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

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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 organic biomass formed during the processing of sugar beet [2, 3]. The operation of biogas plants showed that facilitate contact with anaerobic bacteria biomass substrate is provided by mixing the substrate, but with intensive mixing should be avoided as this may result in termination of anaerobic digestion at the expense of symbiosis atsetohennyh and methanogenic bacteria [4]. At the same time, the experience of operating reactors biogas plants showed virtually impossible to eliminate separation of biomass in the reactor at mineral and organic sediment floating biomass, indicating deficiencies in the operation of the mixing biomass [5, 6].

We have patented a number of technical solutions that largely eliminate the separation of biomass by providing biomass mixing layers using embedded rotating biogas reactors. Defined as the level of immersion in liquid rotating digesters and its filling ratio of geometric parameters of rotary digesters and density of the liquid, which is immersed rotating digesters while ensuring its location in the suspended state [7]. It is known [8, 9] that the first stage of anaerobic fermentation bacteria under substrate is hydrolyzed to form organic acids, alcohols, simple carbohydrates. The second stage is formed acetic acid, hydrogen and carbon dioxide. These stages of anaerobic digestion can be summarized by the following equations:

$$C6H12O6 \mathrm{2N2O\ 2SN3SOON + \rightarrow + 4N2 + 2SO2} \quad (1)$$

$$SN3SN2ON \mathrm{+ N2O \rightarrow CH3COOH + 2H2} \quad (2)$$

$$SN3SNONSOON \mathrm{+ N2O \rightarrow CH3COOH + 2H2 + CO2} \quad (3)$$

$$SN3SN2SN2SOON \mathrm{2N2O + + 2H2 \rightarrow 2SN3SOON} \quad (4)$$

$$SN3SN2SOON \mathrm{+ 2N2O \rightarrow CH3COOH + 3N2 + CO2} \quad (5)$$

$$SN3SN2SN2SN2SOON \mathrm{4N2O\ 2SN3SOON + \rightarrow + 5N2 + CO2} \quad (6)$$

where C6H12O6 - glucose; SN3SN2ON - ethanol; SN3SNONSOON - lactate; SN3SN2SN2SOON - butyric acid; SN3SN2SOON - propionic acid; SN3SN2SN2SN2SOON - valeric acid; H2O - water; CH3COOH - acetic acid; H2 - hydrogen ;. CO2 - carbon dioxide.

Later, methanogenesis occurs through the activity of microorganisms, reducing carbon dioxide to methane, as well as those that will eventually decompose acetic acid to methane and carbon dioxide [8]. The equation of biochemical reactions under methanogenesis anaerobic fermentation are as follows:

$$\mathrm{4N2 \rightarrow CO2 + CH4 + 2H2O} \quad (7)$$

$$CH3COOH \mathrm{\rightarrow CH4 + CO2} \quad (8)$$

where CH4 - methane.

Current material balance anaerobic fermentation of organic matter above biomass showed that microbiological decomposition during anaerobic 1 kg fermentation of organic matter is accompanied by an average of 0.4 kg and 0.7 kg of methane carbon dioxide [10]. It was also established that during anaerobic digestion maximum decomposition of organic matter manure biomass was 53% [11], the biomass of green mass of grass - and 45% corn silage - 59% [12, 13]. However, the question of obtaining kinetic equations anaerobic fermentation of biomass based on experimental data digestion process requires relevant research.

The purpose of research - Develop a methodology for kinetic equations anaerobic fermentation of biomass based on experimental data digestion process.

Results. Technology is constantly improving biogas production towards increased concentration of biomethane and shortening fermentation. Since the decomposition of organic matter due to the development of micro-organisms, growth is described by kinetic equations [14] and assuming that the rate of decomposition of organic matter in the biogas fermentation proportional to the amount of organic matter unresolved [15], which can still be expanded, kinetic equation anaerobic fermentation of organic biomass in differential form will look like:

$$\frac{dM}{d\tau} = -k\left(M - M^*\right), \tag{9}$$

where $M-$ organic matter content of the biomass that is not decomposed at the current time biogas fermentation kg; $M^* -$ biomass content of organic matter that is not decomposed during the biogas fermentation kg; $k-$ biogas fermentation process parameter that characterizes its speed, days-1; $\tau -$ a biogas fermentation days.

After mathematical transformation and integration of differential equations within the contents of organic matter from the initial value to the current, we obtain a one-parameter equation anaerobic fermentation process, which determines the content of organic matter that is not decomposed at the current time:

$$M = M^* + \left(M_0 - M^*\right)\exp(-k\tau), \tag{10}$$

where $M_0 -$ total content of organic matter biomass at the beginning of biogas fermentation kg.

At the same time the amount of organic matter biomass is decomposed at the current time is:

$$M_0 - M = \left(M_0 - M^*\right)\left[1 - \exp(-k\tau)\right]. \tag{11}$$

Citing the amount of organic matter decomposed at the current time, the total content of organic matter on top of biogas fermentation, we obtain a formula for determining the level of decomposition of organic matter at the current time

$$\alpha = \alpha_0 \left[1 - \exp(-k\tau)\right], \tag{12}$$

where $\alpha_0 = \frac{M_0 - M^*}{M_0}$ – maximum decomposition of organic matter in the anaerobic fermentation relative units.

Given that the maximum level of decomposition of organic biomass material for long-term exposure during anaerobic fermentation of biomass is green mass of grass - 45%, and for corn silage - 59% [12, 13], the kinetic equation of anaerobic fermentation of biomass will look like :

– green herbs for weight

$$\alpha = 0{,}45\left[1 - \exp(-k_{ЗМТ}\tau)\right]; \tag{13}$$

– for corn silage

$$\alpha = 0{,}59\left[1 - \exp(-k_{КС}\tau)\right]. \tag{14}$$

Calculation of parameters of anaerobic fermentation, which characterizes its speed, hold under techniques [16] and on the basis of experimental data using the formula:

$$k = \exp\left[N^{-1}\left(\sum \ln\left(\ln\frac{\alpha_0}{\alpha_0 - \alpha_i}\right) - \sum \ln \tau_i\right)\right], \tag{15}$$

where N – number of measurements;

To calculate the speed of the process of anaerobic fermentation of biomass green mass of grass and corn silage, we use experimental data [12, 13].

Calculations showed that the process of anaerobic fermentation of organic matter decomposition rate is: for green mass of grass - $k_{ЗМТ} = 0{,}095\ діб^{-1}$; for corn silage - $k_{ЗМТ} = 0{,}119\ діб^{-1}$.

Thus, the kinetic equation of anaerobic fermentation of biomass green mass of grass and corn silage will be as follows:

– green herbs for weight

$$\alpha = 0{,}45\left[1 - \exp(-0{,}095\tau)\right]; \tag{16}$$

– for corn silage

$$\alpha = 0{,}59\left[1 - \exp(-0{,}119\tau)\right]. \tag{17}$$

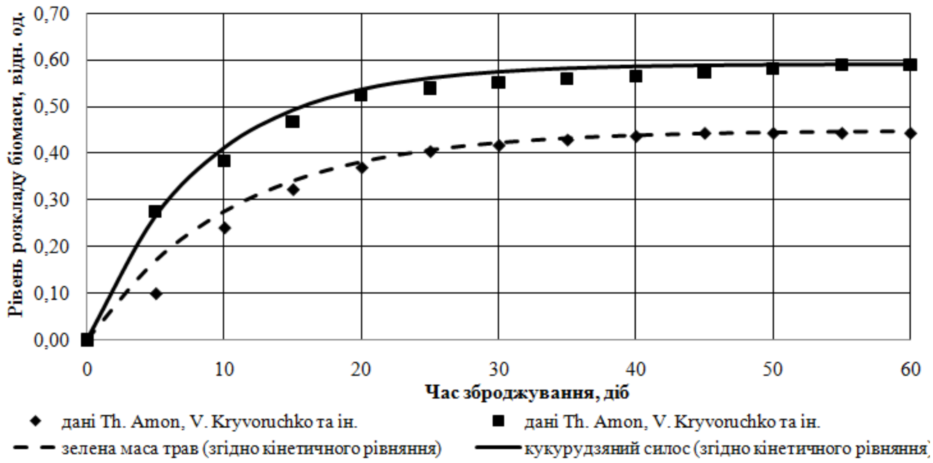

Fig. Kinetics of biogas fermentation of organic material.

In graphical form kinetic equation (16), (17) are shown in Fig.

Conclusion. Developed kinetic equation decomposition of organic materials during the anaerobic fermentation of biomass grasses and green mass of corn silage. It was established that the rate of anaerobic fermentation of corn silage than a quarter the rate of anaerobic fermentation of biomass grasses green mass.

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Powered method of obtaining kynetycheskyh equations anaэrobnoy fermentatsyy rastytelnoy byomassы.

Kynetycheskye equation, rastytelnaya byomassa, anaerobic fermentatsyya, Level decomposition, velocity process.

The procedure of obtaining kinetic equations of anaerobic fermentation of biomass is given.

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