NANOBIOTECHNOLOGIES OF IRON RICH SPIRULINA CULTIVATION AS A SOURCE OF ANTIANEMIC PRODUCTS

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Abstract: The investigation of processes connected with iron accumulation in biomass of algae represents an interest as from theoretical point of view as well from practical. The study of some new Fe(III)coordinative compounds influence on iron accumulation in spirulina biomass have been carried out. The coordinative compounds have been administrated at the cultivation medium through 3 modalities: in the first or in the third day of cultivation and supplementation on rates (1/2 dose of compounds in the first day and the rest in the third day). In the result of our investigations have been established, that the quantity of iron determined in biomass increases proportionally with concentration increasing of the tested compounds.

The maximal iron content in biomass has been accumulated at 50mg/l compounds concentration and is not depending of modality of supplementation. The highest content of iron has been determined in spirulina biomass in presence of all studied coordinalive compounds in case of supplementation on rates. The content of iron in biomass depends on the iron concentration in the respective compound as well as on the nature of the compound. Thus, the highest quantitative values of iron have been determinated in spirulina biomass in case of supplementation on rates at the maximal concentration of the coordinative compounds (50 mg/1) its content in spirulina biomass is: Fe3O-Gly -1.20% Fe3O-Ala - 1.01% Fe3O-Val -0.64%

In conclusion, the results of our investigations demonstrate that the all three coordinative compounds of Fe(III) may be used in nanobiotechnology of spirulina cultivation for obtaining some new antianemic products .

INTRODUCTION

The researches in the field of nanobiotechnology opens new perspectives in medicine and pharmacology for obtaining of some effective products, including antianemic remedies using spirulina biomass as a source of organic iron. Spirulina contains high level of proteins, chlorophyll, phycobiliproteins, vitamin 812 and folic acid; therefore it is able to increase the quantity and efficiency

of red blood cells. Increasing of organic iron content in spirulina biomass by nanobiotechnology of Spirulina cultivation in presence of some coordinative compounds of Fe (III) will permit to obtain the new more efficiently natural antianemic products.

The investigation of processes connected with iron accumulation in algal biomass represents an interest as from theoretical point of view as well from practical. Our researches have been carried out on this problem.

MATERIALS AND METHODS

The object of study: the variety of cyanobacterium *Spirulina platemis* (NORDST.)Geitl Calu-835. The culture of spirulina has been inoculated in Zarrouk modified nutritive medium. As the iron source have been used the coordinative compounds: [Fe3O(Gly)6(H2O)3]NO3-3H20 (Fe3O-Gly), [Fe3O(Val)6(H2O)3]NO3-H2O (Fe3O-Val), [Fe3O(Ala)6(H2O)3]NO3-4H2O (Fe3O-Ala), supplemented at medium of cultivation through 3 modalities in the concentrations 5, 10, 20, 30, 40 and 50 mg/1. Cultivation of spirulina has been effectuated in Erlenmeyer 250 ml retorts, during 144 hours, respecting the cultivation parameters as follows: temperature - 30°C, light intensity - 3000 lux during first 72 hours and respectively - 32°C and 4000 lux in the next 72 hours of the cultivation process. In stationary phase spirulina has been separated from the liquid by filtration. The collected biomass with concentration 10 mg/ml has been frozen, and repeatedly unfrozen.[l] .

Iron determination has been realized via colorimetric method based on the Fe(III) reaction with KSCN [2].

RESULTS AND DISCUSSION

There have been tested 3 new coordinative compounds of iron with amino acids: Fe3O(Gly), FesO(Ala), Fe3O(Val), synthesized by scientists of Institute of Chemistry, using nanotechnologies methods described in [3].

The determination of optimal conditions of iron biomass accumulation will be an essential parameter. The other important parameter is productivity. By the way the coordinative compounds have been administrated at the cultivation medium through 3 modalities: in the first or in the third day of cultivation and supplementation on rates (1/2 dose of compounds in the first day and the rest in the third day). According to table 1 data the studying of tested coordinative compounds of Fe (III) with amino-acids on spirulina productivity have been showed a relative stimulative effect.

Table1.

The spirulina productivity and iron accumulation at cultivation on presents of some coordinative compounds of Fe (III)

The coordinative compounds concentration mg/l	Productivity g/l	Fe determined in biomass, %	Productivity g/l	Fe determined in biomass, %	Productivity g/l	Fe determined in biomass, %
	Supplementation in the first day		Supplementation in the third day		Supplementation in the first and the third days	
Fe_3O-(Gly)6						
5	1.15	0.144	1.0	0.305	1.20	0.342
10	1.15	0.259	1.10	0.558	1.30	0.536
20	1.14	0.457	1.20	0.618	1.30	0.703
30	1.10	0.664	1.20	0.811	1.35	0.808
40	0.80	0.792	1.20	0.929	1.35	0.918
50	0.80	1.143	1.10	1.15	1.15	1.20
Fe_3O-(Ala)6						
5	1.20	0.082	0.90	0.178	1.25	0.241
10	1.20	0.131	0.98	0.293	1.35	0.311
20	1.20	0.242	1.0	0.476	1.20	0.435
30	1.20	0.378	0.95	0.494	1.20	0.567
40	1.20	0.725	0.90	0.717	1.20	0.785
50	1.26	1.00	0.90	0.998	1.10	1.01
Fe_3O-(Val)6						
5	1.15	0.088	1.0	0.121	1.10	0.130
10	1.15	0.180	1.10	0.248	1.10	0.287
20	1.14	0.263	1.12	0.316	1.12	0.434
30	1.12	0.342	1.15	0.386	1.15	0.542
40	1.10	0.460	1.11	0.483	1.25	0.568
50	1.10	0.602	1.0	0.611	1.30	0.640

The iron accumulation in biomass is increasing with the augmentation of the iron coordinative compounds concentrations in the all of the 3 modalities of iron supplementation. The

optimal iron accumulation is observed in the case of supplementation on rates: !/2 of dose in the first day and the rest in the third day. The iron content in biomass are maximal (1.20%) for Fe-Gly at 50 mg/1.

The iron accumulation takes place more less efficiently at Fe(III) coordinative compounds supplementation in the first day, than in the third day, for concentrations 5-40 mg/1 , by except the concentration of 50 mg/1 , where the iron content is approximately the same (1.14 and 1,15 % for Fe3O-Gly; 1,00 and 0.998% for Fe3O-Ala; 0.602 and 0.611 for Fe3O-Val, respectively).

CONCLUSIONS

Analyzing data from the table referring to iron accumulation in spirulina biomass during its cultivation in presence of coordinative compounds of iron with amino acids, the next conclusions could be revealed:

- The quantity of iron determined in biomass increases proportionally with concentration increasing of the tested compounds.
- The maximal iron content in biomass has been accumulated at 50mg/l compounds concentration in this case was not depending of modality of supplementation.
- The highest content of iron has been determined in spirulina biomass in presence of all studied coordinative compounds in case of supplementation on rates.
- The content of iron in biomass depends on the iron concentration in the respective compound as well as on the nature of the compound. Thus, at the maximal concentration of the coordinative compound 50 mg/l in the medium of cultivation, its content in spirulina biomassis:

  Fe3O-Gly - 1.20%

  Fe3O-Ala - 1.01%

  Fe3O-Val - 0.64%

- The all three coordinative compounds of Fe(III) may be used in nanobiotechnology of spirulina cultivation for obtaining of the new antianemic products.

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