СЕКЦІЯ 5.
БІОЛОГІЯ ТА БІОТЕХНОЛОГІЇ

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BIOTECHNOLOGY OF LIVESTOCK WASTE DISPOSAL WITH BIOGAS PRODUCTION

Currently, the state has taken a course to increase the energy efficiency of the country's economy, including the conservation of natural resources, the elimination of energy losses, and the increase in the efficiency of their use [1-4].

Anaerobic processing of organic waste to obtain biogas, energy, fertilizers refers to resource and energy-saving technologies. Energy and, consequently, resource conservation is not only an economic problem, but also to a large extent an environmental one: a huge amount of fuel is burned to generate electricity, provide hot water and heat buildings. This leads, in addition to the depletion of one of the types of natural resources, to enormous emissions into the atmosphere, pollution of soil, surface and groundwater. Therefore, one of the advantages of increasing energy efficiency is a reduction in environmental pollution [5].

To implement the National Waste Management Strategy in Ukraine and the National Waste Management Plan until 2030, regions need to activate the areas of effective utilization of solid household waste and agricultural waste, for which it is necessary to take into account European norms and standards in this area, as well as disseminate successful Ukrainian and foreign experience, primarily in the direction of biogas production from relevant waste. As of 2022, 61 biogas production enterprises operated in Ukraine, of which 50 biogas reactors were on their balance sheet, which ensured the receipt of electricity at the level of 183.6 million kWh. [3,4].

The environmental benefits of biogas production and utilization are both global and local. The global benefits include: reducing the consumption of fossil fuels and thereby extending the period of their depletion; obtaining a virtually inexhaustible source of energy, since biomass is constantly renewed; no replenishment of greenhouse gases in the atmosphere and thus protecting the climate.

Methanogenesis, as the process of methane biosynthesis, plays an important role in the carbon cycle in nature. By deliberately involving anthropogenic organic waste in this process and then utilizing the resulting biogas, we reduce the burden on the environment both by

accelerating the decomposition of waste and reducing its quantity and volume, and by reducing emissions of a greenhouse gas stronger than carbon dioxide - methane [6].

If we use manure as an organic substance, we completely stop the emission of methane and nitrous oxide, which is an obligatory companion of manure storage on an open surface. In addition, the use of manure for biogas production reduces carbon dioxide emissions, firstly, because a large amount of carbon is converted into methane, and secondly, due to the replacement of fossil fuels. In transportation, the transition of vehicles from gasoline and diesel fuel to biogas from manure reduces CO2 emissions by 180% per car and gives an environmental effect of reducing emissions of other pollutants in densely populated regions even higher than when using biogas for electricity generation [5].

For example, manure, one of the most large-tonnage types of organic waste, belongs to the category of volatile organic contaminants and, according to the World Health Organization, is a factor in the transmission of more than 100 types of various pathogens of animals and humans. In addition, manure is characterized by a high content of environmentally hazardous substances: ammonia, hydrogen sulfide, mercaptan, phenol, salts of heavy metals, etc. So much manure is produced on livestock complexes that it is often not even used as fertilizer, but accumulates on the territory of farms [6,8].

When processing manure into biogas and biohumus, in addition to the output of marketable products, there is also disinfection of products, since anaerobic fermentation provides deworming, loss of germination of weed seeds, suppression of pathogenic forms of microorganisms, increase in the fertilizer value of the produced product and production of biogas. The death of pathogens occurs not only due to the high temperature of the fermentation process, but also due to the bactericidal effect of volatile fatty acids formed at the stage of acidogenesis [8].

When processing waste in biogas plants, we obtain several types of marketable products. Biogas, which can be used either as a fuel for direct combustion instead of conventional natural gas, or for the production of electrical and thermal energy. Biogas can be stored, compressed, pumped, and used after additional purification: from H2S - to generate electricity, from CO2 - to refuel vehicles. Efficient biogas production is possible only when the total energy of the gas is significantly higher than the energy costs for its production. The residue after anaerobic digestion is environmentally friendly liquid and solid fertilizers, agronomically highly efficient, which increase yield by 40-50%. Carbon dioxide released from biogas during its purification can be used either for the production of carbon dioxide or for plant nutrition in greenhouses [6, 7].

Consumption of environmentally friendly quality agricultural products when using environmentally friendly (biological, not chemical) fertilizers will contribute to the health of the entire population. Biogas energy is generally less dangerous to the environment than traditional energy sources.

The disadvantages of biogas technology for farming are quite high capital, but one-time investments. The level of these investments depends on the capacity of the plant, equipment with modern automation and control means and the manufacturer of specific devices. The high cost of special equipment is also caused by the fact that due to the lack of sufficient demand it is produced in small quantities. The installation itself is most profitable when operated in the farm as additional equipment. Capital costs will be higher than in other countries due to the colder climate and the associated need to increase thermal insulation, which entails a large material consumption of the equipment. Also, part of the energy

produced will be spent on the plants' own production needs – for mixing and maintaining the temperature, and, firstly, unevenly throughout the year and, secondly, the colder the climate, the greater this part: heating the methane tank and heating the incoming mass to the mesophilic temperature in winter in colder regions can consume about 50% of the biogas produced. For comparison: in Denmark, where the average monthly air temperature is higher, this figure is 15 (for mesophilic) – 25% (for thermophilic fermentation) [7,8]. Such increased energy consumption for own needs, in turn, will reduce the share of profit received from the sale of energy.

Thus, improving the management of biogas production in Ukraine can be ensured by creating bioenergy clusters in the regions with the integration of artificial intelligence tools into the waste collection and processing system. The implementation of the experience of developed countries in the field of supporting the creation of biogas production, the development of biogas production technologies using automated waste collection and processing management systems, the production of biogas from waste from agricultural enterprises and households will increase the energy independence of the state, reduce the costs of households and agro-industrial formations for energy resources, reduce greenhouse gas emissions and provide agricultural producers with organic fertilizers.

References:

1. Методологічні основи та методи наукових досліджень у ветеринарній гігієні, санітарії та експертизі : навч.-метод. посіб. / [П. П. Антоненко, А. В. Доровських, М. П. Високос та ін.] ; Дніпровський ДАЕУ. – Дніпро : «Свідлер А. Л.», 2018. – 276 с. http://dspace.dsau.dp.ua/jspui/handle/123456789/963.
2. Милостивий Р., Високос М.П., Тимошенко В., Музика А., Другий В., Другий С., Черненко О., Іжболдіна О., Хмельова О., Гофман Г. (2020). Особливості формування та моніторингу мікроклімату в неутеплених корівниках: невирішені проблеми. *Теоретична та прикладна ветеринарна медицина* , *8* (2), 73-85. https://doi.org/10.32819/2020.82011
3. Розпорядження Кабінету Міністрів України; Стратегія від 08.11.2017 № 820-р «Про схвалення Національної стратегії управління відходами в Україні до 2030 року» https://zakon.rada.gov.ua/laws/show/820-2017-%D1%80#Text
4. Фурман, І., & Ксенчин, Д. (2024). УПРАВЛІННЯ ВИРОБНИЦТВОМ БІОГАЗУ З ВІДХОДІВ ПІДПРИЄМСТВ АПК ТА ДОМОГОСПОДАРСТВ. *Економіка та суспільство*, (59).
5. Biogas Road Map for Europe. – AEBIOM, European Biomass Association. 2009. – 24 p.
6. Hoyos-Seba, J. J., Arias, N. P., Salcedo-Mendoza, J., & Aristizabal-Marulanda, V. (2024). Animal manure in the context of renewable energy and value-added products: A review. *Chemical Engineering and Processing-Process Intensification*, *196*, 109660.
7. Foged H.L. Energy from cattle manure. Status, technology and innovation in Denmark. – Agro Business Park A/S, Niels Pedersens Alle 2, 8830 Tjele, 2012. – 40 c.
8. Wu, X., Nawaz, S., Li, Y., & Zhang, H. (2024). Environmental health hazards of untreated livestock wastewater: potential risks and future perspectives. *Environmental Science and Pollution Research*, *31*(17), 24745-24767.