CHLORELLA VULGARIS INFLUENCE IN AQAUCULTURE

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ABSTRACT

Chlorella vulgaris microalgae has acquired a wide range of applications in the last century. This plant variety is widespread around the world and requires minimal conditions for growth and development: water, light, temperature and dissolved micronutrients. *C. vulgaris* are intensively used to treat natural water resources and to remove various pollutants from wastewater. As an empirical phenomenon, the amino acids found in Chlorella vulgris in large quantities contribute to the formation of complex compounds with metal ions.
Furthermore, the biomass of algae has a valuable nutritional composition and is used as a feed for marine habitats and, according to repeated studies, can improve fish immunity, disease resistance and stress tolerance.

Keywords: chlorella vulgaris, feeding, pollution, algal biomass, widespread use, growing technology.

Chlorella vulgaris is a genus of single-celled green algae, classified as Trebixiophilic, and their herbaceous green cells have a microscopic spherical shape ranging from 2 to 10 microns (fig. 1). The cells themselves contain chlorophylls a and b, their predominance over the carotenoids α- and - carotene, lutein, neoxantin, violaxantine, zeaxantine, anteraxantin determines the coloring of the chloroplast.

Figure 1. C. Vulgaris cell structure
[16]

The nutrient value of the biomass of this green algae is extremely high: algae contains 40 amino acids, 62% protein, 30% carbohydrates, 5% fat, 3% mineral salts [1]. Furthermore, algae cells are enriched with fatty acids such as palmitic, oleonic, palmitolene, stearin, myristine, pentadecano, linole, peanut, eruca, etc. In general, C. vulgaris biomass is 3-4 times more potent than soy biomass, and chlorella protein is as good as meat protein or powdered milk. In 1 g of the dry matter chlorella contains carotene 1000-1600 ug, vitamin B1 2-18 ug, B2 21-28 ug, B6 9 ug, B12 0.025-0.1 ug, C 1300-5000 ug, Provitamine D 1000, K-6 ug, PP-110-180 ug, E-10-350 ug, pantotenic acid-12-17 ug, folic acid-485 ug, biotina-0.1 ug, leukovirina-22 ug [2]. As a result, these properties make green microalgae available and effective fodder for invertebrates. Favourable conditions for rapid growth of algae are achieved in the laboratory by means of phytoberators and open-air installations, which provide optimal temperature by means of electric heaters, Industrial light sources or exhaust gases. The main condition for photosynthesis is light, which is supported by equipping the installations with gas-discharge and fluorescent lamps at a height of 15-20 cm from the suspension surface. The suspension is regularly supplied with air that provides the medium with sufficient amounts of carbon dioxide and oxygen [3]. The feed medium used is phosphorus and nitrogen, in which the following microelements are present: N, P, S, Mq, Fe. The table 1 presents formulations of nutrient media. The most common nutrient medium for C. vulgaris is Tamia.

Table 1.

C. Vulgris nutrient media

Components	Knopa	Prata	Tamiya	Myers	№3	Yaguzhinsky's	LGU
$Ca(NO_3)_2$	0,25	-	-	-	-	-	-
$CaCl_2 \times 2H_2O$	-	-	-	-	-	-	-
$MgSO_4 \times 7H_2O$	0,06	0,01	2,5	1,204	0,75	0,1	0,3
K_2HPO_4	-	0,01	-	-	-	-	0,3
KH_2PO_4	0,06	-	1,25	1,224	1,5	-	-
KCl	0,08	-	-	-	-	-	-
KNO_3	-	0,1	5	1,213	-	0,5	2
NH_4NO_3	-	-	-	-	-	-	-
NH_2CONH_2	-	-	-	-	0,03	-	-
$FeSO4 \times 7H_2O$	-	-	0,003	-	-	0,02	-
$Fe_2(SO4)$	-	-	-	0,0747	-	-	-
$FeCl_3$	0,01	0,01	-	-	0,01	-	-
Microelement solution	-	-	0,0001	0,00005	-	-	0,00005
EDTA	-	-	0,037	-	-	-	0,01

Thus, in the pond on the basis of OOO «Semikarakorsk fish» (Rostov region) a group of researchers introduced a microalga strain C. vulgaris IFR C-111 as a feed additive for vespanos in order to increase fish productivity and improve water quality. At the end of the study, it was noted that the mass of fish increased by 37%, as well as its immunity and resistance to toxic substances. In addition, the concentration of ammonium and nitrites in the water decreased, creating a safer environment for fish [1].

Moreover, bioremediation studies of C. vulgaris from highly toxic oil products were conducted. The results were that even though chlorella destroys only a sample of toxic contaminants, the quantity of petroleum products has decreased in the original mixture and, furthermore, in all experiments with chlorella, the rainbow film of petroleum products has disappeared from the water surface, which proves the effectiveness of this biological purification [4]. C. vulgaris is also

suitable for extracting metal ions from wastewater, which extends the purification function [5] [6].

Another biological decontamination laboratory experiment for persistent organic compounds has shown that it is possible to combine microalgae and macrophytes for a better treatment of industrial wastewater [7].

Conclusion. In summary, C. vulgaris has a wide range of uses in aquaculture: its biomass is used as a feed for many fish species because it contains irreplaceable amino acids, Vitamins and fats; microalgae are also used extensively for biological water purification and waste-water treatment. Considering chlorella cultivation from a technological point of view, it can be said that the production process of this strain has great advantages in the form of a relatively simple high crop yield technology: the process does not need sterility, this culture is also not nutritious. This is used by many manufacturers from different fields, and the properties of C. vulgaris are actively studied by scientists and researchers.

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