PAPER • OPEN ACCESS

Analysis of laboratory results in anaerobic processing in poultry dung reduction regime

To cite this article: K E Usmanov *et al* 2021 *IOP Conf. Ser.: Earth Environ. Sci.* **868** 012049

Analysis of laboratory results in anaerobic processing in poultry dung reduction regime

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Abstract. At present, a lot of attention is paid to the increase in the economic performance of energy devices based on types of energy to obtain renewable energy as a result of processing of organic waste in an oxygen-free environment, in a relatively short time. The article provides extensive reviews on the study of the physical, chemical and other properties of poultry manure to solve many technological problems of its processing, introduction and storage. Studied the anaerobic processing of poultry droppings by the thinning mode, the analysis of the results obtained on the experimental setup. The results obtained at the experimental plant are compared with the values obtained as a result of theoretical calculations, and an analysis of the experimental and calculated values of the amount of biogas obtained from the bioreactors is given. In general, the amount of biogas from bioreactors and the quality of organic fertilizers determine the cost-effectiveness of the anaerobic process. When the results obtained in the experimental laboratory device are compared with the values obtained by theoretical calculations, it can be seen that the difference between the experimental and calculated values of biogas from bioreactors did not increase by 4%.

1. Introduction

In the world practice, the main part of poultry products, except for eggs, meat and feathers, is given great importance to organic waste. One of the important tasks is to ensure high efficiency in the production of alternative energy and bio-fertilizers as a result of their anaerobic processing, with special attention to environmental, epidemiological and ergonomic indicators in storage and feeding areas.

At present, a lot of attention is paid to the increase in the economic performance of energy devices based on types of energy to obtain renewable energy as a result of processing of organic waste in an oxygen-free environment, in a relatively short time. Carrying out targeted research in this direction, including anaerobic processing of pure poultry manure in the anaerobic process and selection of processing modes and construction of the devices carrying out it without introducing additional products into the organic waste of poultry and ensuring its operation in a highly aggressive environment, and the automatic management of the process is one of the important tasks [1 - 4].

IOP Conf. Series: Earth and Environmental Science **868** (2021) 012049 doi:10.1088/1755-1315/868/1/012049

2. Problem statement

Currently, much attention is paid to improving the economic performance of energy devices based on renewable energy sources as a result of relatively short-term processing of poultry organic waste in an oxygen-free environment. Targeted research in this area, including the selection of operating modes of anaerobic processing of pure poultry manure in the anaerobic process and its equipment without the addition of additional products to poultry organic waste, and the operation of the design in a highly aggressive environment. One of the important tasks is to improve the performance and introduction of modern types of such devices.

Extensive measures are being taken to ensure that the main products of poultry waste do not adversely affect the climatic conditions, environmental and sanitary epidemiology, to ensure the productivity of agricultural products as one of the main factors contributing to production. On the basis of the Action Strategy for the Further Development of the Republic of Uzbekistan for 2017-2021, "... a systemic measure to modernize agriculture, mitigate the negative impact on agricultural development and livelihoods in order to strengthen macroeconomic stability aimed at global climate change, further development and liberalization of the economy The task is to "take action." In this regard, the rational use of poultry waste is one of the important tasks of scientific research on the development of methods and devices for anaerobic processing of poultry waste in a short period of time, without compromising its quality, taking into account global climate change. Recent Government decisions and the focus on every aspect of it for rapid development are critical to improving energy efficiency by optimizing renewable energy-based energy devices.

3. Experimental methods

In order to process poultry manure and ensure its continuity, it is necessary to determine the amount and duration of thinning in which state of the anaerobic process [5 - 7]. To do this, the chemical reactions that take place in the anaerobic process were analyzed. This is because it is possible to adjust the amount of ammonium in the sequence that takes place during the reactions [8 - 12].

The experiments were during by multifactor laboratory device. Multifactor laboratory device consist: bioreactor 1, heating systems 2, drain pipe 3, mixing pump 4, biogas transmission line to the gas holder 5 (Figure 1).

Figure 1. Multifactor laboratory device:1-bioreactor, 2-heating systems, 3-drain pipe, 4-mixing pump, 5-biogas transmission line to the gas holder.

For the introduction of poultry manure into the anaerobic process, a number of laboratory experiments were conducted in different sizes of the dilution regime and in the pressure ranges of the released gas (-0,05...1 kg / cm^2) and in the temperature regimes.

Poultry manure imported from the Piskent Poultry Factory in the Piskent district of the Tashkent region for testing in November 2016 at the request of the experiment did not change during 8 months of storage in the laboratory. No gas leakage was felt even when the lower limit of the temperature regime changed to 16^{0}S and the upper limit to 28^{0}S. Therefore, in order for the anaerobic process in bioreactors to proceed smoothly, it became necessary to monitor not only the temperature regime but also the microbiological process. There are two ways to do this:

- First, the microbiological selection of the optimal composition of the biomass for the anaerobic process during the daily loading of bioreactors;
- Absorption of biomass from the initial treatment period of pollutants in the amount of daily load on bioreactors.

Poultry manure loaded on the laboratory device was tested at different temperature regimes, ie at temperatures from 16^{0}C to 97^{0}S, and the results were observed. During the experiments, the method of dilution (absorption of foul gases) was used in the bioreactor [9, 10].

The results of the experiments are summarized in Figure 2. Poultry manure loaded into the laboratory biogas plant (Figure 1) resulted in the release of biogas from the process as it was loaded into a moderately functioning laboratory plant despite being stored for different durations (5,10,20,30, 50 days). However, it has been shown that this duration depends on the daily amount loaded on the bioreactor, the temperature, and the dilution regime. In many of our analyzes (experiments in 2009, 2012, and 2014 without attenuation regimes) we have seen that in any technological regime, biogas production or poultry manure introduced into the anaerobic process is switched to at least 45...60 days of fermentation. Experiments carried out in the laboratory device in the mode of dilution showed that the time of introduction of poultry manure into the anaerobic process was also reduced to 9...12 days [13-16].

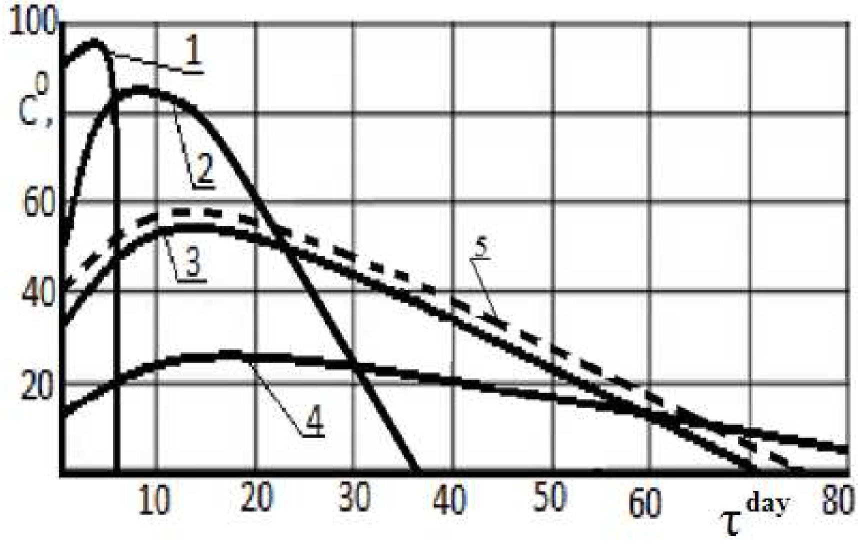

Figure 2. Biogas separation of organic waste from anaerobic processing at variable temperature. Temperature mode: 1 at boiling water temperature, 2-thermophilic (54 ± 2^0S), 3-mesophilic (36 ± 2^0S), In cases with 4 psychrophilic (15 ± 2^0S).

As can be seen from Figure 2, in the temperature regimes of poultry organic waste introduced into the anaerobic process, it is necessary not only under the influence of heat, but also the presence of residual microorganisms in it and the creation of conditions for their metabolism. Experiments have shown that poultry organic waste loaded into the bioreactor begins to emit foul gases from the initial period of loading into the bioreactor at a boiling water temperature (96 ± 2^0C). The composition of the obtained biogas showed a sharp decrease in methane (SN_4) gas (Figure 2, curve 1), and from 5 to 6 days, the production of biogas stopped completely.

Subsequent observations in the experimental laboratory showed an increase in the amount of biogas from the first day of processing of poultry manure in thermophilic mode. However, a relatively large proportion (62...64%) of the commodity biogas obtained was used to maintain the temperature regime in the bioreactor, and the duration of the biogas obtained from the bioreactor was not stable (Figure 2, curve 2). This showed that only the unconcentrated portion of poultry manure introduced for biogas production, which has a short duration of decomposition in the anaerobic process, enters the anaerobic process faster.

In our next experiments, organic waste of poultry was carried out at a mesophilic (36 ± 2^0C) temperature regime. Experiments carried out at this temperature regime showed that the amount of methane (SN_4) gas in the obtained biogas was relatively stable (Figure 2, curve 3) and increased to 67...72%. In the experiments, it was found that the duration of biogas production is a bit longer, and the composition of the obtained biofertilizer also fully meets the requirements of anaerobic processing.

The duration of the anaerobic process that takes place in the psychrophilic temperature regime is very time consuming (Figure 2, curve 4) and leads to the accumulation of organic waste in sources that generate organic waste, and it can be seen that the amount of biogas produced is relatively small. In general, the amount of biogas from bioreactors and the quality of organic fertilizers determine the cost-effectiveness of the anaerobic process.

When the results obtained in the experimental laboratory device are compared with the values obtained by theoretical calculations, it can be seen that the difference between the experimental and calculated values of biogas from bioreactors did not increase by 4% (Figure 2, curve 5).

4. Conclusion

The amount of methane (SN_4) gas in the obtained biogas was relatively stable and increased to 67...72%. In the experiments, it was found that the duration of biogas production is a bit longer, and the composition of the obtained biofertilizer also fully meets the requirements of anaerobic processing. The duration of the anaerobic process that takes place in the psychrophilic temperature regime is very time consuming and leads to the accumulation of organic waste in sources that generate organic waste, and it can be seen that the amount of biogas produced is relatively small. In general, the amount of biogas from bioreactors and the quality of organic fertilizers determine the cost-effectiveness of the anaerobic process. It has been found that the introduction of biomass from the initial treatment period and the introduction of the dilution method in test equipment have a direct impact on biogas production.

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