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BIOTECHNOLOGY: TECHNOLOGY FOR PRODUCTION OF BIOGAS FROM ORGANIC PRODUCTS AND ITS APPLICATION

Annotation. The article examines the biotechnology of production and use of biogas and shows the principle of operation of the biogas plant. In the course of the study, the volume of the necessary bioreactor from traditional livestock, products and the required amount of biogas was determined. The main attention is paid to the composition of biogas released as a result of methane separation.

Keywords. Biotechnology, biogas, biotechnological processes, biogas production, methane, biogas plant, biofertilizer.

Introduction.

Biotechnology - (bio bios bios-life+thechne, (Greek. — art, craftsmanship and logos — science) - the use of living organisms (organisms) and biological organisms in production. The term Biotechnology was first introduced by Hungarian engineer Karl Ereki in 1917. According to Karl Ereki, "biotechnology is work in all directions on the production of certain products with the help of living organisms." Currently, this term is defined as follows: Biotechnology is a new direction of science and production, which is engaged in the production of cost—effective, important substances and obtaining strains of high-yielding microorganisms, breeding varieties and forms of plants, pedigrees of animals based on biological processes and the use of objects. That is, the production of products necessary for a person with the help of biological objects. In this case, microorganisms and plant and animal cells, cellular organelles or biologically active molecules are used. The production of biogas from organic products is based on the property of organic products to emit combustible gas as a result of "methane disclosure" under anaerobic conditions. Biogas released as a result of methane dissection consists of 50-80% methane, 20-30% carbon dioxide, about 1% hydrogen sulfide, as well as other gases in small quantities (nitrogen, oxygen, hydrogen, ammonia, etc.). Methane-destroying bacteria convert organic acids into the desired methane, carbon dioxide. Thousands of types of microornisms participate in this complex systematization complex. But the main ones are methane-converting bacteria. Metaflowering bacteria acid-flowering yeasts require a longer time for reproduction compared to microorganisms and have a lower resistance to environmental changes. Therefore, due to the fact that volatile acids are first formed in the discovery medium, the first stage of methane discovery is called acidity. Further, the rate of formation and processing of acids is recorded. Consequently, the decomposition of the substrate and the formation of gas occurs simultaneously. The productivity of gas formation depends on the living conditions of methane-forming bacteria. The peculiarity of this process is that in the case of pure culture, another product is obtained, and in the case of a syntrophic association, another product. For example, in the tummy of cattle, Selenomonas ruminantum is fermented to glucose lactate.

And with the syntrophic association, Methanobrevibacter ruminantium forms acetate, methane and CO2. If a cell is fermented with a thermophilic eubacterium with a pure culture of the bacterium Clostridium thermoccelum, ethanol, acetate, H2 and CO2 are formed. With the syntrophic association of metronobacteruim thermoantotrophicum, acetate, methane CO2 is formed. Clay gas is called "swamp gas". It burns with a blue flame, no smell, no smoke. During the combustion of wood, manure, smoke is released, polluting the environment. fuel and electricity are saved; fertilizers and herbicides are saved; biogas and biofertilizer can be sold; crop yields increase; feed additives for pets and birds are used; biogas plants compensate for yields for about a year; organic waste does not accumulate, and because of their use, the air is purified, respiratory and eye diseases are reduced; the epidemic situation associated with the destruction of microorganisms in organic waste improves; environmentally friendly clean agricultural products improve health; the time when manure, coal, firewood are sent for collection, transportation, drying, finances are saved and no storage space is required; due to the destruction of grass seeds in organic waste, the time that is sent to weed harvesting is saved [2].

Materials and methods.

Biogas installation of hermetically sealed containers, in which the process of opening the organic mass of agricultural products with the formation of biogas at certain temperatures takes place. The principles of operation of all biogas plants are the same: raw materials accumulated and brought to the required humidity are placed in the reactor, where conditions are created for improving the processing of raw materials. Obtaining biogas or biofertilizer from raw materials is called fermentation or fermentation. From raw materials (manure) prepared during the processing of organic products in a biogas plant, biogas and biofertilizer are formed in the reactor. Biogas is purified, stored and used as gas fuel or motor fuel. Biofertilizer is stored and used as a feed additive or introduced into the soil [4].

Biogas is a combustible gas formed during the methane opening of organic waste in solid and liquid state. Biogas is formed in Arab waters during starvation of waste from the woodworking and food industry. It contains 55-65% methane and 35-45% carbon dioxide. Biogas can also be obtained by special cultivation and fermentation of algae and other microorganisms, which ripen quickly and give abundant biomass. It is used in fuel accounting. Carbon dioxide formed during the disclosure and decomposition of organic waste is absorbed into the atmosphere and affects its reproduction.

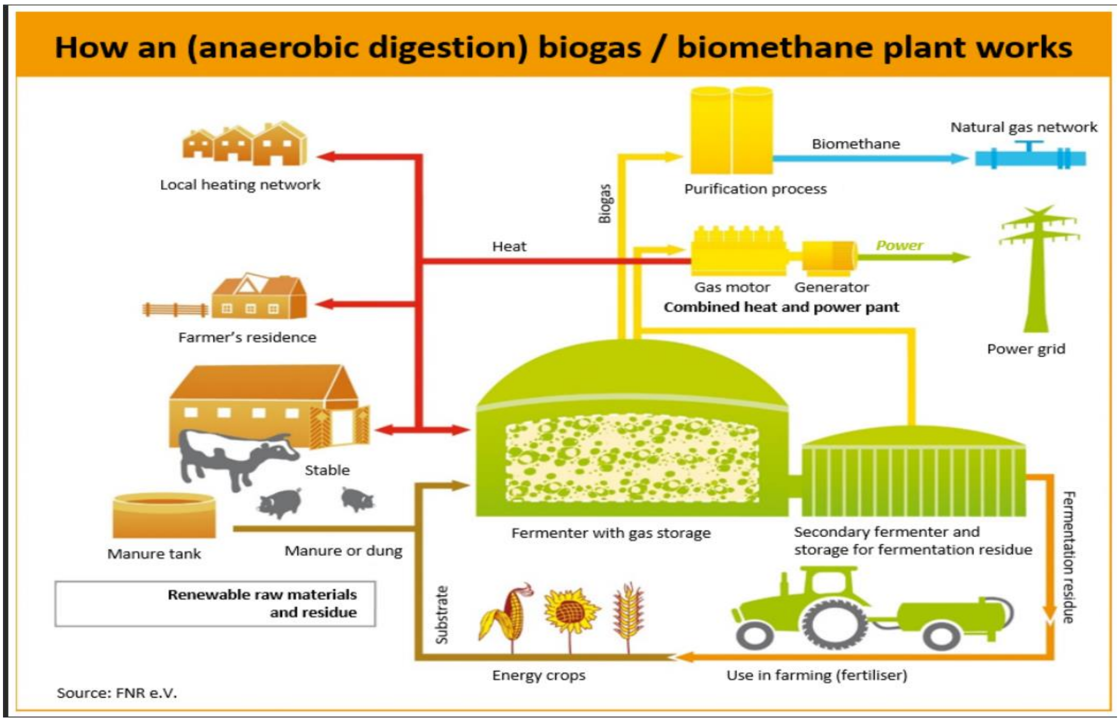

Figure 1 - The principle of operation of a biogas plant

Results and discussion.

The work of the biogas plant is carried out as follows: waste from farm animals (in stock), food waste and other industries (woodworking) are transported to storage warehouses; when using raw materials requiring alignment, this operation is also performed, after which the harvested raw materials are produced by placing pumps and conveyors (on solid raw materials), additional biomass in the transmission the tank (from acid-into the tank circuit), where the tank is heated, is introduced; The finished raw materials enter the bioreactor, which determines the biogas production process, is durable, acid-resistant and hermetically sealed; to create optimal conditions for disassembling the prepared raw materials and accelerating the fermentation process, installations are usually installed in the reactor that provide additional heating and mixing of decomposition products; the optimal temperature regime for the operation of the bioreactor is +40.0 C; as a result of fission and fermentation after a certain period of time, depending on the raw materials and technical capabilities of specific plants, biogas and biofertilizers appear; Biogas can be separated from the bioreactor or accumulated in a gas tank installed in one package; Biocilizers accumulate in the bioreactor tank and are removed after the fermentation process is completed for further use; Biogas, a pressurized cleaner in the gas tank, is then used by consumers to generate electricity, heat and domestic consumption; Biocilizers enter the tank in It is then divided into solid and liquid, and then used for its intended purpose. Every day, food waste is loaded into the bioreactor, the mass of which is 500 kg. From 1 ton of dry matter, 340 to 500 m3 of biogas is released, respectively, from 1 kg-3 to 0.34-0.5 m. It is known that 70% of food waste decomposes, and the remaining 30% remains [7].

Calculate the amount of decomposed waste:

$$M_{dec} = m \cdot C = 500 \cdot 70 = 350 \text{ kg } 100\% , \quad (1)$$

where: m - is the mass of food waste, kg; C - is the amount of decomposed food waste.

If we calculate the remaining amount:

$$M_{res} = m - M_{dec} = 500 - 350 = 150 \text{ kg}, \quad (2)$$

where: m - is the mass of food waste, kg; M_{dec} is the mass of decomposed waste, kg. That is, the energy source necessary for the life and economy of rural residents can be fully provided with the amount of biogas released by the raw materials produced by their cattle. But in the village it is recommended to install a bioreactor biogas plant in certain volumes. Biochemical methane "fermentation" is anaerobic respiration.

The electrons of organic matter (acetic acid) are transferred to carbon dioxide and reduced to methane. Hydrogen serves as an electron donor for methane-converting bacteria.

$$4C_6H_5COOH + 24H_2O \rightarrow CH_3COOH + 4HCOOH + 8H_2 \quad (3)$$
(benzoate)
$$12CH_3COOH \rightarrow 12CH_4 + 12CO_2 \quad (4)$$
(acetate)
$$4CHCOOH \rightarrow 4CO_2 + 4H_2 \quad (5)$$
$$3CO_2 + 12H_2 \rightarrow 3CH_4 + 6H_2O \quad (6)$$
$$4C_6H_5COOH + 18H_2O \rightarrow 15CH_4 + 13CO_2 \quad (7)$$

Of the bacterial species, Methanobacterium formicicum and Metahanospirillum hungati predominate. For example, Methanobacterium kadomensis st 23-20 solar methanogenesis is carried out after 8 days. It takes about 20 days for cattle and poultry to germinate, and about 10 days for pigs to be opened. If 300 million cows are formed annually.when converting manure tons into biogas, the amount of energy obtained is 33 million tons. it depends on the amount of energy obtained from oil. That is, the cost of 1 ton of cow manure is 0.11 tons for oil. From an equal number of cattle cows and pigs, 50% more biogas is produced than pigs [10].

During the study, the volume of the required bioreactor from traditional animal husbandry, products and the required amount of biogas were determined. Depending on the number of domestic animals (animals), the daily dose (quantity) of raw materials (manure) was determined. DSH-dosage of raw materials.

Determination of DS by the number of animals:

Cattle 1989 x 36 kg = 71604 kg = 71,604 t
Sheep-goats 10404 x 4 kg = 41616 kg = 41,616 t
Horse 459 x 10 kg = 4590 kg = 4,59 t
Bird 5355 x 0,16 kg = 856,8 kg = 0,8568 t
Total 118666,8 kg or 118,6668 t
The dose of raw materials formed per day is RMD = 118,6668 t.

Due to the release of a large amount of biogas during the opening of cattle manure, horses, sheep and goats, bird droppings for 10-15 days, a mesophilic mode was chosen for the opening process in the reactor. In the mesophilic fermentation mode, the rotation time of the reactor is 10-20 days, and the daily dose of raw materials (D) is from 1/20 to 1/10 of the total volume (TV) of raw materials in the reactor. The total volume of raw materials in the installation should not exceed 2/3 of the volume (VR) of the reactor.

That is, the reactor volume will be equal to VR = 1.5 x VRM.

VRM = 10 x D, or D =RMD+WD
RMD =118666,8 kg
WD = 59333,4 l
D = 118666,8 kg+ 59333,4 l = 178000,2 kg= 178 t.
VRM = 10 x 178 kg= 1780 t.
VR = 1,5 x VRM = 1,5 x 1780 t = 2670 м^3

The biogas product was determined depending on the type of livestock, the total amount was calculated:

Cattle 71,604 t > 2721 – 3688 м^3
Sheep-goats 41,616 t > 1894 – 3912 м^3
Horse 4,59 t > 139 – 209 м^3
Bird 0,8568 t > 40 – 81 м^3
Total 4794 – 7890 м^3

In the village, depending on the type of livestock manure and its daily rate, the daily rate of biogas is 4794 – 7890 m3. For example, if we take into account that 175 houses live in one village, then as a result of the examination, the population in one family is on average 4 people, then the amount of biogas needed for a family and a household is 49.6 — 52.6 m3. This indicator is 8729.6-9257.6 m3 per 175 houses. Then it turns out that 175 families in the village need 8729.6 – 9257.6 m3 of biogas per day.

Conclusion.

Biogas installation of hermetically sealed containers, in which the process of opening the organic mass of agricultural products with the formation of biogas at certain temperatures takes place. The principles of operation of all biogas plants are the same: raw materials accumulated and brought to the required humidity are placed in the reactor, where conditions are created for improving the processing of raw materials. Obtaining biogas or biofertilizer from raw materials is called fermentation or fermentation. From raw materials (manure) prepared during the processing of organic products in a biogas plant, biogas and biofertilizer are formed in the reactor. Biogas is purified, stored and used as gas fuel or motorfuel. Biofertilizer is stored and used as a feed additive or introduced into the soil.

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БИОТЕХНОЛОГИЯ: ОРГАНИКАЛЫҚ ӨНІМДЕРДЕН БИОГАЗ АЛУ ТЕХНОЛОГИЯСЫ ЖӘНЕ ОНЫ ҚОЛДАНУ

Аңдатпа. Мақалада биогаз өндіру мен пайдаланудың биотехнологиясы зерттеліп, биогаз зауытының жұмыс істеу принципі көрсетілген. Зерттеу барысында дәстүрлі мал шаруашылығынан, өнімнен қажетті биореактордың көлемі және биогаздың қажетті мөлшері анықталды. Метанның бөлінуі нәтижесінде бөлінетін биогаздың құрамына басты назар аударылады.

Түйінді сөздер. Биотехнология, биогаз, биотехнологиялық процестер, биогаз өндіру, метан, биогаз зауыты, биофертилизатор.

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БИОТЕХНОЛОГИЯ: ТЕХНОЛОГИЯ ПОЛУЧЕНИЯ БИОГАЗА ИЗ ОРГАНИЧЕСКИХ ПРОДУКТОВ И ЕГО ПРИМЕНЕНИЕ

Аннотация. В статье исследуется биотехнология производства и применения биогаза и показан принцип работы биогазовой установки. В ходе исследования был определен объем необходимого биореактора из традиционного животноводства, продуктов и необходимое количество биогаза. Главное внимание обращается на состав биогаза выделяющийся в результате разделения метана.

Ключевые слова. Биотехнология, биогаз, биотехнологические процессы, производство биогаза, метан, биогазовая установка, биоудобрение.

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