Research on biogas fermentation raw materials

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Abstract. Biogas fermentation is a hot topic of biomass energy research at home and abroad, and biogas fermentation raw materials are the key influencing factors of biogas fermentation process.The article mainly introduces the related research of biogas fermentation materials at home and abroad, the biogas fermentation raw materials can be divided into plant fermentation source, animal manure fermentation source, organic sewage fermentation source and mixed fermentation four categories, and points out that animal waste materials of large-scale centralized processing and optimization of the whole structure of biogas fermentation materials will become the future development direction of biogas fermentation materials, for the construction and development of biogas engineering has important practical significance.

1 Introduction

Biogas is a kind of renewable biomass gas fuel. At a time when petrochemical resources are increasingly exhausted, the efficient use of biomass conversion to obtain clean biogas has become a research hotspot at home and abroad. The raw material of biogas fermentation is the key factor of biogas fermentation. At present, there are many kinds of biogas fermentation raw materials with wide sources and characteristics. After studying and analyzing a large number of relevant literature at home and abroad, this paper divides them into plant fermentation sources, animal excrement fermentation sources, organic sewage fermentation sources and mixed fermentation sources, and points out the future development trend of biogas fermentation materials, which is of great value to the practical application of biogas fermentation.

2 Plant fermentation source

Plant fermentation materials include crop straw, plant waste leaves, agricultural and forestry products processing waste, aquatic plants and so on. The species of plants that can be used as fermentation materials in different regions are different, depending on the type of local vegetation distribution, the type of crops planted and the characteristics of economic industry.

2.1Crop straw

Crop straw includes crop straw mainly for food crops and economic crops mainly for flowers and vegetables. The majority of crop straw contain a lot of coarse fiber and a variety of trace elements, which can be used for anaerobic biogas fermentation research. Maize, rice, wheat and other crops straw yield more, is the main research object of crop straw fermentation. Cui ping Guo [1]studied the specific parameters and process conditions of dry rice straw fermentation biogas. The orthogonal experiments were carried out on the influencing factors of dry rice straw fermentation, and the parameters of orthogonal experiment were optimized. The optimum conditions for dry rice straw fermentation were obtained.Orthogonal experiments were carried out on the influencing factors of parched rice straw fermentation. In the area with the flower industry as the characteristic economic industry, when planting flowers in a large area, it is faced with the fundamental problem of how to deal with waste straw reasonably and effectively.

Economic crops straw varieties are abundant, depending on the land. Hong Yang etc[2] studied the potential of biogas production from rose stalks. Under certain conditions, rose stalks are superior to other plant materials.The potential of biogas production from rose straw indicated that under certain conditions, rose straw was superior to fresh plant material fermentation. The larger local flower-growing base provides ample fermentation materials. In addition, biogas slag can be used as feed stock for planting bases, and have high fertilizer efficiency, which can realize the recycling of energy. Research shows that straw biogas fermentation has huge development potential, but its collection has seasonal restriction and is not easy to degrade. At present, the process of using crop straw as fermentation material is in a bottleneck period with low utilization rate.

2.2 Plant waste leaves

Plant waste leaves include weed, leaves, vegetable leaves, etc. The waste leaves of plants contain cellulose, hemicellulose and other sugar, which have the potential of biogas fermentation.With the concept of biomass

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energy and the concept of sustainable development gaining popularity, there are more and more research reports on the use of plant waste leaves in biogas fermentation.

Weed has adverse effects on agricultural planning and urban and rural landscape. They are often removed but not used.Liu Jinghui et al [3] used wild Artemisia argyi as fermentation raw material to carry out batch anaerobic fermentation research, which showed that the biogas fermentation was carried out with wild Artemisia argyi as raw material, and the effect was good.

When an area is invaded by plants, how to cope with the invading plants properly is often the key. Li Rong feng et al [4] conducted a pilot study on the preparation of biogas by using six common invasive plants as the main fermentation materials. The results showed that all the plant materials studied could produce biogas. Among them, plantain had the best fermentation effect. When the number of invasive plants is large enough and the performance of fermentation gas production meets the usual requirements, biogas fermentation treatment can be regarded as a method.

In addition, waste leaves, vegetable leaves, tea leaves and other leaves can be used for biogas fermentation. Li Ya chun et al [5] pointed out that the fresh leaves of flue-cured tobacco can be used as raw materials to produce biogas.

2.3 Agricultural and forestry products processing waste

Agricultural and forestry products processing wastes refer to the unused residues, residues, etc. in the processing of agricultural and forestry products as raw materials.When the agronomists product processing industry develops to a certain scale, reasonable disposal of waste becomes a difficult problem. Through the fermentation of biogas, waste resource can be realized and economic and environmental benefits can be enhanced.

Residues in the processing of agricultural and forestry products can be used as fermentation raw materials. Wei-wei Liu etc.[6] studied biogas fermentation of decay, diseased pears and apples. It is showed that both of them could be invoked as good raw materials for biogas fermentation.

In the fruit planting industry, except the straw can be fermented to produce gas. The peel can also be treated without waste through biogas. Zhu Hai chun etc.[7]explored the biogas fermentation with banana peel as raw materials of biogas fermentation process, the results show that under the condition of average temperature of 23.3 ℃, mature banana peel total solid residue (TS) and gas potential of 752.16 ml/g, volatile solid residue (VS) and gas potential of 975.05 ml/g, biogas producing excellent performance.

In addition, waste residue as the raw material, the process of raw material crushing is eliminated, and it is easy to become decomposed by bacteria. Miki etc.[8]had a research on fermentation potential of tea residue indicates that the biogas fermentation performance of tea residue is good.

2.4 Aquatic plants

China is full of Marine and aquatic resources. At present, studies have been done on the production of ethanol and biodiesel from Marine organisms, but few studies have been conducted on the fermentation of biogas.Due to the need for environmental protection, relevant researches mainly focus on the biogas fermentation of water environment damaging aquatic plants and algae, such as water hyacinth, water peanuts and blue algae[9].

Zhong Xiangrong[10] studied the anaerobic fermentation performance of water hyacinth, and a new scheme for water hyacinth treatment in lijiang river basin was proposed3/ kg. Chun-yan gao etc.[11] noted that algae can be used as a new raw material for the fermentation of biogas, but there is a lack of in-depth study on the related processes. In recent years, eutrophication has taken place in some water bodies in some regions, and the number of algae has increased explosively. Biogas can be prepared from algae and other aquatic plants, which can be "turned into maggots" to achieve efficient treatment of algae and effective control of the water environment.

The study shows that it is feasible to use aquatic plants as raw materials for biogas fermentation, but its disadvantages are that the raw materials contain too much water, the pretreatment process is time-consuming and labor-consuming, and the actual application effect is unknown without pilot amplification research.

3 Animal excrement fermentation source

Animal excrement mainly refers to human and animal excrement, which is the principal raw material for biogas fermentation in China's rural areas[12]. With the development of urbanization, the large-scale intensification of breeding industry gradually provides sufficient animal excrement for the concentrated fermentation of biogas, which makes the development and construction of large-scale biogas fermentation project possible.

Song Li etc.[13]conducted a comparative study on the biogas production potential of 6 kinds of livestock and poultry feces found that under the condition of medium temperature fermentation, the order of total solid gas production rate of various raw materials was as follows: rabbit feces < sheep feces > cow feces < pig feces < duck feces > chicken feces, but pig feces produced the largest amount. Therefore, comprehensive consideration, often uses pig manure as biogas fermentation materials.Ji Xi yan et al [14] studied the gas production effect of pigeon manure as biogas fermentation raw material. Experiments show that pigeon manure is a biogas authentic material with good fermentation performance, and the biogas production per unit is slightly higher than that of other livestock manure materials.

After anaerobic fermentation of animal excrement, in addition to producing clean, efficient and renewable biogas, biogas slag can also be used as fertilizers, and the fermentation process prevents the loss and escape of carbon and nitrogen. Therefore, compared with the original faces, biogas slag have better fertility[15], which can provide nutrients needed in the agricultural production process and from the energy recycling of waste materials.

The problem that cannot be ignored is that with the deepening of urbanization construction in China and the general improvement of the income level of residents, the aquaculture industry has gradually shifted from decentralized operation to centralized management, and the number of ordinary farmers in rural areas has decreased, which will cause farmers to use animal manure biogas. Insufficient fermentation raw materials, and relying on the centralized production of biogas in large-scale farms still has certain development prospects.

4 Organic sewage fermentation sources

Organic sewage mainly includes industrial organic sewage, aquaculture sewage, urban and rural domestic sewage. The organic sewage that can be used for biogas fermentation is mainly biodegradable, with less harmful substances and high concentration of organic pollutants. The products are industrial sewage, urban domestic sewage and meal waste water.

4.1 Status of biogas production from organic sewage

With the increasingly serious environmental protection situation, the problem of efficient treatment of organic sewage has become more and more conspicuous, and the production of biogas by biological anaerobic fermentation is an important resource treatment. Weng Xinchun et al [16] compared the anaerobic biological treatment process and aerobic biological treatment process in the wastewater treatment of food industry. It pointed out that anaerobic biological treatment has many advantages, is an energy-saving sewage treatment process, will become the sewage treatment of food industry Mainstream direction.Periyasamy Elaiyaraju et al [17] found that sago processing waste-water can produce biogas by anaerobic fermentation, and the first-stage gas production per unit volume of sewage can reach 3,393 ml. At the same time, it can effectively reduce the environmental pollution of organic sewage.

Zheng Chao [18] studied the biogas fermentation process of fiber ethanol, and explored the influence of trace metal ions on the anaerobic fermentation process, and explored a highly efficient fiber ethanol waste-water treatment route. Li Shulan [19] and others have proved through experiments that the biogasification treatment of wood processing waste-water is effective. Liao Jialin [20] studied the effect of oil on gas production performance on the basis of anaerobic fermentation of waste water. The experiment pointed out that the proper amount of oil in waste-water can increase the methane content in biogas.

4.2 Use of biogas from organic sewage sources

A variety of utilization methods of biogas fermented from organic sewage have been developed, mainly for power generation and fuel.Ivan Felipe Silva dos Santos et al [21] analyzed the feasibility and market potential of anaerobic biogas production in the Brazilian sewage treatment plant were analyzed. Guo Yuejiao [22] and others studied and analyzed the CDM project in the field of high concentration organic waste-water treatment was studied and analyzed by et al. This project is a waste water produced by a brewery. Through anaerobic fermentation, the efficiency of biogas electricity generation is improved, the economic value is improved, and the environmental pollution caused by greenhouse gases is reduced.Nanning Anning Starch Co., Ltd. [23] used Cassava starch and high concentration organic waste water of alcohol were used as raw materials to produce biogas, which was purified into natural gas and applied to taxi industry on a large scale.

The anaerobic fermentation of biogas and the comprehensive utilization of urban sewage or industrial sewage with high organic content is a way of sewage treatment[24]. Centralized recovery of greenhouse gases in sewage can, on the one hand, reduce the greenhouse effect caused by sewage and clean the sewage. On the other hand, the recycling of organic matter in sewage can be realized, and the energy of sewage can be changed. The production of biogas in organic sewage is the hope of biogas fermentation in the future.

5 Mixed fermentation source

Mixed fermentation raw materials refer to the biogas fermentation materials obtained by fully mixing two or more raw materials with certain technological techniques, which are generally mixed with crop straw and human and poultry excrement. In China, it is one of the characteristics of rural biogas fermentation to use mixed raw materials for combined fermentation. In practical application, the scientific, reasonable and appropriate proportion should be selected according to the characteristics of raw materials. Jin-li Wang etc.[25] studied the sugarcane leaf dry anaerobic fermentation biogas production process, using grass dung mixed fermentation raw materials, and sugarcane leaves by the pile of retting mixed with fresh pig, the quantity of 30%, grass dung ratio is 1:1, the fermentation temperature of 35 ℃ condition, get better fermentation efficiency. Shungang Wan etc.[26] concluded that the mixed biogas fermentation material was decomposed and fermented for 45 days, and the average gas production was 429.3 L/kg, and the methane content was about 60%. Yun-fei Zhao etc.[27] found that the methane content of methane increased with the increase of the proportion of sludge in the mixed substrate. On the other hand, it can also alleviate the inhibition of VFAs.

Compared with biogas fermentation with single

component raw materials, mixed fermentation has the adva- ntages of easy decomposition, high efficiency and strong stability[28]. Its application will expand with the research of biogas fermentation

6 Summary and prospect

Biogas fermentation using biomass. On the one hand, it can replace some petrochemical energy and relieve energy pressure. On the other hand, through the reasonable utilization of waste resources, it provides a good remediation scheme for environmental purification, which can realize the resource, energy and harmlessness of industrial residues.

It has been found that at present, biogas fermentation materials are mainly divided into plant fermentation sources, animal excrement fermentation sources, organic sewage fermentation sources and mixed fermentation sources. Plant fermentation comes from many sources, but it is difficult to degrade. Animal excrement fermentation sources have good gas production effects, but the traditional breeding industry has begun to transform large-scale breeding. Biogas industry also tends to be centralized and large-scale, and the biogas raw materials of ordinary farmers will be limited. At present, the exploration of biogas production from organic sewage in China is still in the primary stage, and the important practical significance to environmental protection will promote the in-depth study of this field. Under the condition of effective control of the proportion of each raw material, the gas production quality of the mixed fermentation source is higher and the advantages are obvious.

During the 13th five-year plan period, China will step up the construction of ecological civilization. In the development of biogas industry, challenges and opportunities coexist. Biogas aspect, as a result of animal manure fermentation source material will gradually limited, the future of biogas fermentation raw material or class fermentation to straw fermentation source and organic waste-water source development, but is restricted by the related technology, in a certain time in the future, the main of biogas fermentation materials will become the animal waste raw material mixed with other raw materials. On the one hand, large-scale biogas industry can be based on large-scale farms in the future, and biogas can be produced from animal waste. On the other hand, it is the future development direction of biogas fermentation materials in China to develop the key technologies for the degradation and utilization of biogas raw materials, gradually get rid of the excessive dependence on animal faeces fermentation sources, and realize the optimization and upgrading of the overall structure of biogas raw materials.

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