$

$$B4 = \begin{pmatrix} 1 & 1/4 & 2 \\ 4 & 1 & 9 \\ 1/2 & 1/9 & 1 \end{pmatrix}; \quad B5 = \begin{pmatrix} 1 & 4 & 2 \\ 1/4 & 1 & 1/2 \\ 1/2 & 2 & 1 \end{pmatrix}; \quad B6 = \begin{pmatrix} 1 & 6 & 1/2 \\ 1/6 & 1 & 1/7 \\ 2 & 7 & 1 \end{pmatrix}$$

II. Hierarchical single ordering and consistency checking

① We calculate the above matrix maximum eigenvalue λ and the corresponding normalized characteristic matrix $\{w_{i1}, w_{i2}, \dots, w_{in}\}$

② Definition consistency index is
$$CI = \frac{\lambda - n}{n - 1}$$

③ The definition of random consistency index RI, and there are the table available RI=1.24.

n	1	2	3	4	5	6	7	8	9	10	11
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51

$$CR = \frac{CI}{RI} < 0.1$$

④ When the consistency ratio $\frac{CI}{RI}$, the degree of inconsistency matrix within the allowable range uses the normalized eigenvector as the weight vector, or to re construct the matrix should be adjusted.

Through the above steps, it can be calculated:

$$A: w_i = [0.1807, 0.3129, 0.5289, 0.0689, 0.1807, 0.0989]$$

$$\lambda_{\max} = 6.0755, CI = 0.0155, RI = 1.24, CR = 0.0125 < 0.1$$

$$B1: w_i = [0.6311, 0.2287, 0.0829]$$

$$\lambda_{\max} = 3.007, CI = 0.0035, RI = 1.24, CR = 2.28 \times 10^{-3} < 0.1$$

$$B2: w_i = [0.5858, 0.3299, 0.0743]$$

$$\lambda_{\max} = 3.014, CI = 0.007, RI = 1.24, CR = 5.65 \times 10^{-3} < 0.1$$

$$B3: w_i = [0.0997, 0.2992, 0.5983]$$

$$\lambda_{\max} = 3, CI = 0, RI = 1.24, CR = 0 < 0.1$$

$$B4: w_i = [0.1571, 0.6535, 0.0755]$$

$$\lambda_{\max} = 3.0015, CI = 0.0075, RI = 1.24, CR = 3.13 \times 10^{-2} < 0.1$$

$$B5: w_i = [0.5904, 0.1476, 0.2952]$$

$$\lambda_{\max} = 3, CI = 0, RI = 1.24, CR = 0 < 0.1$$

$$B6: w_i = [0.3455, 0.0689, 0.5774]$$

$$\lambda_{\max} = 3.032, CI = 0.016, RI = 1.24, CR = 1.29 \times 10^{-2} < 0.1$$

Therefore, all matrices are satisfied with the consistency checking condition, and it doesn't need to be adjusted.

III. The level total ordering and its consistency checking

$$W_{P1} = \sum_{i=1}^{n=6} W_{Ai} \cdot W_{Bi1} = 0.5017$$

$$W_{P2} = \sum_{i=1}^{n=6} W_{Ai} \cdot W_{Bi2} = 0.3813$$

$$W_{P3} = \sum_{i=1}^{n=6} W_{Ai} \cdot W_{Bi3} = 0.4703$$

$$CI = \sum_{i=1}^{n=6} C_i I = 0.0527, RI = 0.9, CR = 0.0585 < 0.1$$

Because of the consistency of the test conditions, so $W_{P1} > W_{P3} > W_{P2}$ is set up.

In summary, the plastic incineration is the best scheme.

Using the above method can respectively obtain optimal scheme, namely waste composition of composting has organic matter and food residue; the garbage composition of incineration process has plastic garbage and non-plastic garbage; landfill waste composition has glass, ceramic, ash, stone, cement block and so on.

Conclusions

The relevant laws and procedures of the garbage disposal in our country are still at the beginning, the problems of domestic waste disposal are outstanding day by day, and we need to find the optimal scientific classification processing method of domestic refuse. In the year time, we visit the Chaoyang circular economy park, and Changping Asuwei landfill and other companies to conduct field research. After mastering a large number of data, using mathematical modeling method can obtain the optimal treatment method of the different composition of municipal solid waste (MSW), and puts forward reasonable suggestions.

References

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