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METHOD OF CALCULATION OF ENERGY BALANCE digesters

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Principles method of calculating the energy balance digesters. Factors involved in the formation of the methodology of calculation of the energy balance digesters.

Methods, energy, balance, digesters.

Problem. Calculation of energy balance digesters is the definition of energy coming from stalyuvannya biogas obtained and compared it with the energy that is spent on the production of biogas (methane tanks heating, heat loss to the environment and job mixing device) [1]. The efficiency of the biogas plant is determined by the rate of commercialization of biogas plant of its annual energy efficiency and economy of conventional fuels by biogas obtained during the year [2].

Analysis of recent research. The method of calculation of heat balance digesters presented in [3].

According to [4], the energy loss in the digesters are determined by the formula:

$$E_{Т.М} = E_{П} + E_{Д} + E_{Міш},$$

where ET.M. – heat loss in the digesters, MJ / day; VC – heat loss by heating the substrate to a temperature fermentation, MJ / day; ED – loss of energy in the environment, MJ / day; Emishi – consumption of energy for mixing the substrate during fermentation, MJ / day.

The amount of heat that is spent on heating downloaded overnight to biomass fermentation temperature is defined as:

$$E_{П} = M_{доб} \cdot c_{с} \cdot \left(T_{бр} - T_{бм}\right),$$

where Mdob – bulk substrate is loaded into digesters per day, kg / day; ss – teplomistkist substrate MJ / (kg·K); Tbr – fermentation temperature, °K; Tbm – temperature biomass is loaded into the digesters, °K.

Whereas:

$$T = 237{,}15 + t,$$

where t – temperature, °C, the formula is written in the form:

$$E_{П} = M_{доб} \cdot c_{с} \cdot \left(t_{бр} - t_{бм}\right),$$

where tbr– fermentation temperature, °C; tbr – fermentation temperature, °C; tbm – temperature biomass is loaded into the digesters, °S.

The mass of the substrate that is loaded into the digesters per day

*Mdob*Determined for the previous formula.

The average value of the heat capacity of the substrate is ss 4.18·10.3 MJ / (kg·K).

Temperature loaded biomass tm depends on how it is loaded into digesters. If a lot for fermentation are the repository for manure, its temperature is temperature environment. If the mass comes directly from livestock housing, its temperature is the same as in the building of the complex. The optimal parameters of microclimate in livestock buildings are.

Fermentation temperature depends on the type of project adopted in fermenting processes; for thermophilic fermentation t6 = 52-54 ° C; for mesophilic – t6 = 32-34 ° C.

Therefore, **for research** is a method of calculating the energy balance digesters.

Results. Heat losses from the digesters in the ED environment defined by the formula:

$$E_Д = k \cdot S_М \cdot \left(t_{бр} - t_д\right),$$

where ED – loss of energy in the environment, W; k – coefficient of heat transfer from the substrate to the environment W / (m2·K); SM – digesters external surface area, m2; TA – temperature environment, °S.

Taking into account that 1 W·h is 3600 J of heat loss to the environment digesters ED, expressed in MJ / day, determined by the formula:

$$E_Д = 0{,}0036 \cdot k \cdot S_М \cdot \left(t_{бр} - t_д\right) \cdot \tau ,$$

where ED – loss of energy in the environment, MJ / day; τ – number of hours in a day.

The value of the average air temperature in regions of Ukraine presented in Table. E.3 Annex E.

The area of the outer surface of the cylindrical digesters for SM digesters is:

$$S_М = П_М \cdot H + \frac{\pi \cdot D^2}{4} = \pi \cdot D \cdot H + \frac{\pi \cdot D^2}{4} = \pi \cdot D \cdot \left(H + \frac{D}{4} \right).$$

where PM – perimeter digesters, m; H – height digesters, m; D – diameter digesters city.

Heat transfer coefficient k is given by:

$$k = \frac{1}{R_З + R_{ІЗ}},$$

where RZ – thermal resistance to heat the outer surfaceM2·K / W; RIZ – thermal resistance thermal conductivity of insulation layerM2·K / W.

The thermal resistance of heat on the outer surface *RZ* determined by the formula:

$$R_з = \frac{1}{\alpha_з},$$

where α_{from} – heat transfer coefficient on the outer surface digesters, W / (m2·K).

Heat transfer coefficient on the outer surface digesters α_{from} depends on the wind speed:

$$\alpha_з = 11{,}6 + 7 \cdot \sqrt{v_в},$$

where Vc - wind speed, m / s.

The value of the average wind speed in the regions of Ukraine submitted.

Thermal resistance of thermal conductivity of insulation layer *RIZ* is given by:

$$R_{IЗ} = \frac{\delta_{CM}}{\lambda_{CM}} + \frac{\delta_{IM}}{\lambda_{IM}},$$

where δ_{SM} – wall thickness digesters, m; δ_{MI} – thickness of the insulation digesters, m;λ_{SM} – thermal conductivity wall digesters, W / (m·K); λ_{MI} – thermal conductivity of insulation digesters, W / (m·K).

Thermal conductivity materials, which are made possible digesters and methane tanks are heaters.

The material for the production of methane tanks usually serve as concrete and steel. For warming methane tanks can be used mineral wool, vulkanitove fiber and other materials with low thermal conductivity. Also in the case of methane tanks buried insulating material serves as a ground.

Energy consumption in mechanical mixing of the substrate in the digesters is given by:

$$E_{Miш} = q \cdot V_M \cdot z,$$

where Emishi – consumption of energy for mixing the substrate during fermentation, W; q– unit load on the mixer, W / m3·h; VM – digesters volume, m3; z – the duration of the stirrer overnight, hours.

If we express the energy consumption for mechanical mixing substrate in the digesters through MJ / day, the formula becomes:

$$E_{Miш} = 0{,}0036 \cdot q \cdot V_M \cdot z.$$

The specific load on the mixer q is about 50 W / m3·h. During the day, agitator turns every 4 hours for 15-20 minutes, that runs for about 2 hours.

Calculate heat loss by heating the substrate to a temperature fermentation EP and energy loss in the ED environment possible in several ways.

The most accurate way is when the energy loss in the environment defined by month depending on monthly average temperatures and wind speeds, then their values calculated monthly full heat loss in the digesters, but a daily loss of heat in the digesters is defined as the average of monthly heat loss. Less precise in the way when the heat loss to the environment defined for the coldest and warmest periods, and the estimated value taken their mean value. But since the energy losses to the environment are usually much lower heat loss in heating the substrate to a temperature fermentation allowed to determine the energy loss to the environment by the third method, when the temperature of the environment taken the average annual temperature, and the wind speed - Average wind speed.

Knowing full heat loss in the digesters is useful to compare them with possible power generated resulting biogas.

Energy biogas produced during the day, is given by:

$$E_{б} = V_{б} \cdot Q_{н}^{б},$$

Where: DL – energy biogas produced during the day, MJ / day; *Vb* – volume of produced biogas per day, m3 / day: Qnb– -NCV biogas MJ / m3.

The volume of biogas produced per day is given by:

$$V_{б} = \frac{m_{ACP} \cdot b \cdot j}{100}.$$

Where: mASR – of totally dry matter manure digesters loaded in a day, kg / day; b – biogas yield per unit of organic matter, m3 / kg; j – the degree of decomposition of organic matter,%.

Mass of absolutely dry organic manure mASR determined from the expression:

$$m_{ACP} = \frac{M_{доб} \cdot (100 - W_{Г}^{Н})}{100}$$

where Mdob– daily mass of incoming raw materials for processing, kg / day; WHN – required relative humidity manure%.

The maximum biogas yield in step b the most intense methanogenesis depends on the chemical composition of biomass, defined species of animals and therefore diet, which they receive. From 1 kg manure dry matter biomass introduced into the reactor biogas plant is theoretically possible to obtain an average of 0,4-0.6 m3 biogas. Given that only 40-50% dry matter manure during methanogenesis transformed into biogas, biogas real solution 1 kg dry matter of cattle averaged 0,20.5 m3And the equivalent weight of pig manure – 0,30.7 m3 (Provided that the reactor operates at mesophilic mode). From chicken manure biogas biomass is greater than from manure of cattle or pigs. When fermentation of excrement from one animal can get biogas per day on average cattle (live weight 500-600 kg)– 1.5 m3Pigs (live weight

80th100kg)– 0.2 m3, Chickens or rabbits – 0,015 m3. Average yield of biogas from various substrates when using mesophilic digesters on standby presented.

The degree of decomposition of organic matter during methane fermentation z presented in Table. Z.2 Annex C.

Net calorific value of biogas Qnb given by DI Mendeleev:

$$Q_н = 128CO + 108H_2 + 234H_2S + 339CH_4 + 589C_nH_m,$$

where Qn lower combustion, kJ / kg; CO, H2, CH4, CnHm - composition of gaseous fuel, per cent by volume under normal conditions (0 ° C, pressure 760 mm Hg).

The heat of combustion of biogas containing moisture, counted by the formula:

$$Q_H^W = 0{,}805 \cdot Q_H / (0{,}805 + W);$$

where Q_H^W – lower heat of combustion of fuel containing moisture kJ / kg; .805 – mass 1 m3 water vapor, kg; W – moisture content 1 m3 gas, kg.

Useful zahalnodobove energy production biogas plant is given by:

$$E_{к.б} = E_б - E_{T.M}.$$

where Ek.b – usefulzahalnodobove energy production biogas plant, MJ / day

Marketability factor biogas plant is:

$$K_б = \frac{E_{к.б}}{E_б},$$

where kB – marketability factor biogas plant.

Annual energy efficiency of biogas plant is given by:

$$PEE_б = E_{к.б} \cdot t_{роб.річн.},$$

where REEb – annual energy efficiency of biogas plant MJ / year: trob. per annum. – years working biogas plant, days.

Saving conventional fuel by biogas obtained during the year is as follows:

$$B_{у.п.} = \frac{PEE_б}{Q_у},$$

where Vu.p. - Annual savings of fuel, kg; *Qu* – calorific value of fuel, MJ / kg.

Conclusion. It is believed that the biogas plant produces biogas for 350 days (on preventive maintenance of biogas plant is given 15 days). According to the accepted standard fuel coal with no moisture, heat of combustion which is 7,000 kcal / kg (29.3 MJ / kg).

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Principles of calculation methods Rassmotrenы balance power machinery digesters. Proanalyzyrovanы factors, kotorыe uchastvuyut Formation methods in calculating power machinery balance digesters.
Methods, energetika, balance digesters.

Principles of method of calculation of energy balance digesters. Factors that are involved in shaping methodology of calculation of energy balance digesters.
Methods, energy balance, digesters.

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FEATURES formation of biological yield WINTER WHEAT

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The article is devoted to the issue of increasing the yield of winter wheat by effective use of agricultural machinery, which have a significant impact on the efficiency of growing crops.
Winter wheat, biological characteristics of agricultural machinery, conservation of biological productivity.

Problem. The problem is that the unjustified use of power tools and agricultural machines in growing and harvesting winter wheat crop is accompanied by high losses, leading to an increase in the cost of production, increase in debris field volunteer and as a result, to increase the cost of its post-harvest soil.