

## Research Article

### Research of Disposal Method for Repast Garbage Based on Anaerobic Fermentation Technology

<sup>1</sup>Qing Zhang and <sup>2</sup>Si-Yun Xu

<sup>1</sup>Department of Economic Management, North China Electric Power University, Baoding, 071003,

<sup>2</sup>Department of Insurance, Hebei Finance University, Baoding, 071000, China

**Abstract:** According to the characteristics of repast garbage, this study researches a technical method for disposing repast garbage through anaerobic fermentation technology. Experiments prove that humid anaerobic fermentation technology has its unique superiority to dispose life garbage. Anaerobic fermentation technology can comprehensively dispose repast garbage in cities, which will make garbage harmless, sufficiently recover the resources in garbage, change wastes to treasures and convert harms into benefits.

**Keywords:** Agent-oriented, comprehensive integration, hybrid intelligent system, ISMR, modeling

#### INTRODUCTION

Anaerobic fermentation technology has been used in waste-water disposal engineering of industries such as alcohol, food, fermentation, slaughter, pharmacy, chemical industry etc. Traditional anaerobic compost method has some advantages. For example, its technology is simple and there is no need for the external world to offer energy. But it has some disadvantages (Cheng *et al.*, 2012). For example, organics are decomposed slowly; fermentation period is long; secondary pollution is severe; occupation area is large. Therefore, generally speaking, the used biological disposal method for garbage in our country is aerobic compost currently. In the last several years, anaerobic fermentation technologies in installations have got long-term development in foreign countries. The technologies have some advantages (Sekiguchi *et al.*, 2001). For example, the fermentation time is short; occupation area is small; it is harmless; the effect of reutilization and decreasing amount is obvious. In the year of 1999, there were 53 anaerobic fermentation factories for disposing life garbage in Europe. The total disposing ability was one million t/a. In the year of 2005, there were 74 anaerobic fermentation factories in operation. However, by the year of 2006, the total number of anaerobic fermentation factories which were built and operating was 124 (Zheng *et al.*, 2012). The total disposing ability increased to be four million t/a.

Following the extensive use of anaerobic fermentation technology, in foreign countries, there are some instances in which this technology is used in disposal of organic garbage (Markou *et al.*, 2012). In order to solve the problem of life garbage disposal, we must properly dispose large amount of organic garbage

firstly. There are lots of organics in life garbage of cities. Among the organics, the proportion of biodegradation substances can be more than 70%. The characteristics of these organic garbage are large volume, high water-containing ratio, low calorie, much organic ingredient, obvious season change, easy decay and severely impacting life environment.

Anaerobic fermentation technology means make poultry and animal feces and urine for anaerobic fermentation under certain conditions of temperature, humidity, ph value, etc (Yazdani and Gonzalez, 2007). Removing stink eggs, pathogens and disease in poultry and animal feces and urine, at the same time, producing biogas, biogas slurry and biogas residue. This technology accords with development idea of "Minimization, harmless and Resource" of china and having broad prospects for development. There are Large and medium-sized site 2700 anaerobic digester by the end of 2012. The objective of the Ministry of Commerce is build 800 new anaerobic digester every year. Total quantity will exceed 10000 by the end of 2020 (Ji and He, 2014).

Some environmental protection enterprises began to use this technology in China. And they have got good effects. This study makes discussion and description according to characteristics of organic garbage and application of anaerobic fermentation disposal technology in actual engineering.

#### MATERIALS AND METHODS

Anaerobic fermentation is a process in which several kinds of microorganisms decompose organics in garbage in specific anaerobic environment and release

**Corresponding Author:** Qing Zhang, Department of Economic Management, North China Electric Power University, Baoding, 071003, China

This work is licensed under a Creative Commons Attribution 4.0 International License (URL: <http://creativecommons.org/licenses/by/4.0/>).

Table 1: Process and products of organic garbage's anaerobic fermentation

Fermentation process	Microorganisms	Products
Hydrolysis	Cellulose decomposition bacteria, fat decomposition bacteria, protein decomposition bacteria	Monosaccharide, peptide, amino acid, glycerol, fatty acid
Acidification Acidic decay	Glue acetic acid bacteria, clostridium	Acetic acid, long-chain fatty acid, aromatic acid Ammonia, amine, carbonate, small amount of carbon dioxide, nitrogen, methane, hydrogen, hydrogen sulfide, sulfuric acid
Methanation	Methane bacterial	Methane, carbon dioxide, water

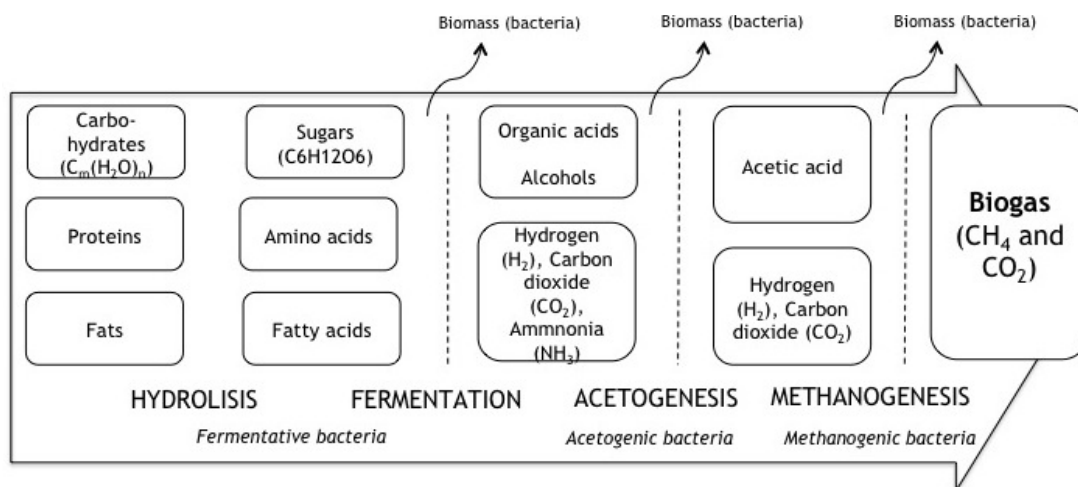
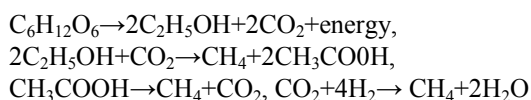


Fig. 1: Technological process of anaerobic fermentation

inside carbon in the form of methane and carbon dioxide at last. The main reactions are:



According to difference of microorganisms' functions and products, anaerobic fermentation of garbage is divided into four stages which can be seen in Table 1.

**Technological process of anaerobic fermentation:**

Anaerobic fermentation technology is mainly used to dispose organic life garbage. In the situation of mixed collection of garbage, anaerobic fermentation technology firstly needs pretreatment to separate the parts which cannot be fermented. As for the garbage which is collected with classification, it also needs pretreatment owing to halfway classification. Therefore, anaerobic fermentation technology is generally composed of three parts which are selection pretreatment, anaerobic fermentation and after treatment (methane utilization, residue compost etc.). The main technological process can be seen in Fig. 1.

According to different evaluation indexes, anaerobic fermentation has many different methods. In actual application, according to moisture content of organic solid in garbage to be processed, anaerobic

fermentation is divided into two kinds which are drying method and moist method.

Drying method requests that solid content rate of garbage should be 24-40%. That mainly keeps the original state of life garbage after selective pretreatment. So the pretreatment requirement to entering materials is simpler than that of moist method. There is no need to add water for garbage. However, in order to satisfy the needs of high viscosity of garbage in drying method, the needed equipments tend to be more expensive than those of moist method (Tan *et al.*, 2014). In addition, amount of produced waste water in drying method is smaller than that in moist method. The needed cost for disposal of waste water is less than that of moist method.

In moist method, solid content rate of garbage is 10-15%. And the garbage needs to be added with large amount of water. A lot of waste water will be produced. The serous fluid in moist method is in a state of absolute mixture. So it is easily restrained by substances such as ammonia nitrogen, salt etc.

The amount of produced methane in drying method is basically same as that in moist method. Solid content rate of drying method is high. So the volume load of reaction container is larger than that of moist method. In moist method, materials are in a state of absolute mixture, which is beneficial to touch of microorganisms. In some circumstances, moist method reversely needs less volume of reaction container than drying method. In our country, after life garbage in cities is separately

selected, there are more than 30% of dry substances in the garbage which needs to be processed. So it is more appropriate to use drying fermentation technology. However, moisture content rate of meal garbage and kitchen garbage is high to be more than 85%. So it is more appropriate to use moist fermentation technology to dispose them.

## RESULTS AND DISCUSSION

In recent years, there are more and more substances in which organics in life garbage of cities are disposed by anaerobic fermentation especially in foreign countries. For one thing, the goal of this producing methane technology of anaerobic fermentation has converted from “energy recycle” to “environmental protection”; for another, the factories in which life garbage is disposed by moist anaerobic fermentation technology have their own unique superiorities, which can be shown in the following aspects:

- The occupation area of the factory is small; factory environment is good. Production process is sealed entirely; there is no waste gas or waste water to be discharged. That will meet the requirement of garden factory. There is no peculiar smell around the factory.
- They sufficiently consider that garbage can be regarded as resource to be recycled and utilized, which can generate large amount of methane and organic fertilizers, achieve the goal of largest degree of reutilization and decrease the cost of garbage disposal.
- They comprehensively supervise the fermentation process. The automation degree is high, which effectively shortens fermentation period. Main technology links in the whole factory have basically achieved automation and utilize uniform central monitoring.
- They utilize water-selection process to separately select, which can effectively select out other impurities in perishable organics and guarantee quality of fertilizers. Fertilizers can be confected according to needs of different crops, which will increase additional values of garbage disposal products.
- After garbage is separately selected in factory, it is utilized in reutilization. The usage rate is 80-90%.
- After circulatory use and treatment, waste water can reach discharging standard; noise control and disposal of waste gas can reach corresponding standards. The whole factory has no secondary pollution. Anaerobic fermentation technology has its own unique superiority in the aspect of disposing organic garbage. Therefore, it has wide

development prospect. As for the aspects of repast garbage, leftovers in food-processing industries and livestock-poultry feces in farms, it can sufficiently make the wastes be in reutilization, harmless and with decreasing amount.

## CONCLUSION

Anaerobic fermentation technology can comprehensively dispose life garbage in cities, make garbage become harmless, sufficiently recycle resource in garbage, change wastes to treasures and convert harms into benefits. Organics amount in produced organic fertilizers is large. After applying the fertilizers, there are not only obvious effects of production increase but also characteristics of decreasing plant diseases and pests, improving soil structure, improving qualities of crops such as fruit trees and tea trees. When using this technology to dispose life garbage, apart from balance between income and expenditure, there is surplus. This technology and equipments can be enlarged or shrunk according to disposal scale, which can adapt to disposal of life garbage in large-sized cities, medium-sized cities and small-sized cities.

In present kinds of anaerobic fermentation technologies in our country, the biggest existing problems are low automation degree of scale operation and poor technical equipments. We need further researches and experiments for the best biological converting condition of anaerobic digestion, ecological microenvironment and treatment process time, the design of perfect control system of anaerobic digestion process etc. The purpose of doing those things is to get the best disposal effect.

## REFERENCES

- Cheng, X.Y., Q. Li and C.Z. Liu, 2012. Coproduction of hydrogen and methane via anaerobic fermentation of cornstalk waste in continuous stirred tank reactor integrated with up-flow anaerobic sludge bed. *Bioresource Technol.*, 114: 327-333.
- Ji, Y.K. and H. He, 2014. Application of anaerobic fermentation technology in prevent and control pollution of livestock and poultry. *Adv. Mater. Res.*, 850: 1176-1179.
- Markou, G., I. Angelidaki and D. Georgakakis, 2012. Microalgal carbohydrates: An overview of the factors influencing carbohydrates production and of main bioconversion technologies for production of biofuels. *Appl. Microbiol. Biot.*, 96(3): 631-645.
- Sekiguchi, Y., Y. Kamagata and H. Harada, 2001. Recent advances in methane fermentation technology. *Curr. Opin. Biotech.*, 12(3): 277-282.

- Tan, S., C. Zhou, Z. Han, J. Li and H. Qin, 2014. Combined effect of monoxide hemoglobin and sodium nitrite on physicochemical, microbiological and sensory properties of pork sausage. *Adv. J. Food Sci. Technol.*, 6(3): 417-423.
- Yazdani, S.S. and R. Gonzalez, 2007. Anaerobic fermentation of glycerol: A path to economic viability for the biofuels industry. *Curr. Opin. Biotech.*, 18(3): 213-219.
- Zheng, Y.H., J.G. Wei, J. Li, S.F. Feng, Z.F. Li, G.M. Jiang and T.Y. Ning, 2012. Anaerobic fermentation technology increases biomass energy use efficiency in crop residue utilization and biogas production. *Renew. Sust. Energ. Rev.*, 16(7): 4588-4596.