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# MOBILE BIOGAS PLANT FOR AGRICULTURAL WASTE DISPOSAL AND BIOGAS AND ORGANIC FERTILIZER PRODUCTION

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The task of implementing the food security program is considered one of the priorities for the country's development. To solve it, it is necessary to provide agriculture with available energy resources and fertilizers. It is advisable to use available local energy resources that have sufficient energy potential. Recently, agricultural waste has been increasingly used as a stable, cheap local energy resource due to its accumulation in places where energy resources are consumed. Their significant energy potential and, as a rule, the homogeneity of the composition make it possible to obtain relatively high-quality biogas by decomposing waste in bioreactors. Biogas technologies have become widespread in the world due to their relative simplicity, cheapness and the possibility of obtaining not only a valuable energy fuel, but also a high-quality fertilizer as a technological by-product. On average, 25-35 m3 of biogas can be obtained from one ton of manure, about 60% by volume. methane It should be noted that traditional methods of utilization of agricultural waste do not involve the use of their bioenergy potential and are limited to partial removal to the fields for use as fertilizers. When storing waste, this leads to the appearance of unpleasant odors, breeding of insects, washing and contamination of water bodies with harmful substances and microorganisms. Pig and poultry farm wastes are used as fertilizers on a small scale due to sanitary and technical difficulties in their storage and disposal. The lack of organic fertilizers is partially compensated by the use of expensive imported mineral fertilizers. Thus, biotechnological processing of agricultural waste allows simultaneously solving energy and environmental problems - obtaining biogas, as well as high-quality environmentally friendly fertilizers [1, 2].

Currently, considerable material has been accumulated on the introduction of technologies for anaerobic processing of agricultural waste and the use of biogas and fertilizers obtained from agricultural waste. Based on literature data [17], several classifications of biogas plants can be given 1. By raw materials used: • sewage precipitation • agricultural waste a. of plant origin b. of animal origin 2. By energy production: • Thermal • Electric • Combined (thermal and electric) 3. By degree of mobility: • Stationary • Mobile 4. By power • Mini (5-10 kW) • Small (10-75 kW) • Medium (75-150 kW) • Large (>150 kW) Among developing countries, the production of energy and heat using waste processing in small biogas plants is common. Around 16 million households around the world use energy produced in biogas plants for lighting, heating and cooking. These are primarily 12 million households in China, 3.7 million households in India and 140 thousand households in Nepal [2]. In rural China, more than 50 million people now use biogas as their primary energy source. A typical biogas plant has a reactor volume of about 6-8 m3, produces about 300 m3 of biogas per year during 3-8 months of annual operation and costs about $200-250. Biogas technologies can be effectively operated in any climatic region. The energy of chemical bonds of this amount of biomass is equivalent to 8.1 billion tons of conventional fuel. As evidenced by the above data, plant production waste (straw, stalks, husks, etc.) occupies the largest mass among the organic wastes of agriculture. Their processing into biogas simultaneously with livestock and poultry waste requires the development of universal biogas technology and appropriate equipment [3]. Power supply of the smallest farms from centralized sources, most of which are located in hard-to-reach areas, is impractical due to small electrical loads and complexity and road connection to electrical networks. The task of creating biogas plants with a capacity of 2-10 kWh is extremely important for agricultural regions. Their creation does not require special equipment and materials. Production can be set up at home using existing infrastructure. Therefore, world experience in the creation and operation of installations of this class is very important. It should be noted that only recently have small biogas plants been built abroad. Various electrical equipment is used in the personal household (OPG), the composition of which is determined by the number and types of domestic animals and poultry, the amount of land used, and the presence of greenhouses. Incubators, irradiators, brooders, various types of electric root cutters, mowers and other electrical equipment are used in livestock specialization of the farm. In crop production, electricity is spent on irradiating seedlings, heating greenhouses, greenhouses, and watering the garden. Compensation of thermal energy losses in the methane tank is carried out due to the utilization of the heat of the power plant. Because of the intensity of the process of anaerobic fermentation of methane, it is necessary to choose the most effective way of maintaining the temperature regime. A heat exchanger using pipes on the outer surface of the methane tank was chosen as the heating system of the bioreactor. This method allows you to significantly increase the temperature of the coolant, carry out system repairs without stopping the bioreactor, eliminate the sealing of passage nodes, which is a link that reduces the reliability of the system, reduce the sticking of particles due to the absence of additional surfaces, and significantly simplify the design and installation of the heating system. It is proposed to ensure the mobility of the biogas plant by placing all components in dry cargo sea containers of various sizes, which can be delivered even to the most remote areas by road transport. In addition to the two bioreactors, there is also a loading device, a shield with electrical equipment and control equipment. The installation for obtaining biogas with a low productivity (up to two centners of substrate) and a small volume of the reactor (no more than 10 cubic meters) is actively used in small family farms or in summer cottages. The pressure of the obtained gas is very low (up to 0.05 kg/cm$^2$).

Therefore, in such systems, the gas holder is a plastic container or even a rubber chamber. These materials fully correspond to the pressure of the system and successfully cope with the mixing and balancing of the gas. The use of metal tanks in this case is unnecessary and financially unjustified. Gas holders made of plastic or rubber are used in developed countries to collect biogas in combined plants, where an open container serving as a reactor is covered with plastic. The gas holder will be installed on the roof of the container with the power plant in a metal protective box with perforated walls to protect against mechanical damage. Biogas can be used to obtain energy in various ways, but according to the data of the work [3], heat engines operating according to the Diesel cycle are optimal for obtaining energy, with their help, when the content of methane in biogas is more than 50%, it is possible to obtain the most energy for transmission to external network. The proposed mobile biogas plant requires a diesel plant with an installed capacity of 3.5 kW located in a separate container. Diesel generators with power from 2 to 5 kW are widely represented on the market. To reduce the risk of fire, the elements of the biogas plant must be divided into fire protection sectors. The distance that must be observed between sectors depends on the volume of the tank and the choice of material for the walls of the structures. The fire distance from ground gas holders to other elements of the installation can vary from 3 to 20 meters. Potential sources of ignition can be electrical and mechanical sparks, open flames, hot surfaces, and static electricity.

The biogas potential of agricultural waste generated in personal homesteads was determined. The area of land planted with potatoes, necessary for the generation of the required amount of waste, was calculated. The energy consumption of the bioreactor, the required power of the stirrers for mixing the substrate in the reactors was calculated. The scheme of the mobile biogas plant was substantiated and the main components were selected: bioreactors, gas holder, biogas purification unit, power plant. A simulated container in which bioreactors are placed.

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## INCREASE OF WEAR RESISTANCE USING THE TECHNOLOGY OF FELTING OF METALLIC COATINGS

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In modern conditions of the market economy, the requirements for the accuracy and reliability of machines and equipment in the agro-industrial complex are increasing. Significant material and labor resources are required to carry out repair and restoration work of units and aggregates that have failed, which is especially relevant when using imported production equipment. Cold methods of electrochemical restoration, as practice shows, are able to ensure the necessary surface accuracy during the manufacture and repair of parts. To determine the influence of the characteristics of plasma reflow on the properties of the sprayed coating after reflow, it is convenient to use a tool such as mathematical modeling, which allows you to determine the temperature distribution of the composition, the thermal processing cycle and the rate of heating and cooling of the material [1].

The nature of the thermal cycle determines the features of the structures and properties of the material formed as a result of surface treatment. Information about the temperature fields formed in the material under the influence of the heating source allows to predict the geometric parameters of the processing zone, the nature and degree of completion of phase transformations, as well as the structure and properties of the strengthened layer. Thus, in order to select rational modes of plasma treatment of a gas-thermal coating, it is necessary to know the temperature distribution in the coating and substrate during the heating and cooling process. Experimental determination of temperatures in the process of high-speed heating is associated with great difficulties (inertia of the equipment, small coating thickness, high temperatures, etc.). Therefore, the calculated determination of temperatures in a composite material under the influence of a plasma heating source is of great practical and theoretical importance [1, 2].

To select the parameters of the processing regime and predict the abrasive wear resistance, due to the change in the structure of the coating, a mathematical model of plasma melting of a two-layer material was built by solving the boundary value problem of thermal conductivity by the Green's function method. The stages of building the model include: analytical solution of the heat conduction equation through the Green's function, analysis of the influence of the parameters of the plasma treatment mode on the geometry of the reflow zone, and assessment of the structural state of the coating to determine the material with greater resistance to abrasive wear. To determine the influence of the parameters of the plasma melting mode on the temperature distribution in the "coating - base" composition, a number of calculations were carried out with a change in one processing parameter and the constancy of others. Since the voltage in plasma processes is a function of the parameters of the processing mode, and this influence is not taken into account in the developed model, we will take it as the average in the range of values of the used currents of 150-180 A, according to experimental data [2]. To prevent peeling of the coating and increase its adhesion, it is necessary to ensure the melting temperature on the surface of the substrate [2], while in order to reduce the