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THE APPLICATION OF SOME COORDINATION COMPOUNDS IN REGULATION OF THE CONTENT OF ANTIOXIDANTS IN *SPIRULINA PLATENSIS*

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Abstract. *This paper reports on the study of possibility of utilization of some coordination compounds of V(IV) and Co(III) as regulators of the content of bioactive substances with antioxidant properties: superoxiddismutase (SOD), phycobiliproteins, carotenoids and lipids in the biomass of cyanobacteria Spirulina platensis.*

INTRODUCTION

Investigation of non-traditional sources of bioactive substances is one of the current directions of biotechnology development in many countries worldwide. Cyanobacteria *Spirulina platensis* is widely explored and used in recent decades as a source of valuable biologically active substances [1, 4]. An important role in neutralizing the harmful effects of oxidative stress have the enzime superoxiddismutase (SOD), that it is present, also, in the biomass of cyanobacteria *Spirulina platensis*. Summarize the most powerful antioxidants in spirulina biomass can be mentioned water-soluble pigments – phycobiliproteins, possessing anti-inflammatory, immunostimulatory, neuroprotective, hematopoietic properties [3]. Another group of pigments - carotenoids are widely used as natural colorants and antioxidants [2]. Carotenoids possess immunostimulatory properties and inhibit the growth of

cancer cells that present the perspective of their use in prophylaxis and complex treatment of cancer. Cyanobacteria *Spirulina platensis* presents, also, a source of polyunsaturated fatty acids, which, have a cardioprotective role, possess immunostimulatory, antiviral, antibacterial properties.

The aim of this investigation presents a study of possibility of utilization of some coordination compounds of V(IV) and Co(III) as regulators of the content of bioactive substances with antioxidant properties (superoxide dismutase, phycobiliproteins, carotenoids, lipids) in the biomass of cyanobacteria *Spirulina platensis*.

MATERIALS AND METHODS

Object of study is a strain of cyanobacteria *Spirulina platensis CNM-CB-02*. Cultivation of cyanobacteria *Spirulina platensis* was carried out on the nutritive medium *SP – 1*. As stimulators of growth processes of cyanobacteria *Spirulina platensis* and accumulation of bioactive substances with antioxidant properties in the biomass coordination compounds of V(IV) and Co(II) with different ligands of organic nature: $[(VO)_2(2PyTCH)]SO_4 \cdot 4H_2O$; $[(VO)_2(2PyCH)]SO_4 \cdot 4H_2O$; $[(VO)_2(2PyFx)]SO_4 \cdot 4H_2O$; $[Co(L\text{-}H)En] \cdot 3H_2O$; L5 - $Na[Co(DH)_2(NO_2)_2]$ have been used.

Productivity of spirulina was determined according to photocolorimetrical method [5]. The determination of activity of superoxide dismutase in the spirulina biomass was carried out according to the method proposed by Bulimaga. The content of phycobiliproteins was determined according to spectrophotometrical method, elaborated by Bousiba and Richmond. The carotenoids content in the biomass of spirulina was measured according to spectrophotometrical method. Determination of lipid contents was effectuated by spectrophotometrical method [5]. Regression and statistical analysis of data obtained in three series was carried out by the methods proposed by Dospehov [6].

RESULTS AND DISCUSSIONS

It was established a weak inhibitory effect of the two studied compounds: $[(VO)_2(2PyTCH)]SO_4 \bullet 4H_2O$ in concentrations within

5 to 25 mg/l and $Na[Co(DH)_2(NO_2)_2]$ (10-25mg/l) on the productivity of spirulina. In the case of utilization of the other compounds, productivity values are within the reference sample, except for compounds $[Co(L\text{-}H)En]\cdot 3H_2O$ and $Na[Co(DH)_2(NO_2)_2]$, which contribute to increase of productivity by 11-18% compared to the reference sample in the concentration of 5 mg/l.

The analysis of obtained results has demonstrated that phycobiliproteins content is increased by 45-74% compared to the reference sample in the case of utilization of compounds of V(IV). The administration of the coordinative compound of Co (III) - [Co(L-H) En] $3H_2O$ in the concentration of 20mg/l has recorded a maximum increase of phycobiliproteins contents (by 160% compared to the reference sample). The beneficial effect is caused possibly by the fact that coordination compounds of Co (III) causes a stimulation of electron transport in photosynthetic apparatus of the cell, therefore cells possess a greater fluidity of the thylakoid membrane, and also there is an enhancement of heme oxygenase synthesis, which causes the increase of phycobiliproteins content in the biomass.

Beta-carotene contents in the biomass of spirulina cultivated in the presence of complexes $[(VO)_2(2PyTCH)]SO_4 \bullet 4\ H_2O$ and $[(VO)_2(2PyCH)]SO_4 \bullet 4H_2O$ reaches the values of 29 and 25mg%, respectively, at optimal concentration of compounds of 25 mg/l.

The determination of activity of superoxiddismutase (SOD) in obtained extracts from spirulina biomass allowed to establish a positive effect of coordination compounds of Co (III) on the activity of this enzyme. Maximum increase of superoxiddismutase activity in the biomass of spirulina (by 38% compared to the reference sample) was established in the case of utilization of the compound $[Co(L\text{-}H)En]\cdot 3H_2O$ in the concentration of 15mg/l. The significant increase of SOD activity (by 32-36% compared to the reference sample) is registered in the case of administration of the compound $Na[Co(DH)_2(NO_2)_2]$ in the concentration range of 15-25mg/l.

It was demonstrated that all tested compounds contribute to increased synthesis of lipids in biomass with a maximum of about 45-47% increase of their content compared to the reference sample in the case of utilization of coordination compounds of Co(III) -

$[Co(L\text{-}H)En]\cdot 3H_2O$ and $Na[Co(DH)_2(NO_2)_2]$ in the optimal concentration of 20 and 15mg/l, respectively.

Conclusion. The present study reveals that obtained biomass of cyanobacteria *Spirulina platensis* with high content of bioactive substances with antioxidant properties (superoxiddismutase, phycobiliproteins, carotenoids, lipids) can be used for the elaboration of medical remedies for prophylaxis and treatment of diseases, caused by the negative effect of oxidative stress on live organisms and, also, for the elaboration of cosmetic preparations for the prevention of premature skin aging, protection against solar radiation and treatment of skin diseases.

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