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Features of the aral microalgae Dunaliella salina

Научный руководитель – Тонких Анатолий Константинович

Баймурзаев Еркин Нукусбаевич
Аспирант
Институт микробиологии АН РУз, Ташкент, Узбекистан
E-mail: erkin9414@gmail.com

According to FAO UN, 53% of children and 38.4% of adults in the Uzbekistan have the deficient in vitamin A (β-carotene). However, in the numerous hypersaline water bodies of the Aral Sea region (salts more than 100 g/l) there appeared: the microalga *Dunaliella salina*, which is the richest natural source of carotenes (1000 times more than in carrots). This microalga is industrially cultivated in many countries due to its β-carotenoids (up to 12% of biomass), lipids (up to 10% of biomass) and glycerol (up to 30% of biomass) [2]. It is also promising to cultivate *Dunaliella* as food for the brine shrimp Artemia, which, in turn, are a valuable food for the industrial sturgeon cultivation [3, 5].

The purpose of this work was to isolate the microalga *D. salina* from the hypersaline lakes of the Aral Sea region, the study of the features of its development, chemical composition, and possible practical applications.

Materials and methods. Isolation and identification of *D. salina* AR-1 was performed as described in the work of N.P. Masiuk [4]. Chemical analysis of *D. salina* AR-1 and the study of its biological activity was carried out as in the work Y.S Cakmak [3].

Results and its discussion. In the study of samples from various hypersaline lakes of the Aral Sea region, from 30 to 60 species of various halophytic microalgae were found, and among them the dominant species were microalgae of the genus *Dunaliella*. Using special methods, two species were identified: *D. minuta* and *D. salina*. Of these two species, only *D. salina* is capable of accumulating large amounts of β-carotenes; therefore, this microalga was studied in detail by us [5].

It turned out that, in contrast to the described strains of *D. salina*, which reproduce mainly by longitudinal division in a mobile state, the Aral strain *D. salina* AR-1, even under favorable conditions, multiplies in the mucous sacs - palmellas. Basically, cells growing up to 10-15 microns secrete mucus and form palm-like structures that sink to the bottom and attach to the walls of the culture vessel.

Under the microscope, these palmello-like structures move like an amoeba, due to the flowing of mucus. In this palmelo-like form, they reproduce by dividing into 2-6 large (8-10 microns) individuals or into many (up to 30) small (1.5 - 2 microns) individuals that emerge from the palmella, grow to adult state (10-15 microns) and again turn into palm-like forms [5].

Under illumination of 5 - 10 kLx (90 - 180 μMol (photons) $s^{-1}m^{-2}$) *D. salina* AR-1 cells are green. With an increase in illumination to 60 - 80 kLx (1080 - 1440 μMol $s^{-1}m^{-2}$), the cells turn yellow due to an increase in the content of carotenoids [5].

Chemical analysis of *D. salina* AR-1 for the content of total carotenoids, lipids and vitamins showed that this strain basically does not differ in the content of these substances from other strains described in the literature. The biomass of the yellow form contains 1.6 - 2.3% of the dry mass of total carotenoids, 7% of total lipids from 17 fatty acids, of which about 24% are the most valuable essential for human nutrition w6-linoleic 18:2 and w3-linolenic 18:3 acids. The composition of the main vitamins is as follows: B_1 - 3.9 μg/g, B_2 - 5.7 μg/g, B_3 - 0.6 μg/g, B_6 - 15.7 μg/g, B_9 - 1.8 μg/g, C - 7.4 μg/g, D - 39.8 μg/g, α-tocopherol - 60.5 μg/g.

According to the literature, the biomass of *D. salina* and extracts from it have a number of therapeutic properties: immunostimulating, anticancer, antidiabetic, antineurodegenerative, hepatoprotective, antimicrobial, etc. and in the base of many therapeutic properties is antioxidant activity.

Considering that the antioxidant activity of *D. salina* is determined by both water-soluble ascorbic acid and fat-soluble carotenoids, xanthophils, tocopherols, and numerous lipids, we assessed the antioxidant activity against ascorbic acid and α-tocopherol. Currently, there are no unified standard methods for determining antioxidant activity. Therefore, we took as a basis the phosphomolybdenum method used to determine the antioxidant activity in the biomass of *D. salina* in the work of Y.C. Cakmak [3]. It was shown that the antioxidant activity of ethanol extracts of different lots of dry biomass of *D. salina* AR-1 relative to ascorbic acid was 1.1 - 5.3 mg/g, and relative to α-tocopherol 0.3 - 1.8 mg/g. These data are consistent with literature data [3].

In connection with the report on the anticancer effect of extracts from *D. salina* [5], the anticancer effect of freeze-dried biomass of *D. salina* AR-1 was studied in a model of Ehrlich's solid tumor (ESR) in mice. It was shown that oral administration of biomass to mice with transplanted ESR resulted in a 60% inhibition of tumor growth on day 28. It was concluded that further studies of the biomass of *D. salina* AR-1 for antitumor activity are promising.

In the literature, there is a report that an alcoholic extract of *D. salina* administered orally causes the normalization of some biochemical parameters in experimental rats with an $AlCl_3$-induced neurodegenerative state (SDS), similar to Alzheimer's disease [1]. In our experiments, oral administration of *D. salina* AR-1 biomass to rats with a model of neurodegenerative state induced by aluminum chloride ($AlCl_3$) causes some restoration of changes in the behavioral activity of animals.

Thus, our data show that the biomass of the Aral strain of the microalga *D. salina* AR-1 can be used as preparations of biologically active additives (BAA) for the prevention of vitamin deficiencies, some oncological and neurodegenerative diseases.

Источники и литература

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