ANALYSIS reactor designs
For solid state fermentation

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Abstract.*In work the analysis of nuclear reactor for processing solid organic waste into biogas and biofertilizers with their structural strengths and weaknesses.*

Keywords: reactor, solid phase fermentation, biogas, bio

Formulation of the problem. Reducing natural reserves of conventional fuels encourages society to reflect on the problem of finding alternatives biofuel. Recycling food waste today is one of the areas of reduction and more power features that you can use during processing of vegetables and fruits.

Each year, 7 mln. Tonnes of food waste directed to landfills. Experts estimate that one third of food raw materials lost in the production process, another third - during implementation and during cooking, the rest are sent to dumps directly to households. [9] Therefore, research on processing of organic food waste through the use of solid-phase fermentation reactors is relevant.

Analysis of recent research. Solid state fermentation takes place in solid, granular or paste medium with substrate humidity from 30 to 80% [2].

One of the most widespread local food is potatoes, which are grown every year in Ukraine an average of 20 mln. Tons. By its content it is composed of water, proteins, fats, carbohydrates and fiber (Fig. 1) [8]. Out of biogas from 1 ton of fresh potatoes is from 160 to 200 m3 / t with methane content of 50 to 52% [8, 10]. Because potato processing residues and wastes potato dishes are relevant.

The most common types of solid fermenters, bioreactor type tray; bioreactor with compacted layer; bioreactor type of drum that rotates; solid phase bioreactor that

rocks; in a bioreactor tanks with agitator; solid phase bioreactor with air psevdorozridzhenym layer (Table. 1) [1].

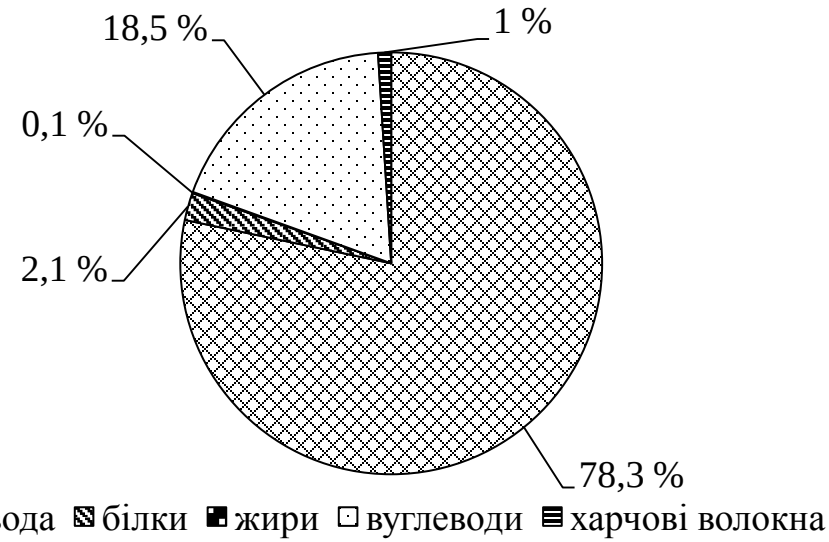

Fig. 1. The components potatoes.

1. Types of solid fermenters and their weaknesses.

Type fermenter	Shortcomings
lotkovyy	– allowed external contamination by microorganisms; – reactor has significant size and require significant expenses for its operation.
of the densified layer	– granular substrate - a significant heat leads to slower growth of micro-organisms; – constant aeration dries the substrate.
rotating	– in the middle of a moving substrate are shear, leading to the destruction of fungal structures (mitseliumu, sporanhiumu, fruktovehetatyvnoyi weight); – continuous movement of the fermenter can cause agglomeration of wet substrate; – surface required for communication with the external environment (inlet pipes and exhaust, pipe water supply), which can be a source of contamination.
oscillatory with a mixer	– limited volume fermenter. – problems with the use of significant amounts substrate, because it can not move uniformly without causing destruction of the structure of the substrate.
psevdorozrid with air-layer zhenym	– requires a relatively large volume reactor and significant energy costs.

The purpose of research is the analysis of nuclear reactor for solid-phase fermentation.

Results. The analysis of existing designs of reactors to produce biogas showed that the most common designs for fermentation liquid or a combination of solid and liquid phase fermentation.

A patent search revealed that solid-phase fermentation using a reactor using a modular type tray bases (Fig. 2) [1]. Model of the fermenter is easy to use: trays with substrate easily loaded and unloaded from the

reactor, which also facilitates its decontamination. But it is also a downside to this reactor since it leads to significant downtime in furthering loading, unloading biomass and disinfection or washing the reactor, which in turn will negatively affect its performance.

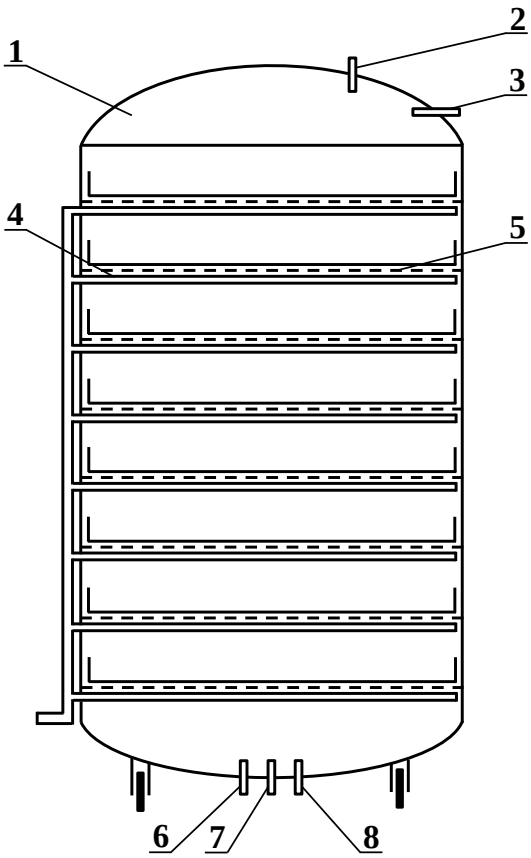

Fig. 2. The solid fermenter [1] 1 - a cover; 2 - pipe for the exhaust; 3 - hole for seeding fermenter; 4 - pipe to cool the substrate; 5 - 6 modular basis - pipe for air supply; 7 - pipe for water supply; 8 - pipe water supply of sowing material of microorganisms.

For the treatment of solid organic waste there fermenter [3] (Fig. 3), which takes into account all the key aspects of biogas even managed to combine the reactor with the gas container in a design that accordingly it complicated. The disadvantage is also considerable distance transportation biosyrovyny the reactor.Biomass unloading system implemented by installing a screw unloaders on the bottom of the reactor, which also passes through the nozzle boot heater and moisture removal system that does not allow for maximum-quality bio-discharge.

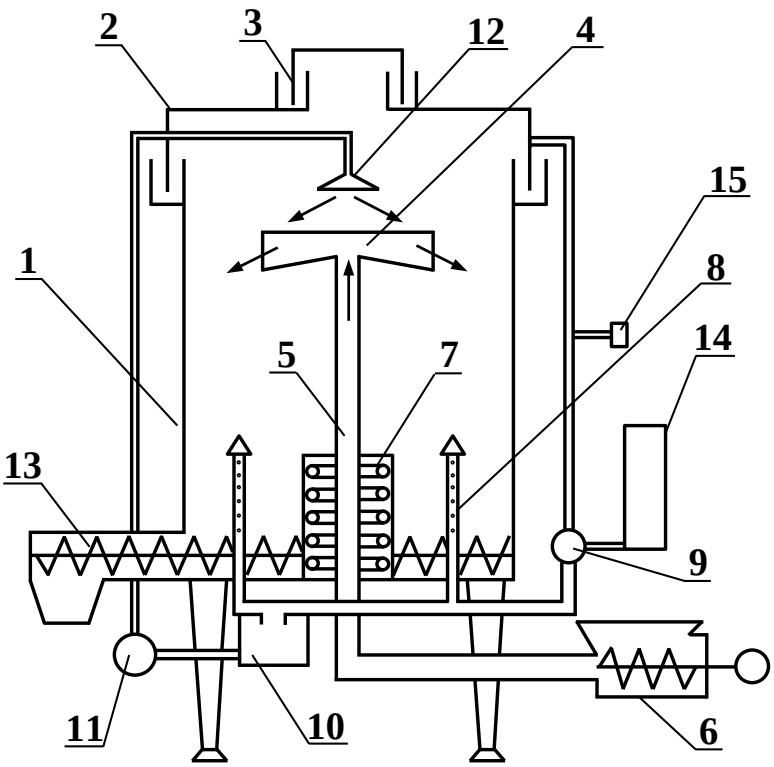

Fig. 3. fermenter [3]: 1 - the case; 2 - cover; 3 - gasholder; 4 - distributor; 5 - pipe loading; 6 - a device for loading; 7 - heater; 8 - bubbler; 9 - compressor; 10 - innokulyator; 11 - innokulyatora pump; 12 - sprayer; 13 - screw discharger; 14 - the capacity to collect fuel; 15 - air intake.

The biogas reactor [4] (Fig. 4) ensures the continuity of the process of production of bio-fertilizers and biogas, but it also has a significant drawback, namely grid-iron lattice with holes, which means that the biomass, which is located on the grid will be deleted wet. When the weight is moved to the second grid reactor, the moisture will be even less, and it will negatively affect the performance of the reactor for the production of biogas.

The biogas reactor [5] (Fig. 5) has projected system biomass unloading, but using auger biosyrovyny distribution in the reactor does not allow it to perform equally to the same performance leads to mixing spresovuvannya biomass.

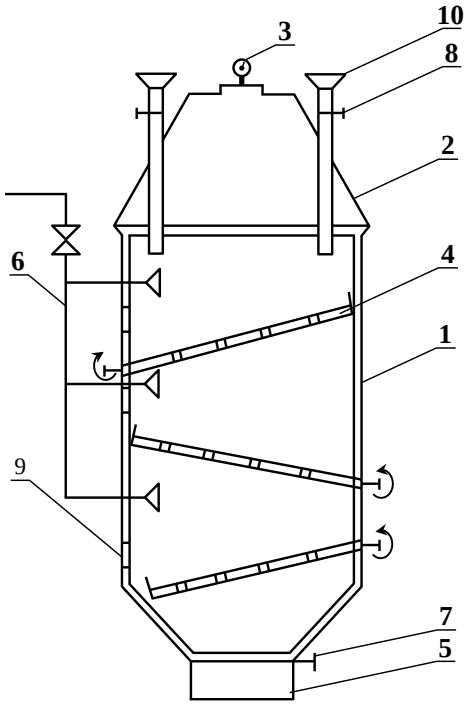

Fig. 4. The biogas reactor [4] 1 - tank; 2 - cap; 3 - gauge; 4 - failing grid-iron lattice with integrated heater; 5 - capacity to collect bio; 6 - trumpet consumer; 7 - flap; 8 - valve; 9 - viewing window; 10 - Mine download biomass.

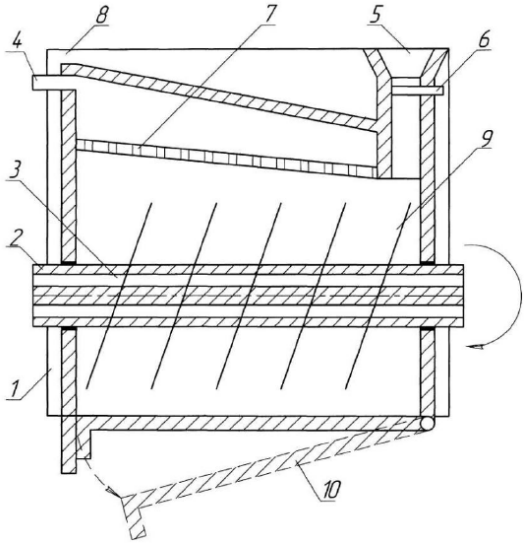

Fig. 5. biogas reactor [5]: 1 - tank; 2 - shaft; 3 - heater; 4 - fitting biogas drainage pipes to the consumer; 5 - bin loading; 6 - Gate valve; 7 - Protective gas distribution grid; 8 - the case; 9 - screw mixer; 10 - the bottom of which is pivotally attached to the body.

Existing combined fermenters (Fig. 6, Fig. 7) [6, 7] operate on one principle: a structural element in Fig. 6 to install for solid and liquid fermentation of organic waste a screw conveyor, and digesters (Fig. 7) - scraper used for the loading and transport of solids through a liquid phase

reactor. However, the use of such reactors, in the presence of significant amounts of solid biomass, is impossible.

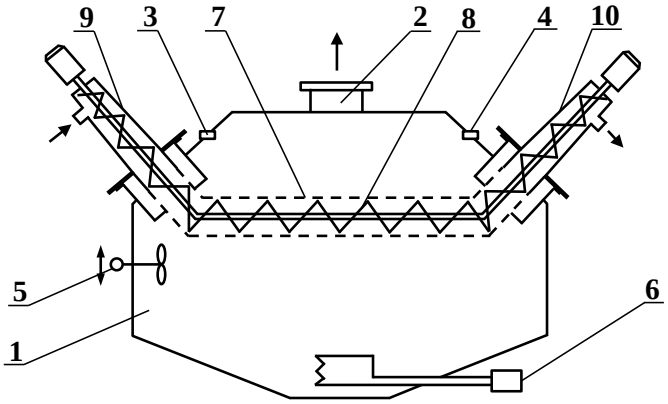

Fig. 6. Installation for digestion of solid and liquid organic waste [6]: 1 - reactor; 2 - pipe gas to exit; 3 - pipe loading of liquid organic waste; 4 - pipe discharging liquid organic waste; 5 - a device for mixing; 6 - device for heating; 7 - perforated container; 8 - the screw; 9 - unit loading of solid organic waste; 10 - node unloading of solid organic waste.

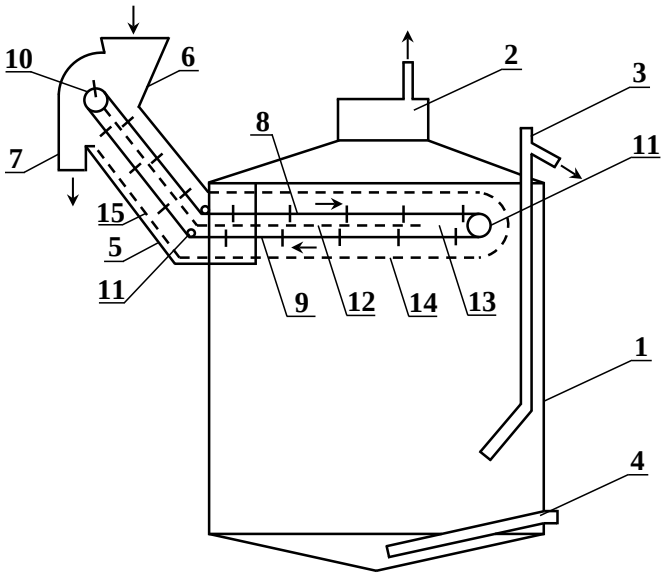

Fig. 7. digesters [7]: 1 - tank; 2 - gas collector; 3 - drain pipe; 4 - pipe emptying; 5 - variable chain-scraper loading and unloading elevator; 6 - pipe loading; 7 - nipple discharge; 8 - the upper branch of the elevator; 9 - the lower branch of the elevator; 10 - leading asterisks; 11 - Auxiliary side and End sprocket; 12, 14 - punched fence; 14 - handling window; 15 - Slant of perforated fence.

The analysis of existing designs of reactors for solid-phase fermentation showed (tab. 2) existing reactors periodic and continuous action. If a batch reactor, then the main disadvantage is its low productivity, and if continued - it is the absence or imperfect system of mixing biomass.

2. Basic requirements for solid-phase reactors and their parameters.

reactor type	Requirements for the parameters of reactors					
	Efficient intermixing tures	Download biomass	High-quality biomass removal	Maintain temperature set-Tumu modes	Maintaining the humidity of the substrate	The level of performance
trays	-	+	+	+	+	-
Multifunctional	-	-	-	+	+	+
Stepped	-	+	+	+	-	+
Screw	-	+	+	+	-	-
Combined	+	-	+	+	+	-
Shovels	+	+	+	+	+	+

Conclusion. Analysis of existing structures for solid-phase fermentation reactors showed that the design of the reactor must take into account the different mechanical properties of the substrate (humidity, density and uniformity of the substrate) and its preparation for digestion and that it ensure effective mixing, loading and quality of biomass removal, continuous process, sterile conditions during the fermentation process and maintain the set temperature and humidity of the substrate. It is also necessary to note that the greatest extent satisfy the requirements of solid state fermentation horizontal cylindrical reactors with blades for mixing.

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Abstract.*In the work brought reactors for analysis structures of solid REFINING Organic waste in biogas and byoudobrenye with specified konstruktsyonnыh s Benefits and drawbacks.*
Keywords: reactor tverdofaznaya fermentation, biogas, byoudobrenye

Annotation.*The analysis of reactor designs for processing solid organic waste into biogas and biofertilizer with their structural strengths and weaknesses is presented in work.*
Key words: reactor, solid fermentation, biogas, biofertilizer

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MODEL OF parametric synthesis rehabilitation AGRICULTURAL MACHINES

IL Rogovskiy