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The dynamic of pigments level in sunflower sprouts after zinc compounds supplementing in growth

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Abstract The purpose of this paper is to study the dynamic of pigments level in sunflower sprouts after zinc compounds supplementing in growth. Was evaluated as the content of total chlorophylls, chlorophylls a, chlorophylls b, carotenes and xanthophylls. Seedlings were obtained by germinating of sunflowers greens in the presence of Zn. For germination were used textile germination beds. There were six groups: Group 1 - distilled water;Group 2 - potable water; Group 3 - $ZnSO_4$ -50 ppm Zn;Group 4 - $ZnSO_4$ -100 ppm Zn;Group 5 - $(CH_3COO)_2Zn$ -50 ppmZn;Group 6 - $(CH_3COO)_2Zn$- 100 ppm Zn. We observed the increasing of chlorophyls a,b and total for the groups treated with zinc sulfat, comparative with control groups and the negative influence of zinc acetate solution on pigments syntesis, at 50 ppm dose as well as at 100 ppm dose. Application of zinc sulphate or zinc acetate solution had a negative influence on the carotenes and xanthophylls content in sunflower sprouts.

Key words

sunflower sprouts, zinc sulfat, zinc acetat, chlorophyll, carotenes and xanthophylls

Sunflower seeds have a high content of B vitamin complex, vitamin E, protein, essential fatty acids, magnesium, selenium and zinc. Sprouting the seeds increases their content of beta-carotene, chlorophyll and vitamin C.

As a medicinal food, sunflower seeds are considered antioxidant, diuretic, expectorant, nutritive and warming. They have been used for thousands of years as a tonic for eyes, helping to decrease light sensitivity, improving energy and fertility. Unlike fruits and vegetables, which stop growing when plucked from their mother plant, sprouts continue growing up until the moment they are digested, and impart a subtle life force to the body. Sprouts are considered excellent anti-aging foods due to their rich supply of enzymes[9].

Many important natural substances are chelates. One such chelate is chlorophyll, the green pigment of plants. In chlorophyll the central ion is magnesium, and the large organic molecule is a porphyrin. There are several forms of chlorophyll. The chlorophyll benefic effects are detoxification, intestinal tract adjusting, healing and compensation of lesion, slowing the antiage processes, protection against cancerigene radiation, annihilation effects of some nocive xenobiotics.

It seems that human organism is set to intense interact with this green elixir which adjust the major of vital processes. The strong action of chlorophyll is exercise on human blood, adjustment in diverses mineral deficiencies and helping to toxic eliminating.

Chlorophyll is one of strong antioxidant substances. So, chlorophyll adding by food ratio lead on significant decrease of oxidative effects induced by carcinogens. An important property of chlorophyll is the ability to form molecular compact complexes with some chemical substances which are incriminated to determine cancer. Great chlorophyll level gives experimental plants benefic effects enhancement toward control plants [3].

Approximately 80-90% of the carotenoids present in green, leafy vegetables such as broccoli, kale, spinach and brussel sprouts are xanthophylls, whereas 10-20% are carotenes [7].Carotenoids are notable for their wide distribution, structural diversity and very important biological function. Carotenoids are terpenoids synthetized in the plants plastides as hidrocarbons (carotenes) and their oxigenated derivatives (xanthophylls). These compounds confer to the tissues a yellow, orange or red colour [4]. Carote-noids have been credited with other benefi-cial effects on human health: enhancement of the immune response and reduction of the degenerative diseases risk such as cancer, cardiovascular diseases, cataract and macular degeneration [4,5].

Material and Method

Seedlings were obtained by germinating of sunflowers in the presence of Zn. For germination were used textile germination beds. There were six groups:

- Group 1 - distilled water
- Group 2 - potable water

- Group 3 - $ZnSO_4$ -50 ppm Zn
- Group 4 - $ZnSO_4$ -100 ppm Zn
- Group 5 - $(CH_3COO)_2Zn$ -50 ppm Zn
- Group 6 - $(CH_3COO)_2Zn$- 100 ppm Zn

Application of zinc sulphate or zinc acetate solution and distilled or potable water it was made 24 in 24 hours and equal volumes for all lots of the same species, seedlings benefit from the same environmental conditions (temperature, humidity, light).

Determination of chlorophylls. Chlorophylls content of seedlings was studied spectrophotometry. The plant material was triturated with acetone 80% in the presence of quartz sand. The homogenate obtained was then centrifuged at 3000 rpm. and the supernatant was collected in a glass containers. The precipitate was reextracted with acetone until the extract became colorless. Supernatants were collected and colorimetred at 646, that 663 nm UV-VIS Perkin Elmer spectrophotometer. Acetone extract obtained was dosed spectrophotometrically against a blank of acetone 80% for the two data wavelengths.
Under McKinney-Arron relationship [6], chlorophyll content was quantified as:

$$\text{Chl a} = 12.21 \times (A_{663}) - 2.81 \times (A_{646})$$

$$\text{Chl b} = 20.13 \times (A_{646}) - 5.03 \times (A_{663})$$

$$\text{Chl total} = 17.32 \times (A_{646}) + 7.18 \times (A_{663})$$

where:
Chl a – chlorophyll a, in mg/kg
Chl b – chlorophyll b, in mg/kg
Chl total – total chlorophyll, in mg/kg
A_{663} – sample absorbance at 663 nm
A_{646} – sample absorbance at 646 nm. [6,1]

Determination of carotenes and xanthophylls. The content of carotenes and xanthophylls (c + x) from seedlings acetone extracts was measured by spectrophotometric method [2,8], at a wavelength of 470, 646, respectively 663 nm and was used for calculating the relationship:

$$carotene + xanthophyll = [(1000 \times A_{470}) - (3.27 \times Chl\ a) - 1.04 \times Chl\ b] / 229$$

where: A_{470} – sample absorbance at 470 [8].

Results and Discussions

In fig.1 are presented the images from our experiment.

Fig.1. Sunflower greens

VIS overlapping curves of wheat acetone extracts are presented in figure 2.

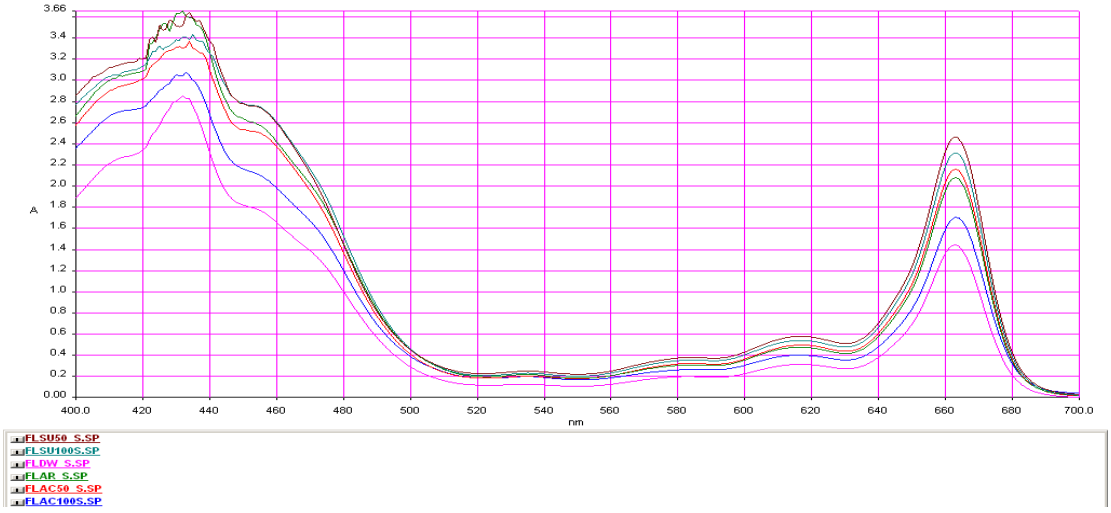

Figure 2. VIS-curves of sunflower germinated greens acetone extracts, after zinc adding

The obtained results are presented in table 1. and figures 2-5.

Table 1

Pigments content (mg/g) in sunflower sprouts consecutive zinc compounds treatment

Group		**$\bar{X}\pm Sx$ (mg/g)**
Group 1 distilled water	Chl a	4,473468
	Chl b	0,01415376
	Chl $_{total}$	5,51549203
	Carotene şi xanthophyll	2,462133
Group 2 potable water	Chl a	8,238173
	Chl b	0,02888409
	Chl $_{total}$	10,884279
	Carotene şi xanthophyll	3,834347
Group 3 $ZnSO_4$ 50 ppm Zn	Chl a	8,657303
	Chl b	0,03578884
	Chl $_{total}$	10,8959188
	Carotene şi xanthophyll	2,853392
Group 4 $ZnSO_4$ 100 ppm Zn	Chl a	4,740772
	Chl b	0,02996375
	Chl $_{total}$	6,08792761
	Carotene şi xanthophyll	2,597307
Group 5 $(CH_3COO)_2Zn$ 50 ppm Zn	Chl a	3,621024
	Chl b	0,02330083
	Chl $_{total}$	4,55767649
	Carotene şi xanthophyll	1,973439
Group 6 $(CH_3COO)_2Zn$ 100 ppm Zn	Chl a	3,522502
	Chl b	0,02121018
	Chl $_{total}$	4,38419525
	Carotene şi xanthophyll	1,940959

Regarding the chlorophyll a and chlorophyll b levels in sunflower greens(Fig.2 and Fig 3), we observe that the variant 3($ZnSO_4$ 50 ppm Zn) registered best results, and the variants 4,5 and 6 lower values of this parameter.

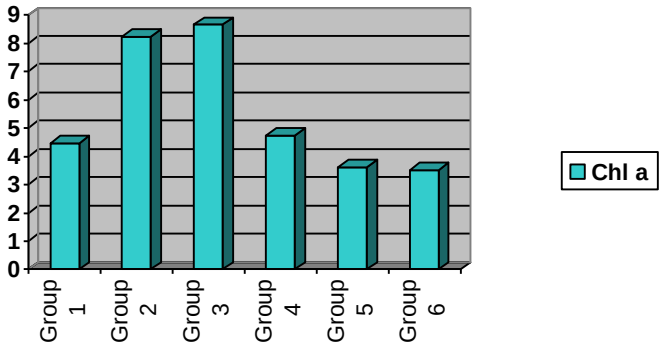

Fig.2. Dynamic of Chlorophyll a level of sprouts obtained by sunflower seeds germination in the presence of Zn(mg/g)

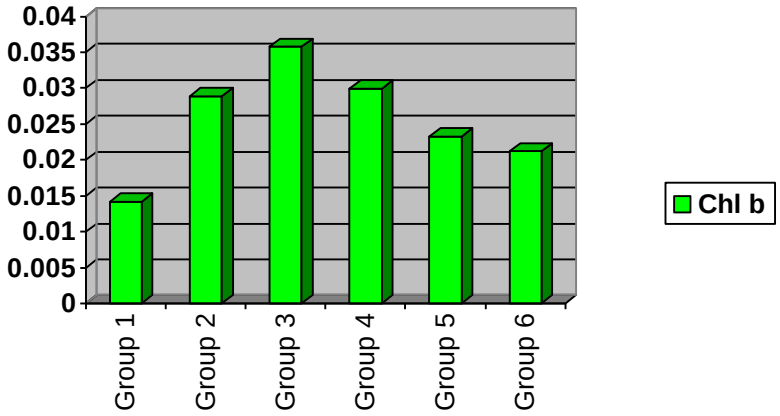

Fig.3. Chlorophyll b level dynamics of sprout obtained by sunflower seeds germination in the presence of Zn(mg/g)

The Total chlorophyll of sunflower seedlings obtained by germinating seeds in the presence of Zn sulfat 50 ppm was higher than the control group, and all the others variants(Fig.4).

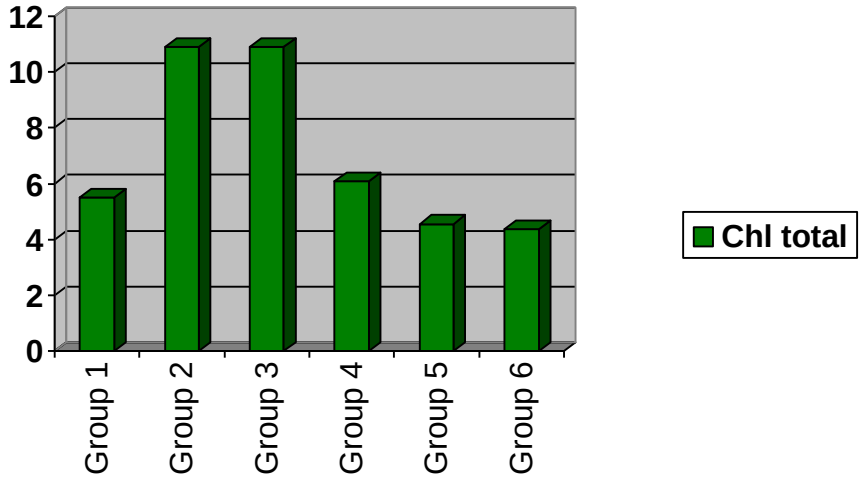

Fig.4. Total chlorophyll level dynamics of sprout obtained by sunflower seeds germination in the presence of Zn(mg/g)

Carotene şi xanthophyll level dynamics of sprout obtained by sunflower seeds germination in the presence of Zn (Fig.5) show us the decreasing of carotenes and xanthophylls content after application of zinc sulphate or zinc acetate solution.

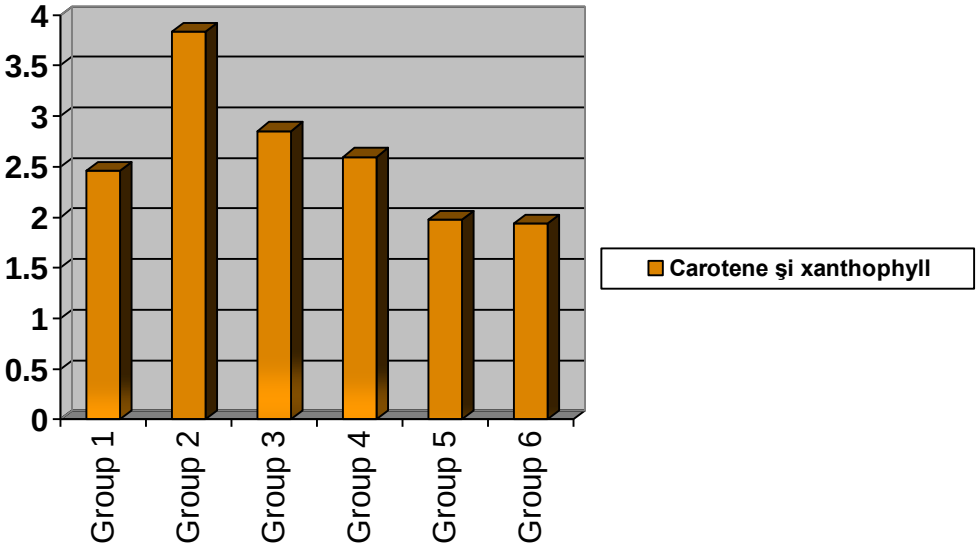

Fig.5. Carotene şi xanthophyll level dynamics of sprout obtained by sunflower seeds germination in the presence of Zn(mg/g)

Conclusions

It is known that sunflower seeds are high in B vitamin complex, vitamin E, protein, essential fatty acids, magnesium, selenium and zinc. Sprouting the seeds increases their content of beta-carotene, chlorophyll and vitamin C.

Our researches regarding the dynamic of the chlorophylls, carotenes and xanthophylls from sunflower greens, after the zinc sulphate and respectivly zinc acetate adding, leaded us to the folowing conclusions:

- the negative influence of zinc acetate solution on pigments syntesis, at 50 ppm dose as well as at 100 ppm dose .
- increasing of chlorophyls a,b and total chlorophyl for the groups treated with zinc sulfat, comparative with control groups;
- decreasing of carotene şi xanthophyll content after application of zinc sulphate or zinc acetate solution;

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