UDC 663.127

JUSTIFICATION OF THE CHOICE OF FERMENTER DESIGN IN THE PRODUCTION OF FEED YEAST

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ABSTRACT: *scientific and technical sources and patents of different countries have been reviewed and analysed in order to justify the choice of fermenter design. On the basis of generalisation of literature data, the apparatus for the production of fodder yeast was selected.*

KEY WORDS: FEED YEAST, FERMENTER, AN AERIAL LIFT AIR DISTRIBUTOR, MODERNISATION.

ОБҐРУНТУВАННЯ ВИБОРУ КОНСТРУКЦІЇ ФЕРМЕНТЕРУ ПІД ЧАС ВИРОБНИЦТВА КОРМОВИХ ДРІЖДЖІВ

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АНОТАЦІЯ: *для обґрунтування вибору конструкції ферментера було розглянуто та проаналізовано науково-технічні джерела та патенти різних країн. На основі узагальнення літературних даних обрано апарат для виробництва кормових дріжджів.*

КЛЮЧОВІ СЛОВА: КОРМОВІ ДРІЖДЖІ, ФЕРМЕНТЕР, АЕРОЛІФТНИЙ ПОВІТРОРОЗПОДІЛЬНИК, МОДЕРНІЗАЦІЯ.

The fermenter is one of the most important devices in the production of feed yeast. It is in this apparatus that the main stage is carried out - the cultivation of yeast biomass, which is the final product or raw material for further processing [1].

To justify the choice of the apparatus design, let's consider the main types of fermenters, their advantages and disadvantages.

The stirred fermenter is one of the most common types of fermenters. A stirrer is installed inside the apparatus, which ensures mixing of the medium. Advantages: efficient mixing and aeration, ability to maintain a uniform temperature, pH, and nutrient concentration. Disadvantages: the presence of moving parts - higher operating costs, complicated cleaning [2].

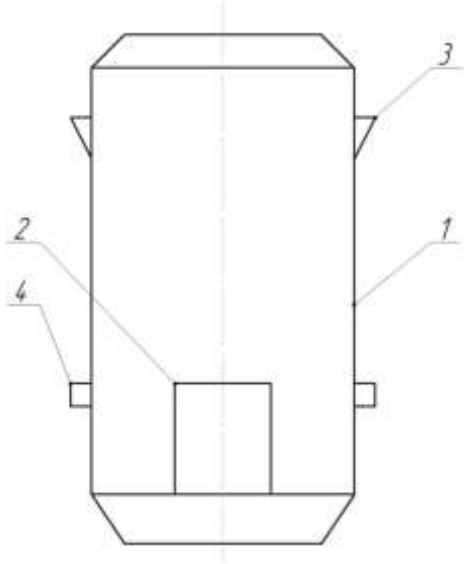
Bubble (gas-lift) fermenter - gas is supplied from below, forming bubbles that mix the medium without a stirrer. Advantages: simple design, suitable for sensitive cells, lower power consumption. Disadvantages: less efficient mixing compared to stirring devices [2-4].

Pneumatic fermenter (tubular or with air aeration) - mixing and transportation of biomass is carried out by a jet of air or steam. Advantages: high sterility, suitable for large volumes. Disadvantages: limited mixing, not suitable for viscous media [3, 4].

Compressed gas fermenters are the most commonly used for biomass cultivation due to their operational reliability, which is due to the absence of moving parts [3].

Given the advantages, we chose a fermenter with an aerial lift air distributor. This design of the fermenter has a number of advantages over fermenters of other designs, as it has no rotating parts, which reduces operating costs, the fermenter is installed outside the building and can be made of steel, reinforced concrete, and even brick.

The scheme of the fermenter is shown in Figure 1. The fermenter is a cylindrical apparatus with a capacity of 80 m3 for a 240 t/year plant, which is usually installed outdoors next to the feed yeast plant. The fermenter with an aerial lift air distributor is designed for the continuous cultivation of fodder yeast. The main elements of the fermenter are: body 1, diffuser 2, irrigator 3. Inside the vat there is an air distribution system and pipes for air and wort supply. The apparatus is equipped with fittings for the drainage of mash (not shown in the diagram), which are located in the lower part of the fermenter [3].



1 – housing; 2 – diffuser; 3 –irrigator (water inlet); 4 – water outlet

Figure 1 - Scheme of the fermenter

The yeast is grown in a continuous flow. At the beginning of the production, the nutrient medium and the required amount of sulfuric acid are poured into the vat to create the desired acidity. As soon as the medium covers the air distribution system, air is injected with a blower to aerate it. The duration of yeast cultivation is 10...20 hours in a constantly aerated medium. During the yeast cultivation period, the temperature and acidity of the environment are maintained at a constant level. The air supply is strictly controlled. The air distribution device must ensure that the air is

crushed, i.e., that the yeast uses oxygen to the fullest extent possible. Periodically, a sample is taken from taps located at different levels to determine the number of yeast cells. After the accumulation of yeast in sufficient quantity at the first filling of the vat and steady state, the selection of brag from the fermenter begins, adding the same amount of nutrient medium. The process is stopped with the release of the apparatus for disinfection, after which it is resumed in the same order. Such a fermenter provides high productivity, reliability and efficiency of the process, reducing costs due to the absence of mechanical components and easy maintenance.

To substantiate the modernization of the fermenter, let's consider patent sources. Patent [5] describes a bioreactor with an air draft tube that provides efficient circulation of liquid and gas without mechanical mixing. Advantages: design flexibility, scalability. Disadvantages: limited mixing efficiency and volume. Paper [6] discusses a U-shaped fermenter with nozzles for gas injection, which improves mixing and mass transfer in the system. Advantages: improved mixing, increased mass transfer. Disadvantages: limited flexibility in scaling.

The patent [7] describes a continuous aerial lift fermenter with a mechanism for mixing the suspension and ensuring a constant flow of the medium. Advantages: continuous operation, uniform mixing. Disadvantages: complexity in design and setup, possible formation of stagnant zones.

Conclusions: based on the analysis of scientific and technical literature, the choice of the design of the fermenter for the production of feed yeast was substantiated. A patent search showed that the inventors' efforts were aimed at improving circulation and mixing, intensifying mass transfer. The proposed modernization ideas help to reduce energy costs for production, increase the reliability of equipment operation, etc.

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