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BIOREACTOR FOR GROWTH OF GREEN ALGAE

[1]Khalikov A.M., [2]Bozorov E. O.

[1]Scientific Research Institute of Fishery, [2] "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers" National Research University

Abstract: The article presents information on an optimized variant of growing unicellular green algae and intensifying photosynthetic radiation, namely, the transmission of a moving mechanism using belt drives, in the field of fish farming and animal husbandry**.**

Key words: algology, kelp, algae, biotechnology, container, bioreactor, suspension, microorganism, mini-electric motor.

Introduction. Algae are a group of organisms of various origins united by the following features: photoautotrophic nutrition, absence of true tissues (with the exception of highly organized brown algae, but even in them the tissues are few in number and poorly differentiated [1]) and vegetative organs, organs of sexual (gametangia) and asexual (sporangia) reproduction, unicellular, habitat in an aquatic environment or in humid conditions (in soil, damp places, etc.). The body of algae is called a thallus, or thallus. Algae are an ecological group of predominantly heterogeneous photoautotrophic unicellular, colonial or multicellular organisms that usually live in an aquatic environment, systematically representing a set of many divisions.

Algae are a group of organisms of various origins united by the following features: photoautotrophic nutrition, absence of true tissues (with the exception of highly organized brown algae, but even in them the tissues are few in number and poorly differentiated [2]) and vegetative organs, organs of sexual (gametangia) and asexual (sporangia) reproduction, unicellular, habitat in an aquatic environment or in humid conditions (in soil, damp places, etc.). The body of algae is called a thallus, or thallus [4].

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The reason why algae do not have distinct tissues is related to the peculiarities of the aquatic habitat - life in water implies relatively stable conditions for most of the cells that form the body of the organism. They are all illuminated almost equally; the water surrounding the plant provides all its parts with the same set of substances dissolved in it. In addition, water provides a temperature regime similar for all cells. As a result, algae cells do not have any special differences between themselves, and equal conditions for all do not stimulate the differentiation of cells into specialized ones [8].

Some algae are capable of heterotrophy, both osmotrophic (by cell surface), such as flagellates, and holozoic - by swallowing food particles through the cell mouth (euglenophytes, dinoflagellates). The size of algae varies from fractions of a micrometer (coccolithophores and some diatoms) to 30-50 m (brown algae - Laminaria, Macrocystis, Sargassum) [5]. The thallus can be either unicellular or multicellular, and is characterized by enormous morphological diversity.

In the artificial environment of a photobioreactor, specific conditions are carefully controlled for the respective species. Thus, the photobioreactor provides much higher growth rates and purity levels than anywhere in nature or in habitats similar to nature [2]. Hypothetically, phototropic biomass could be produced from nutrient-rich wastewater and carbon dioxide flue gas in a photobioreactor.

Algae can be cultured in open ponds (such as runoff ponds and lakes) and photobioreactors. Runoff ponds can be less expensive.

Materials and methods. The importance of algal culture in physiological and biochemical studies, as well as the fact that algae are among the most efficient converters of solar energy into useful form, have led to increased interest in algal culture methods. Algal culture methods can be divided into two categories: the first is applied in laboratory conditions and controlled environments, and the second is applied in open-air conditions for large-scale biomass production [7].

Algae include a varying number (depending on classification) of eukaryotic divisions, many of which are not related by common origin. Blue-green algae, which are prokaryotes, are also often classified as algae.

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Algae are the main producers of organic matter in the aquatic environment. According to estimates by various scientists, the contribution of algae to the total production of organic carbon on our planet is 26-90% [3]. Algae directly or indirectly serve as a source of food for all aquatic animals. They are used as food by protozoa (for example, ciliates, amoebas), oligochaetes, crustaceans, mollusks, dragonfly larvae and other invertebrates, as well as fish [8].

Among multicellular algae, along with large, complexly dissected representatives, often visually very similar to higher plants with structures that outwardly resemble stems, leaves and even fruits, there are microscopic forms (for example, the sporophyte of Laminariaceae). Among unicellular algae, there are colonial forms, when individual cells are closely connected to each other (connected through plasmodesmata or immersed in common mucus) [11].

Microalgae are valuable ecological and biotechnological resources. Particular attention is paid to the use of economically important algal products, including aquaculture feed, biomass production for the health sector, green manures, pigments, vitamins, antioxidants and antimicrobial agents.[10] The contribution of microalgae to environmental research is also appreciated; for example, they play an important role as indicator organisms in environmental impact assessment. Similarly, special collection strains of microalgae are used for ecotoxicity testing.

Microalgae are microscopic freshwater or marine organisms that play a key role in nature as a food source for higher animals (zooplankton, fish), for the transport of nutrients in aquatic food webs, and for the balance exchange of CO2 between the ocean and the atmosphere.[12] Microalgae are microscopic freshwater or marine organisms. They are a very diverse group, ranging in size from a few hundredths of a millimeter to a few tenths of a millimeter, taking many different forms, and existing singly, in chains, or in groups.

The most commonly used microalgae culture system for research and industrial purposes include track pond, round pond tank, shallow large pond and closed pond. Some examples of open pond culture systems are lakes and ponds for natural reservoirs, round ponds and race ponds for artificial reservoirs.

There are several methods of growing algae: using rocks and stones on the seabed as a substrate; on artificially created reefs; on artificial substrate in the water column; on

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soft soil of lagoons, ponds and other closed water bodies; in special artificial pools, tanks, various containers with controlled conditions.

The proposed bioreactor is to increase the coefficient of light absorption by photosynthetic microorganisms and significantly increase the productivity of the bioreactor. The photobioreactor can be used to cultivate unicellular algae, such as zoospores, chlorella, etc.

The purpose of the proposed bioreactor is to increase the coefficient of light absorption by photosynthetic microorganisms and to significantly increase the productivity of the bioreactor.

A bioreactor unit for photosynthesis of green algae is installed in the frame and the bed.

The main body is a cubic glass container, the outer surface of which is 5 mm thick, and the opposite side is covered with foil. On one of its sides there is a sodium lamp, and there is also a branch pipe through a screw adapter for placing a biological solution. A temperature sensor is installed for constant temperature control.

An open cylindrical glass (thickness b = 5 mm) for growing chlorella (bioreactor) is carried out by rotating it on a tank stand. The rotation of the bioreactor is carried out using a small pulley, which is transmitted by a mini-electric motor and transmitted via a belt conveyor. The selection of the diameter of the large and small pulleys, the speed (number) of revolutions is regulated by a belt drive. In this case, the movement of the large pulley depends on the rotation of the glass container at low speed.

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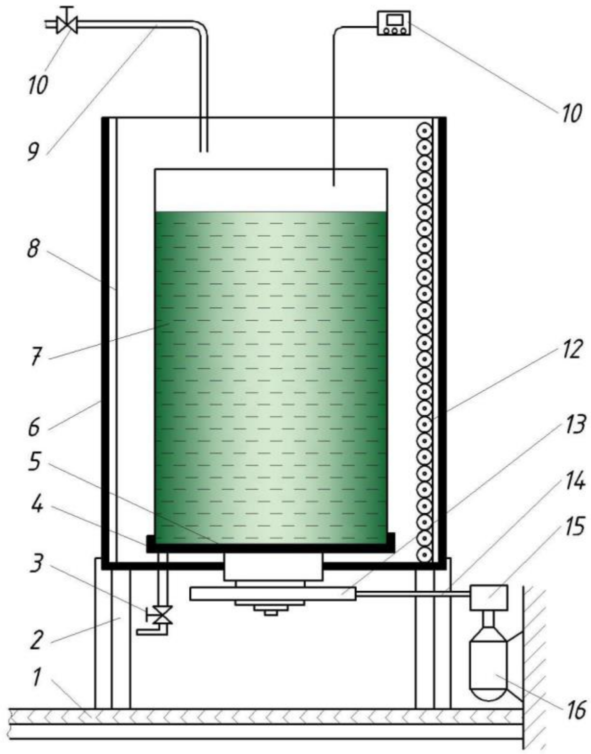

The principle of operation of the green algae bioreactor is as follows:

The biological solution is poured into a cylindrical glass container (thickness b = 5 mm) through a tube. The biological solution contains components necessary for the development of microorganisms, for example (g / l): NH_4Cl - 0.5; $MgSO_4 * 7H_2O$ - 0.02; KH_2PO_4 - 0.72; $CuSO_4 * 5H_2O$ - 0.0016 others, which have a pH value of the environment.

Fig.1. Bioreactor for green algae growth. *1-Floor; 2-stand; 3-chlorella drain tap; 4-reservoir stand; 5-frame; 6-main body; 7-glass container; 8-foil; 9-pipe; 10-screw adapter; 11-temperature sensor; 12-sodium lamp; 13,15-pulley; 14-belt; 16-mini electric motor*

Then a suspension of chlorella is introduced and the suspension is saturated with a gas mixture containing up to 2% carbon dioxide, supplied from a cylinder through a tap.

At the same time, the sodium lamp with the supply voltage is switched on.

It is located spirally and provides illumination of the biomaterial in the container. The temperature of the reaction medium is controlled by a thermometer, which should not exceed 28.5...30 °C.

In the initial period, the mini-motor is controlled by the small pulley, and the movement is transmitted to the large pulley through the belt drive, while the connection of the belt drive and the technological power of the mini-motor ensure the slow rotation of the bowl axis.

The optical density of the suspension is determined depending on the maximum value of about 40-50 million cells and provides a control signal for automatic pouring of the finished biomass through the drive pipe. By changing the above speed, number of

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revolutions, temperature and light flux, it is possible to provide the necessary optimal mode at the stages of chlorella growth (1 day, 2 days...8 days).

Conclusions. The proposed bioreactor is to increase the coefficient of light absorption by photosynthetic microorganisms and significantly increase the productivity of the bioreactor. By rotating the vessel spindle in this way, the reaction mixture begins to mix for a certain time. At the same time, the process of chlorella growth begins, which increases by 2-4 times.

The temperature of chlorella in the tank is controlled by changing the number, power and voltage of the bulbs depending on the power of the bulbs. With the help of the lamps, the flow of light supplied to chlorella is regulated, and the optimal process of photosynthesis is ensured.

References

1. Joel L. Cuello, Takanori Hoshino, Sarah Kuwahara, Cody L. Brown. Biotechnology for Biofuel Production and Optimization. 2016, Department of Agricultural and Biosystems Engineering, University of Arizona, Tucson, AZ, USA. Pages 497-511.

2. Shivokiene J.S. The number and biomass of bacteria in the digestive tract of pond fish depending on their diet // Issues of Ichthyology. - 1995.- Vol. 25/5. - P. 821-827.

4. Bergner H.R. Scientific foundations of farm animal nutrition / H.R. Bergner, H.A. Ketz // Translated from German. M.: Kolos, 2013.- 597 p.

5. Berman Sh. A. Research on the role of antibiotics in carp feeding / Sh. A. Berman. - Bulletin of the Academy of Sciences of the Latvian SSR, 2016, N3. - P. 151-154.

6. Bondarenko L. G. Starter feed for fish / - A.s. N 1084005 /. - 2017.

7. Butler N. The transition from fossil fuels, Sustainable Energy / N. Butler // Cambridge Energy Forum. 2006.

8. Day J.G. In vitro Culture and Conservation of Microalgae: Applications for Aquaculture, Biotechnology and Environmental Research / John G Day, Erica E, Benson,

ISSN (E): 2181-4570 ResearchBib Impact Factor: 6,4 / 2024 SJIF 2024 = 5.073/Volume-3, Issue-4

Roland A, Fleck // In Vitro Cellular & Developmental Biology Plant, 1999. 35(2): 127-136.

9. Olaizola M. Commercial development of microalgal biotechnology: from the test tube to the marketplace / M. Olaizola // Biomolecular Engineering, 2003. 20: 459-466.

10. Gorbunova N. P. Algology. - M.: High school, 1991.

11. Khramtsov A. K. Brief guide to identification of genera of freshwater algae. - Minsk, 2004.

12. Yuehe Lin, Glen E. Fryxell. Selective Sorption of Cesium Using Self-Assembled Monolayers on Mesoporous Supports // Environmental science and technology. - 2001. - No. 35(19). - P. 3962-3966.