UDC 662.763.3.2

BIOTECHNOLOGICAL BASES BIOGAS

VM Polishchuk, MN Lobodko, Ph.D.
OV Dubrovin, applicant

Conditions of bioconversion of biomass into biogas metanoutvoryuyuchymy bacteria. Presented their classification by temperature conditions. The basic stages of converting biomass to biogas and with periodic phase fermentation in the digesters. For example, depending on the release of biogas time duration painted methane fermentation phase flow cattle manure.

Biogas substrate bioshlam, digesters, gasholder, temperature, hole-phase ekspotentsialna phase slow growth phase, phase extinction.

Problem. Since the beginning of civilized society before him all the time was the problem of environmental protection. Due to industrial, agricultural and household activities of man occurred constantly changing physical, chemical and biological properties of the environment, and many of them are very unfavorable. Waste products of animals and humans, usually always used to improve soil fertility. This is not a problem if they formed a little. In the case of a large livestock farms area surrounding land may be insufficient for disposal

excreta of animals. The result may be contaminated groundwater surrounding ponds and wells. Waste products of certain animals can not always be put directly into the ground, because these animals are often carriers of pathogens and parasites, which can also be ill person. These animals are, primarily pigs. Recently, it was reported cases of infection with avian influenza. Therefore, pigs and poultry waste must first disinfect. The same applies to wastewater major cities, including human waste products, fats and sugars get there with catering and home kitchens. Wastewater industry also should be cleaned before they are recycled or descend into rivers and reservoirs. Organic waste, consisting mainly of water, protein, fat and carbohydrates, are able to decompose the primary components under the action of microorganisms. Moreover, the process of decomposition can take place in the presence of oxygen, and in an oxygen-free atmosphere. If the medium undergoes decomposition, oxygen is present, the organics decompose under aerobic microorganisms (bacteria and Micromycetes). In this case the

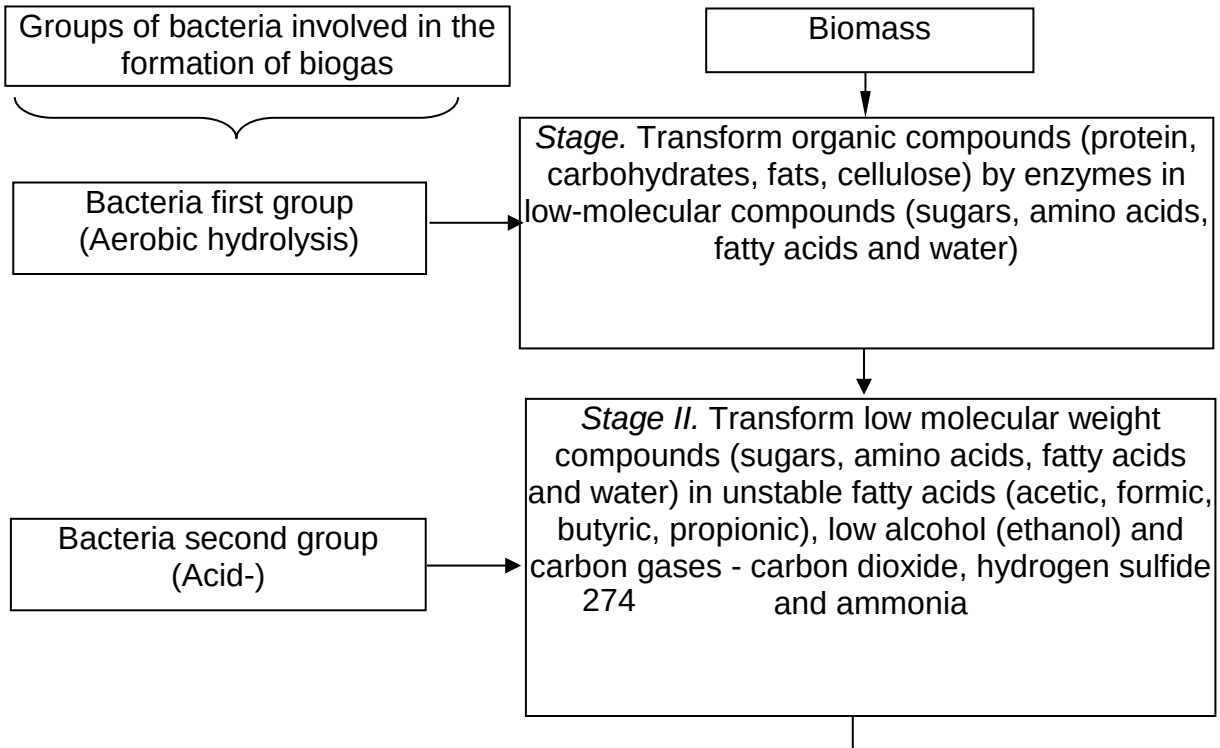
composting of organic waste. If the process of decomposition of biomass is without air, it is called anaerobic. This process involves anaerobic bacteria, as a result of their actions on organic matter produced high-quality organic fertilizer and a mixture of gases (mainly methane and carbon dioxide and a small amount of hydrogen sulfide, ammonia, nitrogen oxides, etc.), called biogas. It can be used to produce electricity for domestic purposes (for cooking), for heating residential and industrial buildings, purged of impurities biogas (pure methane) in cylinders suitable as fuel for automobiles and tractors [1].

Analysis of recent research. The application features metanoutvoryuyuchyh bacteria in the process of anaerobic digestion of waste described in [2, 3, 4], where the stages are described methane fermentation and bioconversion of waste sequence symbiosis mentanoutvoryuyuchyh organisms. In [4] presented biochemical aspects of methanogenesis. However, the processes in digesters with periodic and continuous fermentation of waste not described. In the understanding of these processes is necessary for the efficient and cost-effective recycling biogas.

The purpose of our research is to determine the biotechnology of biogas production bases for efficient operation of biogas plants.

Results. Processing of raw materials to methane occurs during complex interactions in mixed populations of bacteria belonging to the group of Archaea, also known methanogens. Total, more than 40 species of bacteria metanoutvoryuyuchyh. They form methane as a by-product of metabolism in anoxic conditions. Widespread in wetlands, which produce methane as marsh gas in the intestines of ruminant mammals and humans, which are responsible for flatulence [1].

The process of decomposition of biomass methanogens can be divided into 4 stages, and the products of digestion (metabolism) of each group of bacteria are the nutrients for the next group of bacteria (Fig. 1).



Stage. Aerobic bacteria hydrolysis rebuild macromolecular organic substances (proteins, carbohydrates, fats, cellulose) by enzymes in low-molecular compounds such as sugars, amino acids, fatty acids and water. Enzymes isolated hydrolytic bacteria attached to the outer wall of bacteria (called ekzofermenty) while splitting the organic components of the substrate into small soluble molecules. Polymers (bahatomolekulyarni formation) become odnomery (single molecules). This process, called hydrolysis is slow and depends on extracellular enzymes such as amylase, protease, lipase and more. The process affects pH (optimum – 4,5-6) and stay in the tank. In addition, aerobic bacteria consume oxygen hydrolysis, which hit the digesters at boot substrate or the one contained in the substrate, creating the necessary conditions for the activity of anaerobic bacteria.

Stage II. Next involved in acid-splitting bacteria. Some molecules penetrate into the cells of bacteria, where they continue to decompose. In this process, partly involved aerobic bacteria consume oxygen remains, creating a need for methane bacteria are anaerobic conditions and partly anaerobic bacteria. At pH 6-7,5 produced primarily volatile fatty acids (acetic, formic, butyric, propionic), low alcohols (ethanol, methanol), and carbon gases – carbon dioxide, hydrogen sulfide and ammonia. This phase is called phase oxidation (pH decreases).

Stage III. Then vodneprodukuyuchi bacteria from organic fatty acids provide precursors for the formation of methane: acetic and formic acid, carbon dioxide, hydrogen. Such bacteria that reduce the amount of carbon (consisting of organic acids) are very sensitive to temperature.

The fourth stage. At the last stage using metanoutvoryuyuchyh bacteria acetic and formic acid, carbon and hydrogen produced

methane, carbon dioxide and water. 90% of the methane produced at this stage, with 70% of the methane produced from acetic acid. Thus, the formation of acetic acid (ie stage III and to a lesser extent the second stage) is the factor that determines the rate of methane. Anaerobic bacteria Metanoutvoryuyuchi only [2].

Effective progress methane fermentation of organic matter needs to perform four basic conditions:

– oxygen-free atmosphere;
– appropriate temperature mass that is fermented;
– slightly alkaline reaction medium;
– the presence of bacteria that produce methane.

Methane from substance undergoes fermentation takes place only under anaerobic conditions, ie when there is no oxygen (air). Because fermentation should take place in special tanks, closed fermentation chambers and other similar equipment.

A very important factor for the efficient flow temperature fermentation process is mass that is fermented. Depending on temperature preferences are three groups of methanogens – thermophiles, and psyhrofily mesophillous. Temperature zone of these groups of bacteria are given in Table. 1.

Lowering the temperature environment may lead to inhibition of microorganisms, but these changes are reversible signs of recovery occurs within 2-3 h of cultivation at the optimum temperature.

1. Temperature Zone methanogens life[5].

Temperature Zone	Psyhrofily	Mesophillous	Thermophiles
Optimal	10-15 ° C	35-37 °	50-60 ° C
The top growth retardation	25-30 ° C	43-45 ° C	75 ° C.
Lower growth retardation	0-5 ° C	15-20 °	45 ° C

An important prerequisite for regular biochemical processes in the digesters is slightly alkaline reaction FERMENTATION environment with satisfactory find at pH 6.8 (optimal value is in the range 7-7.5 pH). Too alkaline fermentation contributes through pathogenic decay, but is undesirable discharge of hydrogen sulfide. In too acidic environment (with fermentation waste, emissions pigs) methanogenic fermentation may stop blocking the allocation of biogas. Methane fermentation reactors can occur as periodic and continuous manner.

Processes occurring at periodic methane fermentation hnoyivky in digesters are fully consistent with the processes taking place in the cultivation of microorganisms in bioreactors, and divided into several phases. Consider the process of methane fermentation of raw materials

in the digesters volume30 L for example processing hnoyivky cattle at 55°C (Fig. 1). Initially, after the addition of a new substrate, there is a lag-phase or phase addictive organisms to new conditions. In digesters added from 1/2 to 1/3 of its volume hnoyivky, and the same bioshlamu merges. Methane bacteria that remained in "zatravochniy" portion of the substrate in the digesters, some time getting used to the new substrate. Fig. 1 habituation process takes first four days. In this case, such a long period of lag phase due to the fact that the new gas station as a substrate in the digesters was chicken manure, diluted with water, and the temperature of fermentation was 40°C. When the addition of a substrate for consistency digesters held constant, temperature control time lag phase is significantly reduced. After getting used to the new environment bacteria are beginning to grow and reproduce, while stressing the large number of biogas. The process goes into ekspotentsialnu (logarithmic) phase (Fig. 1 corresponds to between 4 and 8 days of fermentation). As the nutritional quality of substrate depletion and accumulation of metabolic products in it, the growth rate is reduced and the process becomes slower growth phase (between 8 and day 15 in Fig. 1) and then into the stationary phase, in which the processes of division and death of bacteria in the population are in dynamic equilibrium (from 15 to 20 days in Fig. 1). When the depletion of nutrients in the substrate and the accumulation of metabolic products overcome the threshold concentration phase begins dying in the bacterial population is gradually decreasing. Accordingly, and reduced the amount of biogas produced. Period extinction phase corresponds to the time from 20 to 35 days in Fig. 2.

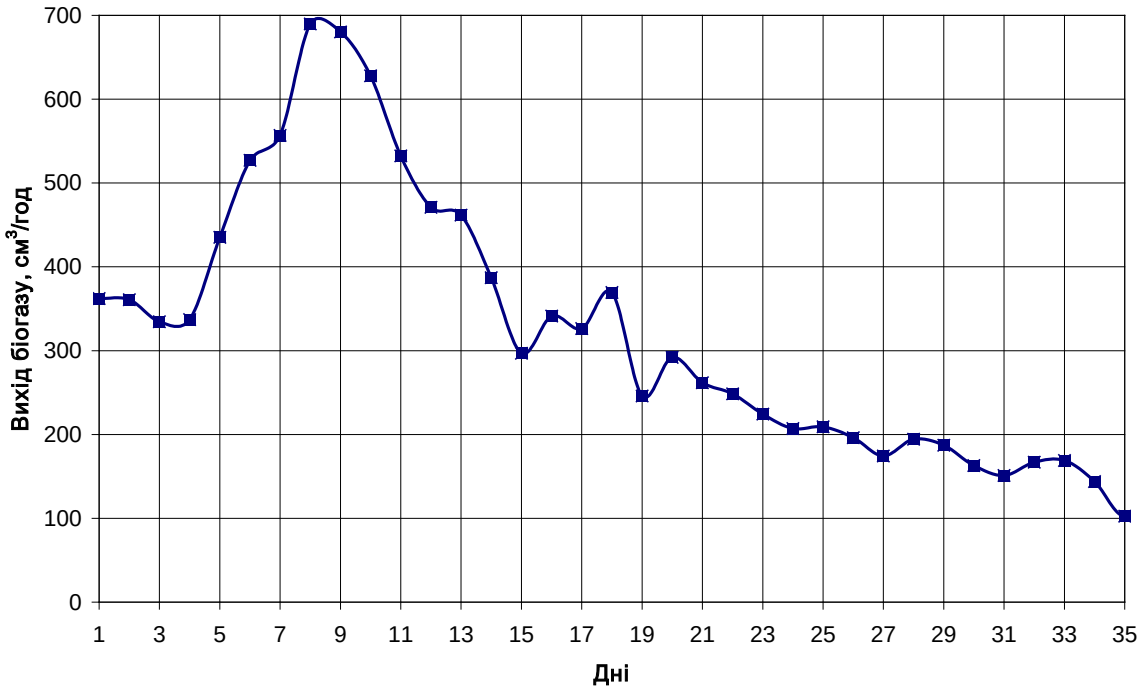


Fig. 2. Process methane fermentation hnoyivky cattle humidity 93% at 55°S.

Disadvantages periodic anaerobic fermentation of biomass way, when the period of effective biogas production is only about 7-8 days during the logarithmic phase flow and stunted growth phase of the next release of gradual decrease of biogas missing in continuous methane fermentation of biomass, which by dosing of substrate digesters in small portions and dosage of taking bioshlamu achieved a permanent job at the logarithmic phase bioreactor fermentation, which significantly increases the efficiency of biogas production.

Conclusions

1. Effective course anaerobic bioconversion of organic material into biogas metanoutvoryuyuchyh require the presence of bacteria, oxygen-free atmosphere, optimal temperature fermentation and slightly alkaline reaction medium.

2. methanogens are four groups of symbiotic bacteria. Products metabolic each group of bacteria are the nutrients for the next group of bacteria.

3. The process of anaerobic digestion of biomass periodic divided into the following phases: lag phase ekspotentsialnu (logarithmic) growth retardation, stunted growth, hospital, dying. The most productive in terms of generating biogas is methane fermentation logarithmic phase (3-5 days) and phase of slower growth. The total period of phases during fermentation of cattle manure is 7-8 days.

References

1. Эder B. Byohazovыe installation. Praktycheskoe posobye / Эder Barbara and Heinz Schulz. - M .: Kolos, 2008. - 240 p.

2. Alternative energy: [teach. guide for students. HI. teach. bookmark.] / MD Melnychuk, VA Dubrovin, V. Mironenko, I. Hryhoryuk, VM Polishchuk, GA Golub, VS Targon, SV Dragnev, IV Svistunova, SM Kuharets. - K: "Agrar Media Group», 2011. - 612 p.

3. Baader V. biogas: Theory and Practice / V. Baader, E. untilit, M. Brennderfer. - M .: Kolos, 1982. - 148 p.

4. The use of biomass for energy purposes in agriculture. Biogas technology. – Research: UkrNDIPVT them. L. Pogorelogo, 2008 .. – 72 p.

5. Effect of environment factors on mykroorhanyzmы / EUROLAB. Of medical portal [electronic resource] / 2013. Access to the journal .: http://www.eurolab.ua/microbiology-virology-immunology/3660/3670/30735/.Access Date: 04.28.2013.

Pryvedenы terms byokonversyy byomassы in biogas metanobrazuyuschymy bacteria. Presented by classification temperature. Opysannыe Main эtapы byomassы transformation in biogas and phases in the Periodic sbrozhenny in digesters. In Example

Output biogas dependence of time t raspysana Operating Time protekanyya phase methane sbrazhyvanyya cattle manure.

Biogas substrate, byoshlam, digesters, gasholder, temperaturnыy re-press, hole-phase эkspotentsyalnaya (loharyfmycheskaya) phase, phase zamedlenyya growth, phase otmyranyya.

These conditions bioconversion of biomass into biogas metanoutvoryuyuchymy bacteria. Presented their classification according to temperature conditions. We describe the main stages of converting biomass to biogas and fermented with periodic phase-no digesters. For example depending on biogas yields at the time painted duration flow phase methane fermentation of cattle manure.

Biogas substrate bioshlam, digesters, gasholder, temperature re-bench, ba-phase exponential (logarithmic) phase, the phase of slow growth phase of extinction.

UDC 620: 95

KINETIC anaerobic fermentation of plant biomass

GA Holub, PhD, Professor
OV Dubrovin, applicant

Powered method for obtaining kinetic equations anaerobic fermentation of biomass.

Kinetic equations, plant biomass, anaerobic fermentation, decomposition level, the speed of the process.

Problem. Analytical description of anaerobic fermentation of plant biomass is one of the areas that allows us to generalize the study of biogas plants as well as getting high-speed methane fermentation process parameters in biogas plants require continuous synthesis.

Analysis of recent research. Obtaining energy from anaerobic digestion of manure and litter is a process that does not compete with food needs of mankind, and therefore we have developed a number of schemes bioenerhokonversiyi organic material in agricultural ecosystems, including biogas technologies, including combined with aerobic fermentation [1]. Recently becomes important biogas from