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HIGH VOLTAGE IMPULSE TO ORGANIC WASTE ANAEROBIC TREATMENT DEVICE WITH CURRENT SUPPLY

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Abstract:

In the article, the amount of accumulated technical water in the waste is from 20% to 100% when the barn floor is cleaned with dry mechanical devices, mechanical tape or self-flowing (samatek) systems, if the ways of cleaning the waste of the barns are troughs or special waste exits instead of troughs (if it is limited to kiya ariks), then the floor is in a dry state, and if the waste in the novariks is cleaned using water, then the volume of water in the waste is 200-250%. In order to ensure the continuous anaerobic process of organic wastes of this composition, we have proposed and obtained a patent for a step-by-step treatment method and device.

Keywords:

Organic waste, anaerobic process, biomass, in thinning mode, animal farms, bulk feed, recycling, microclimate improvement.

Anaerobic processing of agricultural wastes (cattle manure, poultry, sheep, goats, horses, plant residues, etc.) and extraction of energy and fertilizers from them are ancient technologies in world practice. Practitioners have formed the need to recycle organic waste as soon as possible on the basis of several centuries of experience [1,2,3,4]. As the composition of organic wastes is innumerable, the types and types of them require more methods of processing, and they cannot be processed in the same conditions and methods [3,4]. Many practitioners provide opinions, experiences and conclusions about anaerobic digestion under various weather and temperature conditions.

The climatic conditions of the Republic of Uzbekistan and the composition of local organic wastes for the anaerobic process were thoroughly analyzed in the 90s of the last century, and in those works, the necessity of processing all organic wastes based on climatic conditions was mentioned [1,5]. In addition to these, in livestock farms, which are a source of organic waste, the product obtained from them can be increased by up to 30% by enriching the fodder given to livestock. Therefore, the amount of organic waste left after the total treatment of livestock farms is 15-16%. When water is added to such products, which are considered organic waste, or if they are washed and cleaned by technology, their volume increases by 2 ... 5.0 times compared to the initial state, and chicken and piggery waste increases by 3 ... 6 times. The average daily amount of organic waste (excrement) from cattle is presented in table 1 in the analyzes for cattle raised in the climatic conditions of Uzbekistan [5].

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Table 1.
The average amount of excrement taken daily from animals raised in the climatic conditions of Uzbekistan

Wastetype	Bulls, moon	cows, moon	Calves from the 4th month up to 6 months	Young			
				6 to 12 months	6 to 12 months	8 months to 12 to the moon	from 12 months big
Mixed waste (mechanized)	30	35	5-10	10	14 -15	20-20	23-18
Urine	10	20	5	4	7	13	9
Waste (hydraulic)	45	35-45	2-10	4 -15	5 - 24	17-25	50-60

The average moisture content of the product: 88% in lactating cows, 86% in bulls, young cattle and one-month-old calves, and 16% of the remaining dry product after total processing. In our research, it was observed that the daily accumulation of livestock and poultry waste, which is the main source of organic waste, and their accumulation in feedlots due to improper selection of processing equipment (Figure. 1).

Figure 1. Due to the daily accumulation of the amount of livestock and poultry waste and their accumulation in feedlots due to the incorrect selection of equipment for their processing.

In our research, the daily, monthly, quarterly and annual amount of organic waste was analyzed from the farm studied in Qarvulbazar district for the installation of a biogas plant, which is planned to be built on the basis of the State Address Program. According to it, it was determined that the total volume of organic waste collected for one day, except for the waste of suckling calves up to three months, is 25 ... 25.5 tons. For the bioreactors proposed for the anaerobic processing of such quantities of biomass, there was a need to derive the pretreatment time and its loading requirement.

It is reported that the non-processing of such biomass in a short period of time leads to an increase in the daily amount of greenhouse gases released from them in the form of a

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geometric progression [4,5]. The moisture content of the waste coming out of the boxes that are being cleaned by placing bedding products on the bottom of the farm:

- 78 - 72 - 68% in calves if they are kept loose;
- the kiss stored in the wrapping state is variable depending on the storage conditions, it can change by 72 - 79%;
- 69 - 71 - 70% of the cattle are kept in untied beds;
- it was determined that one cow's clean waste coming out of the milking places of cows in farms is 20 liters, and the daily average pollution of this waste is 2-3%.

It was found that the total volume of organic waste of the farm is 0.7 - 0.8 thousand m3, and the remaining product after processing is 17.3%, moisture content is 55 - 60%.

Summarizing the above, the daily waste output (B_e, kg) can be determined using the following formula:

$$B_e = \sum_{j=t}^{j=m} (B_{aj}, n_j, m) \qquad (1)$$

where: B_{aj}- one days worth of cattle waste (bulls, dairy cows or strait cows); n_j - cattle (bulls, dairy cows or cows) on the farm at one time; m is the number of cattle on the farm.

To improve the microclimate in livestock houses, different bedding can be laid. These mats absorb the moisture of waste from the cattle and improve the living conditions of the cattle. The mats reduce the adhesion of animal waste to the animals, which means that when the waste lands on the mat, it becomes more easily shed. In such cases, the beddings falling into the barns are analyzed and their quantity should be taken into account in the rater. In modern farms, the largest volume (quantity) of water is used for washing and disinfecting technical equipment, floors in barns. In stables that do not throw litter, hydraulic equipment is used to clean waste, but to do this reliably, technical water is also needed. Technical water, after cleaning the waste from the bottom of the cattle, falls into a special channel, a channel where a hydraulic belt (transporter) moves. Technical water, in turn, has a (significant) effect on the volume and quality of waste. When cleaning the floors of barns with the help of dry mechanical devices, mechanical tape or self-flowing (samatek) systems, the amount of accumulated technical water in the waste is from 20% to 100%, if the ways of cleaning the waste of the barns are troughs or instead of troughs, special waste exit paths (kiya ditches) is bounded by if the floor is in a dry state and the waste in the novariks is cleaned with water, then the amount of water in the waste is 200-250%. In order to ensure the continuous anaerobic process of organic wastes of this composition, we proposed a step-by-step treatment method and device and obtained a patent for it [6].

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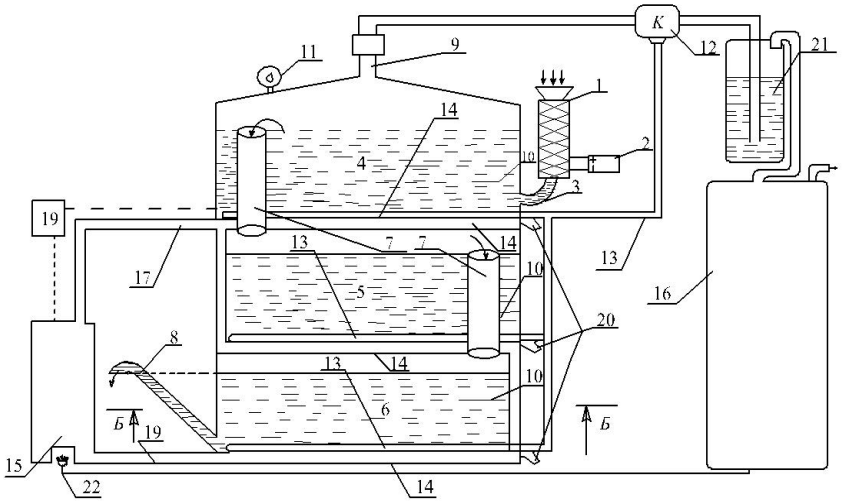

Figure 1. The principle scheme of the step-by-step organic waste treatment device:

1 – organic waste preliminary preparation tank; 2-high pulse current generator; 3 loading pipe; 4, 5 and 6 – first, second and third stage treatment vessels; 7, 8, 9, 17, 18, 19 pipes; 10,11–temperature and pressure measuring sensors; 12-compressor; 13-bubble pipe; 14-heater; 15-boiler; 16-gas holder; 20–drainage tap; 21-water filter; 22-heater.

The organic waste brought from the farm is loaded into the preliminary preparation tank (1) and here the liquid organic waste saturated with methane bacteria taken from the separator is brought to a moisture content of not less than 92-94% and mixed at the level required for the active operation of methane bacteria. In the initial preparation vessel (1) with the help of a high-pulse current generator (2), the pre-treated biomass is loaded into the first stage of the bioreactor (4) through the loading pipe (3). When the amount of biomass in the first stage (4) reaches the line at the top of the pipe (7) connecting the stages, it flows into the next stage and fills the next stage (5), then moves to the third stage (6) and until it is full, i.e. biomass will continue to be loaded into the first stage until the organic waste flows out of the biomass discharge pipe (8). At the same time as filling the bioreactor, the biomass in it is heated with hot water coming from the boiler (15) through the pipe (19) and mixed with the biogas coming under pressure from the barbatage pipes (13). During the initial filling of the bioreactor, the daily amount of the loaded dose is determined taking into account the thermal expansion of the biomass. The volume of the daily loading dose placed in the bioreactor depends on the processing technological requirements and the possibility of its collection source. The pressure of the biogas released in the bioreactor is between 0 - 0.03 MPa (in the dilution mode) and is designed for the holding mode in the dilution state through a constant compressor (12). Additional substances in the biogas produced in the bioreactor (water vapor, partial carbon dioxide and sulfur compounds, etc.) are cleaned using a water filter (21), and then the biogas is collected for storage in the gasholder (16). The processed organic waste is discharged through the discharge pipe (8) at arbitrary pressure in the principle of interconnected vessels and is ready for delivery to the separator. Dewatered (34 - 42%) thick organic waste in the separator is sent to the storage place, and the liquid (moisture not less than 99%) watery part is sent to the loading pipe (1) of the device in order to

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bring the humidity of the new biomass to a state not less than 92%. In order to mix the biomass in the bioreactor in case of need, the barbatage method was additionally used and adapted to supply biogas through the pipe (13) along the surface of the biomass in the bioreactor. Pressure sensors (10 and 11) were installed to control temperature and pressure in the bioreactor. In order to analyze the biomass in the bioreactor at the level of technological requirements along the steps, special drain taps (20) are installed in the device. All technological processes in the bioreactor and operating modes of the device were controlled based on the EHM program [7]. The presence of biomass in sequential anaerobic processes (in a bioreactor - hydrolysis, acid formation, methanogenesis) made it possible to maintain the quality level of biofertilizer, and this took the form of a biogas plant operating in a continuous system. One of the main achievements of the device is that the daily amount of biomass is divided into several parts and sequentially loaded during the day, which affects the amount of biogas obtained, and this was monitored in the pressure sensors (10 and 11) for control in the EHM program line. In the bioreactor, the biomass mixing mode is carried out through the bubble pipe (13) with the help of the pressure generated by a quantity of biogas in the compressor (12). As a result of our research, it has been shown that loading the daily amount of organic waste into the bioreactor in several parts at certain time intervals during the day is highly effective. The proposed method and device made it possible to speed up the anaerobic process up to 2.8 times compared to similar devices and improve the quality of organic waste.

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