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The Formation of Biomass by Microalgae Depending on the Generation

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A B S T R A C T

This article analyzes the dry mass yield of wet algae from wet biomass by generation. According to the results, 27.6% of *Ankistrodesmus* strains, 25.2% of *Scenedesmus* strains, 23.4% of *Botryococcus* strains, 26.2% of *Chlorella* strains and 27.5% of *Chlorococcum* strains were found to have dry mass. The protein and fat storage of micronutrients were observed to differ sharply from each other when grown in the Chu-13 nutrient medium. At the same time, microalgae of the genus *Ankistrodesmus* contain 43.2-46.4% protein and 27.4-32.2% fat. In the same nutrient medium, microalgae of the *Scenedesmus* genus were found to retain 48.8–52.8% protein and 27.4–28.6% fat, respectively. Representatives of the genus *Botryococcus* have been reported as a microalgae offspring that retains relatively small amounts of protein (46.2–46.8%) and fat (26.2–26.4%). Representatives of the *Chlorococcum* and *Chlorella* lineages reported high protein (46.4–48.8%) but low fats synthesis (15.6–18.4%).

Introduction

The volume of feed products produced for agriculture (livestock, poultry, fisheries) around the world at the end of 2016 exceeded 1 billion tons (1). Only 4% of this, i.e. 40 million tons, is intended for aquaculture (2). The absolute leaders in the production of food for aquaculture are the countries of Southeast Asia (primarily China), whose products account for almost half of the total world production. In particular, Latin America produces an average of 2.88 million tons of food per year (2.3 million tons for fish; 0.57 million tons for shrimp (3), while European countries produce 2.0 million tons. million tons, North America 2.0 million tons, Africa (mainly Egypt 0.75 million tons and Nigeria (4), (5) produces about 1.0 million tons of food products (1).

The People's Republic of China is the world leader in the production of food for aquaculture. In particular, China produces 17.30 million tons of food products per year (6), which is 40% of the world's production. At the same time, the Chinese aquaculture industry is in demand for ¾ part of the world's food production (7). Apart from China, Vietnam (2.80 million tons/year), Norway (1.79 million tons / year), Chile (1.24 million tons/year), Indonesia (1.23 million tons/year), India (1.16 million t/year), USA (1.00 million tons/year) (6). The development of this industry can be explained by the specialization of local production. In particular, China produces a large amount of feed for carp (almost 62% of the feed intended for aquaculture), while India, Thailand and Indonesia produce large amounts of feed for shrimp (66%; 42%; 62%, respectively). Large quantities of food products are produced in the United States (40%), Vietnam (36%) and Bangladesh (35%) for trout, while in Peru for trout (74%), Norway (94%), Canada (86%) and Chile (85%) of food products are produced primarily for salmon (6).

China cannot take the lead in food production for all areas of aquaculture. In particular, 75-80% of world production for salmon and trout is accounted for by Chile and Norway(4), (5).In the Russian Federation, the total demand for fisheries is 250,000 tons, but an average of 100 tons of food is produced per year, and the rest is met mainly by imports (2).

Outside of China, there are four major manufacturers (brands) that supply aquaculture with food products, controlling 35% of world production. These are the following companies: Alltech Inc., Aller Aqua, Avanti Feeds Ltd., Beneo, Cermaq ASA, Charoen Pokphand Foods Company Ltd., Dibaq Aquaculture, Guangdong Evergreen Feed Industry Co., Ltd., NK Ingredients Pte Ltd., Norel Animal Nutrition, Nutriad, Nutreco N.V., Tongwei, Ridley Aqua-Feedhave played an important role in providing aquaculture with food products.

The state of Peru controls 40% of the world's manufacturing industry in the production of fish meal, which is the main component of traditional food products for aquaculture (7). The world food market for aquaculture is estimated at around $ 57.7 billion (2012), with an annual growth rate of 11.4% projected to reach $ 122.6 billion by 2019 (8 Aqua Feed Market). However, world production did not reach this figure. It is known that the demand for products in the world market for aquaculture facilities also varies. In particular, food products are sold on the world market for carp (40%), tilapia (20%), crustaceans and salmon (about 20%), as well as mollusks, crucian carp and others (2).

According to experts from the research organization Transparency Market Research, by 2021, food products for carp and crustaceans will occupy a major share of the world market. Food production for mollusks and salmon is also expected to grow rapidly. In addition, due to its geographical location, the Asia-Pacific region is expected to control 65% of the world market and the rapid development of aquaculture in them. Europe may rise to second place in terms of food production for aquaculture (8).

According to experts, radical changes in the food industry for aquaculture are expected. There are many factors of drastic change, which can be summarized as follows: feed for aquaculture (soy, wheat and corn, fish-based feed), as well as traditional technology based on the leading trend of "feeding fish with fish" and its current state does not meet the requirements of long-term sustainable development of the world fishing industry (9). In the world fisheries industry, the greatest attention is paid to the production of natural feed baits with a complete nutritional content and their effective use in practice.

The aim of this study includes to study the biomass and protein synthesis properties of micronutrients, which are a source in the formation of a complete fodder base of the fishing industry.

Materials and Methods

The following genera of algae isolated and algologically purified from different regions of Uzbekistan were used: *Ankistrodesmus* (*Ankistrodesmus* sp.15., *Ankistrodesmus* sp.20), *Botryococcus* (*Botryococcus* sp. 5., *Botryococcus* sp.14), *Scenedesmus*sp. 1., *Scenedesmus* sp.7.),*Chlorococcum* (*Chlorococcum* sp.3., *Chlorococcum* sp.4.) *Chlorella* (*Chlorella* sp.3., *Chlorella* sp.4.). Chu-13 nutrient medium (g/l) was used for growing algae: KNO_3-0.2, K_2HPO_4 - 0.04, $MgSO_4 \times 7H_2O$ -0.1, $CaCl_2 \times 6H_2O$ -0.08, iron citrate - 0.01, lemon acidity - 0.1, boron-0.5 ppm, $MnSO_4 \times 7H_2O$-0.5 ppm, $CuSO_4 \times 5H_2O$-0.02 ppm, $CoCl_2 \times 2H_2O$-0.02 ppm, $Na_2MoO_4 \times 2H_2O$-0.02 ppm, pH 7,5 (10). In the cultivation of algae, CO_2, light and air were given in standard form (11). Temperature 27-30°C. Standard methods were used to determine the microscopy of algae and their morpho-cultural properties (12). The number of cells in Goryaeva's cell was calculated using standard methods. The Loury method (13) used the standard method for determining the amount of fat in determining the amount of protein in research objects (14). The calculation of statistical error, mean, reliability intervals and standard deviations to the experimental data was performed using the computer program STATISTICA 6.0 and standard methods. The statistical significance of the results was determined using the Student t-criterion.

Results and Discussion

According to the results obtained, the microalgae *Ankistrodesmus* sp.15. the strain produced 12.62% wet biomass, from which an average of 3.35% dry matter was recorded. The strain *Ankistrodesmus* sp.20 produced 11.36 g/l of biomass, of which 3.24 g/l of dry biomass was extracted, accounting for 27.5% of the total mass of the cell (Fig. 1). *Botryococcus* sp.5 of the genus *Botryococcus* and *Botryococcus* sp. 4. While the strains produced 9.22–8.62 g/l of wet biomass, respectively, 2.12–2.04 g/l of dry biomass was recorded, respectively (Fig. 3). It was found that the dry matter yield from the total wet biomass averaged 23.4%. *Scenedesmus* sp.7 of the *Scenedesmus* generation. and *Scenedesmus* sp.1. strains produced wet biomass in the range of 11.44–10.66 g/l, respectively, while their dry biomass yield was 3.08–2.48 g/l, respectively (Fig. 2). It was found that the dry matter output from the total cell biomass averaged 25.16%.

Chlorella sp.3 of *Chlorella* genus. while the strain produced 10.02 g/l wet biomass, *Chlorella* sp.4. the strain was noted to produce 9.22 g/l of wet biomass (Fig. 4). The dry mass yield from these strains was 2.56-2.48 g/l, respectively. It was noted that the dry mass yield from total wet biomass was 26.2%.

Chlorococcum sp.4 of *Chlorococcum* genus. the strain produced 12.68 g/l of wet biomass, of which 3.64% g/l of dry biomass was detected (Fig. 5). *Chlorococcum* sp.3 of this generation. In the strain, the wet biomass yield was 11.48 g/l, of which 3.01 g/l was recorded. Of the total biomass, the dry biomass output was 27.5%.

It is known that the process of obtaining dry biomass from wet biomass in the production process determines the industrial productivity and economic efficiency. During the study, 27.6% of dry biomass from wet biomass of microalgae were analyzed by generation, 27.6% from *Ankistrodesmus*, 25.2% from *Scenedesmus*, 23.4% from *Botryococcus*, 26.2% from *Chlorella*, and 27.5% from *Chlorococcum* output was recorded (Figure 6).

Subsequent research has examined the protein and fat storage of micronutrients selected as the object (Figure 7).

As can be seen from Figure 7, the protein and fat storage of micronutrients in the Chu-13 nutrient medium are drastically different from each other. In particular, microalgae belonging to the genus *Ankistrodesmus* contain 43.2-46.4% protein and 27.4-32.2% fat (*Ankistrodesmus* sp.20; *Ankistrodesmus* sp.15). In the same nutrient medium, micronutrients belonging to the genus Scenedesmus can be seen to store up to 48.8-52.8% protein and 27.4-28.6% fat, respectively (*Scenedesmus* sp.7. and *Scenedesmus* sp.1).

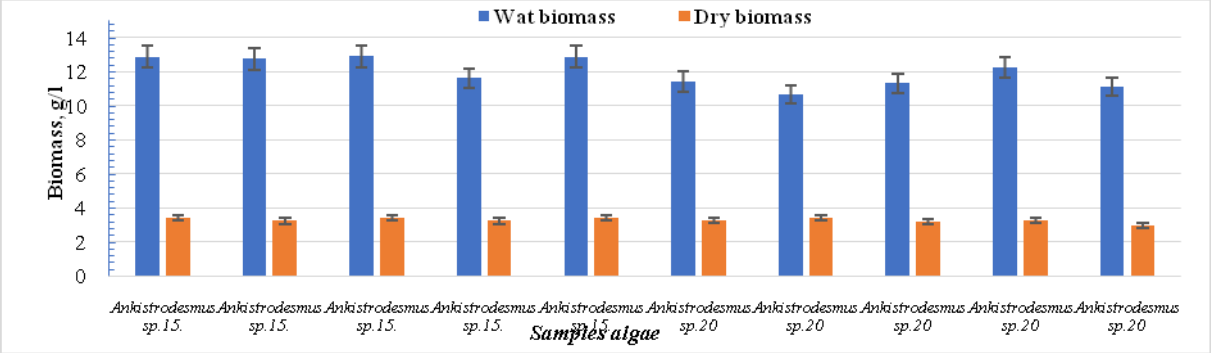

Figure.1 Biomass formation of *Ankistrodesmus* strains, n=3.

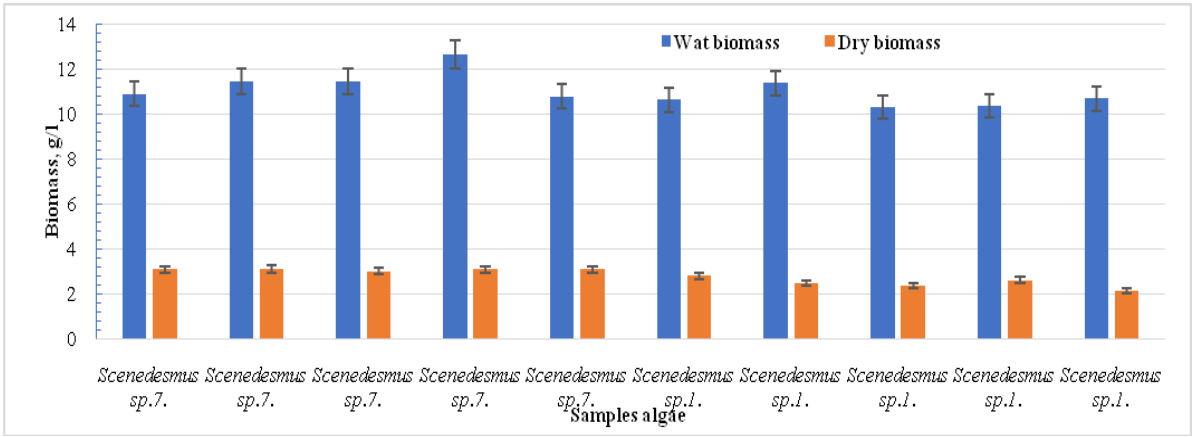

Figure.2 Biomass formation of microalgae belonging to the genus *Scenedesmus*, n=3

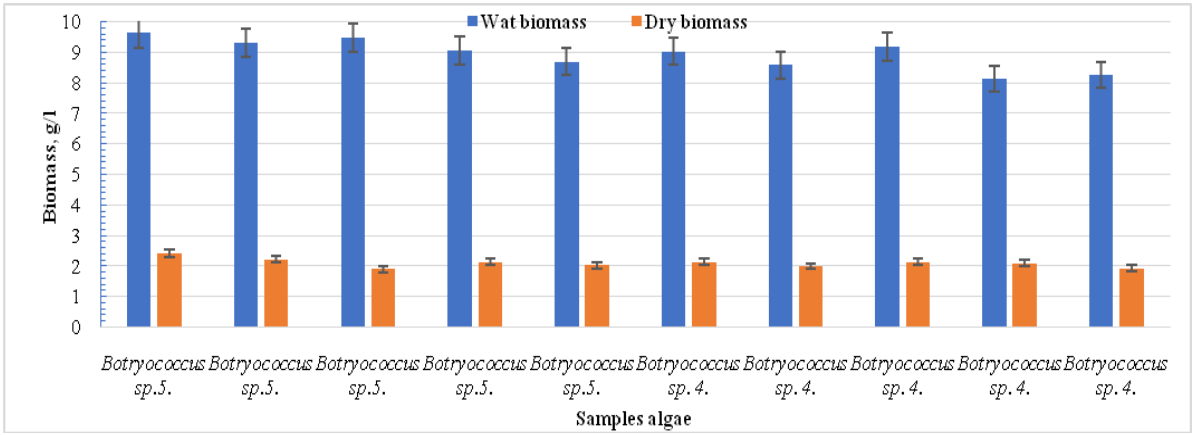

Figure.3 Biomass formation of microalgae belonging to the genus *Botryococcus*, n=3

According to the results of the study, representatives of the genus *Botryococcus* were recorded as a microalgae offspring that retained relatively small amounts of protein (46.2-46.8%) and fat (26.2-26.4%). Studies have shown that members of the *Chlorococcum* and *Chlorella* lineages have high protein retention (46.4–48.8%) but very low fat retention (15.6–18.4%) compared to all microalgae generations studied.

It is known that microalgae isanobject that has its place and importance in almost all sectors of the economy. In particular, it serves as a productive source in the production of biodiesel, bioethanol, biogas, food and feed products, production of various agricultural biopreparations (15).

Therefore, the biomass formed in the production of microalgae biomass and the release of dry mass from this biomass are important. Therefore, in this study, it was found that microalgae form biomass over the generations, and the dry mass from this biomass. It has also been studied that the protein and fat storage that determines the nutritional value of micronutrients depends on the micronutrient generation. In particular, the protein and fat storage of micronutrients in the Chu-13 nutrient medium differs dramatically. It was noted that the microalgae of the *Ankistrodesmus* genus contain 43.2-46.4% protein and 27.4-32.2% fat. In the same nutrient medium, microalgae belonging to the *Scenedesmus* family can be seen to store up to 48.8-52.8% protein and 27.4-28.6% fat, respectively. According to the results obtained, it is advisable to use strains of the genus *Botryococcus* and *Chlorococcum* in obtaining a feed with a complete nutrient content for the aquaculture industry.

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References

1.Alltech Global Feed Survey.2017. URL:http://go.alltech.com/alltech-feed-survey.

2. Feed International's World Feed Panorama: World Feed Panorama facts at-a-glance. URL:http://www.fi-digital.com/201604/#/8.&Lack of Quality Feeds Slows Russia's Aquaculture Sector. URL:http://www.fi-digital.com/201604/#/4.

3.International Feed Industry Federation (IFIF). Annual Report 2012/13. URL: http://ifif.org/uploadImage/2013/10/1/c838a3d3dbb286acb4685f331c1b70241380656385.pdf.

4.WATTAgNet.com: Egypt leads African surge in fish feeds. URL: http://www.wattagnet.com/articles/21889-egypt-leads-african-surge-in-fish-feeds?v=preview.

5.WATTAgNet.com: Aquafeed production continues to expand. URL: http://www.wattagnet.com/articles/26319-aquafeed-production-continues-to-expands.

6. Alltech 2016. Aquaculture Feed Survey. URL: http://go.alltech.com/aquafeedsurveydata.

7. FishFeed: Market Tensions Create Opportunities for Innovations: FISH 2.0 Market Report. URL:http://www.fish20.org/images/Fish2.0MarketReport_FishFeed.pdf.

8. Aqua Feed Market: Global Industry Analysis, Size, Share, Growth, Trends and

Forecast, 2013–2019: Transparency Market Research. URL:http://www.transparencymarketresearch.com/aqua-feed-market.html.

9. Khujamshukurov N.A., Nurmuxamedova V.Z. 2016. Production feed: modern trend and development aspect. Scientific overview. J.Zooveterinary. №8 (105):34-37.
10. Safarov I.V., AbdullaevA.K., KhujamshukurovN.A., ShakirovZ.S. 2019. Influence of Temperature and CO_2 on the Growth and Accumulation Oil of Microalgae. Emerging Issues in Science and Technology Vol. 1. Pp. 93-101.
11. Mata T.M., Martins A.A and Caetano N.S (2010). Microalgae for biodiesel production and other applications, Renew. Sust. Energ. Rev.14(1), 21732.
12. Shakirov ZS., Safarov IV., KadirovaGKh., Khujamshukurov NA. 2014. Isolation and identification of lipid-producing microalgae of Uzbekistan. Environmental Science. Vol.9:405-409.
13. Khujamshukurov N.A.2004. Stady protein compounds bacterium *Bacillus thuringiensis*. Uzbekistan Agrarian Science Bulletin. 1(15):41-45.
14. Rajasri Y, Ramgopal SR, Rao CS. 2012. Lipid accumulation studies In *Chlorella* pyrenoidosa using customized photobioreactor- effect of nitrogen source, light intensity and mode of operation. J Eng Res.Appl.2:2446-2453.
15. Safarov I.V. 2020. Highly productive lipid-producing microalgae of Uzbekistan and regulation of the biosynthesis of oils for obtaining biodiesel.PhD thesis in microbiology. Uzbekistan. P.136.

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