«М.А. Гендельманның 110 жылдығына арналған «Сейфуллин оқулары–19» халықаралық ғылыми-практикалық конференциясының материалдары = Материалы международной научно-практической конференции «Сейфуллинские чтения – 19», посвященной 110-летию М.А. Гендельмана». - 2023.- Т.II,Ч.II.- Р. 185-187.

**UDC:620.98:662(045)**

# BOILER PLANT USING BIOFUELS

*E.K. Groshevik 4th year student of the specialty*
*Electrical engineering and power engineering*
*Scientific supervisor*
*Master of Technical Sciences, A.K. Zhumalieva*

*S.Seifullin Kazakh Agrotechnical University, Astana*

One of the main issues standing in the way of progress in the modern world is the issue of the development of energy based on access to energy resources.
The task of meeting the ever-growing energy needs of the world and national economies necessitates the development of renewable energy and, in particular, bioenergy. It is also dictated by the solution of global problems related to the limited reserves of fossil fuels and ensuring environmental safety — the fulfillment of the commitments made under the Kyoto Protocol.

Bioenergy carries new technologies that will require serious political and economic support from the state for the mass introduction of new types of fuels into the energy balance. Biomass accumulating solar energy in the form of hydrocarbons of plant origin serves as a raw material for the production of biofuels in solid, liquid and gaseous form, depending on the processing technology.

The popularity of biofuels is due to the energy security of any industrially developed country, including Kazakhstan [1]. Secondly, it is one of the directions of the fight against global warming by reducing greenhouse gas emissions and decarbonization [2]. Currently, all major modes of transport are trying to switch to the use of biofuels, since it is cheaper and environmentally cleaner in the combustion process in traditional engines. And the ever-increasing demand for biofuels can significantly affect the state of affairs in the energy market and the subsequent development of technology.

Overview of biogas production plants

The correct choice of a biogas plant plays an important role in the construction of a biogas plant [1]. There are three main types of biogas plants: a fixed dome installation, a floating dome installation and a tubular digester.
Installation with a fixed dome

A biogas plant with a fixed dome is the most common type. This boiler is built underground with a concrete hemispherical dome, as shown in Figure 1. A fixed gas tank is installed on the top of the digester. The installation works by

loading the slurry into the digester through the supply pipe, as shown in Figure 1 [3]. Mixing of the slurry in the digester is carried out by hydraulic changes during the suspension supply, wastewater discharge and gas use. The generated gas accumulates and is stored in the upper part of the digester [3], so the digester must be sealed [3]. The main advantages of this installation are a simple design, low construction costs, as well as a long service life – more than 20 years. However, due to the absence of a gas valve, the gas pressure is unstable

.

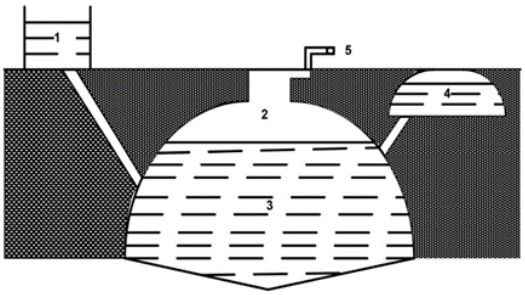


Fig. 1. Digester with fixed dome [4]
1-mixing tank with inlet pipe; 2 – gas tank; 3 - digester;
4 - expansion tank and outlet; 5 - gas pipe

Jerome Ndam and others [2] conducted an experiment to study the stability of a fixed-dome digester in the context of rural Cameroon. The productivity of biogas plants depends on local conditions in terms of climate, as well as the availability of water and manure. The studies were evaluated in terms of biogas production and digester performance. During the entire experimental period, the volume of manure supplied was 578.5 m3, and the total volume of biogas produced was 118.3 m3. One of the main factors that influenced the stable operation of this digester design in the local conditions of Cameroon was the lack of water for diluting manure. With a high concentration of solids due to the limited volume of water, additional mixing would be required to improve the biogas production process. To improve the stable operation of the digester, it is necessary to revise the design configuration in order to improve the mixing process in the digester. The geometry of the digester and the shape of the agitator affect the mixing efficiency [4].

Floating dome installation. The floating dome installation consists of an underground digester and a steel drum as a movable gas tank, as shown in Figure 2. The gas tank is mounted on a movable guide frame. The slurry flows through the intake pipe into the digester. The generated gas is collected in a gas holder, which rises or falls depending on the volume of gas. Due to the weight of the floating drum, the gas pressure is constant. The installation has a shorter service life compared to a fixed dome installation. In addition, regular maintenance is required due to corrosion of the steel drum [1]. A digester with a floating dome may have low biogas productivity, especially in winter compared to a stationary dome type. This may be due to heat loss through a steel gas tank. The digester is easy to operate and its construction carries higher costs compared to other types of bio-installations.

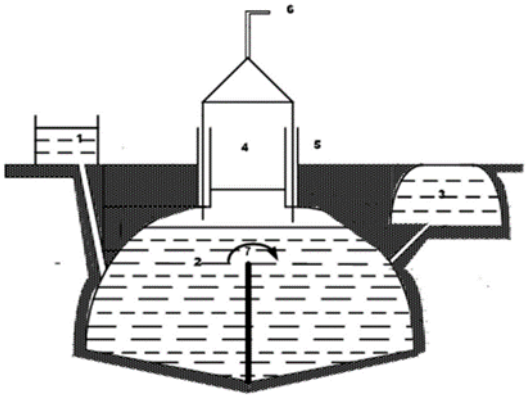

Fig. 2. Digester with floating dome [6]
1-mixing tank with inlet pipe; 2 – digester; 3 - compensation tank;
4 - gas tank; 5 - gas pipe

In addition, it should be noted that the performance of biogas plants depends on various factors, including temperature, pH value, loading speed of suspensions, etc. To improve the performance of biogas plants, it is necessary to maintain the optimal value of the above parameters [1]. The temperature profile plays an important role in the production of biogas [3]. An increase in temperature increases the daily production of biogas. The optimal temperature range is 35-60°C , as this can increase biogas production by 41-144 percent. Heat exchangers are often used to increase and maintain the optimum temperature in the boiler [3]. The volume of energy consumption for the heating system of a large-scale biogas plant is more than 70% of the total energy consumption [3]. Therefore, it is necessary to consider the issue of increasing the energy efficiency of the biogas plant heating system. Currently, different methods of heating the digester are used, namely the use of electric boilers, heat pumps and solar panels, collectors. The use of solar panels (collectors) for biogas digesters leads to a reduction in environmental emissions and total costs of biogas production. A sufficient number of experiments have been conducted in the production of biogas in a digester using a solar panel. The social and economic effect is confirmed by programs for the transition to a Green economy and support for renewable energy sources. The final consumers will be farms in which the installation of a new complex will significantly reduce costs due to the use of their own fuel.

## Reference

1 Ejiroghene Kelly Orhorhoro, Andrew Erameh. A Comprehensive Review on Anaerobic Digestion Plant [Text] /Nigerian Journal of Engineering Science Research (NIJESR), -2019. -№2(1). -P.13-28.

2 Yanfeng Liu, Yaowen Chen, Yong Zhou, Dengjia Wang, Yingying Wang, Daokun Wang. Experimental research on the thermal performance of PEX helical coil pipes for heating the biogas digester[Text] /Applied Thermal Engineering 147, 2019.

3Bakhtiar B.T«The International Conference on Communications, Information», Electronic and Energy Systems (CIEES 2022) will be held on 24th – 26th November[Text] / Mergalimova A.K., Korobkov M.S., Tursunbaeva G.U., Zhumalieva A.K. // Veliko Tarnovo, Bulgaria, 2022. https://www.scopus.com/authid/detail.uri?authorId=57219651463