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CHLOROPHYLL CONTENT AND ANTIOXIDANT ACTIVITY OF SUNFLOWER OIL WITH AROMATIC RAW MATERIALS

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Abstract: *The article presents the results of the study on chlorophyll content and antioxidant activity (AOA) of sunflower oil with aromatic raw materials. Dried parsley and basil were used as aromatic raw materials. Sunflower oil with aromatic raw materials was obtained by extraction. Dried basil and parsley were in the amount of 2 to 10 %. The chlorophyll content was quantified by the photometric method. Determination of the AOA was carried out by the Flourescence Recovery after Photobleaching (FRAP) method. The results show the dependence of chlorophyll content on the amount of raw materials taken for extraction. The smallest content of chlorophyll (26.5 mg/L) was found in oil with 2 % of dried basil addition. The highest content of chlorophyll (185.4 mg/L) has been found in oil with 10 % of dried parsley addition. All samples of the investigated oils have high antioxidant activity. It increases with the addition of aromatic raw materials from 2 to 10 % by 1.57 times for oils with basil and by 1.48 times for oil with parsley.*

Keywords*: chlorophyll content, antioxidant activity, aromatic raw materials, basil, parsley, sunflower oil.*

1. Introduction

In recent decades the structure of human diet has changed significantly. The traditional foods can no longer provide human with essential nutrients due to their decreased bioavailability.

An introduction to human diet of foods that are rich in polyunsaturated fatty acids, minerals, dietary fiber, vitamins and antioxidants can help satisfy the need of biologically active substances (BAS). One of perspective directions is the production of vegetable oils using aromatic plant materials. It allows not only to enrich the product with BAS of natural origin, but also to improve its organoleptic characteristics. These oils are used for cooking in restaurants, because they are important components of the flavoring scale of dishes [1].

We have developed the technology of vegetable oils production with increased biological value using aromatic raw materials [1]. Dried basil and parsley were used as aromatic raw materials. These plants are successfully cultivated in Europe and contain significant amounts of BAS. Furthermore, they contain chlorophyll that strengthens cell membranes, promotes the formation of connective tissue, supports the body's pH balance, improves pulmonary function, liver, kidney, thyroid, intestine, strengthens the immune system, prevents DNA pathological changes, outputs the remnants of toxins and medicines, binds free radicals shows antioxidant and antibacterial properties [2-3]. Chlorophyll is one of the most valuable

components of plants [4] and foods high in their content can prevent a number of diseases.

The aim of our research was to determine the chlorophyll content and antioxidant activity of sunflower oil enriched with BAS of basil and parsley.

2. Materials and methods

2.1 Materials

Oil enriched with BAS of aromatic raw materials was prepared using the cold-pressed sunflower oil and dried parsley and basil. Fresh parsley and basil have high moisture content (about 90%). The use of fresh plants leads to increase of moisture content in the final product. It can promote the process of non-enzymatic hydrolysis of vegetable fat (accumulation of free fatty acids, increment the acid number) and early spoilage. [5-8].

Sunflower oil with aromatic plant materials was obtained by extraction. The technology includes the following stages: preparation of plant material (crushing, infusion with the ethanol-water mixture), processing of oil with prepared material by mixing under vacuum (temperature of - 34 to 36° C, process time - 6 hours), separation of oil from the material by filtration.

Basil and parsley were added in the amount of 2 to 10% by weight of oil. If the addition is of 12% or more, then the final product begins to acquire a bitter taste.

2.2 Chlorophyll content

Quantitation of chlorophyll content was carried out by the method proposed by I.H. Hazzaa, V.A. Vaynshteyn and T.H. Chibilyaev [9].

Weighed sample of oil was dissolved in chloroform.

The optical density was measured at wavelength of 670 nm by CPC-2 photoelectric colorimeter. Chlorophyll content (H, mg/L) was calculated by the formula:

$$H = \frac{D \times P \times 10000}{755} \qquad (1)$$

where: D – optical density; P – multiplicity of dilution of chloroform; 755 – chlorophyll specific absorption coefficient at 668 nm; 1000 – conversion of concentration in mg/L.

2.3 Antioxidant activity

Antioxidant activity was determined by FRAP method. The methanol extracts of vegetable oils for the determination were obtained using the method proposed by A. Szydlowska-Czerniak [10].

1 ml of $FeCl_3$ solutions (1.5 mg/L, methanol) and o-phenantroline (1 mg/L, methanol) were added 1 ml of the methanolic extract of the investigated oil. The obtained mixture volume was adjusted to 5 ml and left in the dark place for 10 minutes. The optical density was measured at wavelength of 670 nm by CPC-2 photoelectric colorimeter. The results were calculated by calibration curve using soluble vitamin E as standard sample (Fig. 1). The calculation of antioxidant activity (AOA, mg/kg) based on the activity of vitamin E was carried out by the formula:

$$AOA = \frac{(a \times X_s + b) \times V}{M} \qquad (2)$$

a,b – coefficients determined from the calibration curve; X_s – optical density of the sample; V – total volume of the methanol extract, mL; M – sample weight, kg.

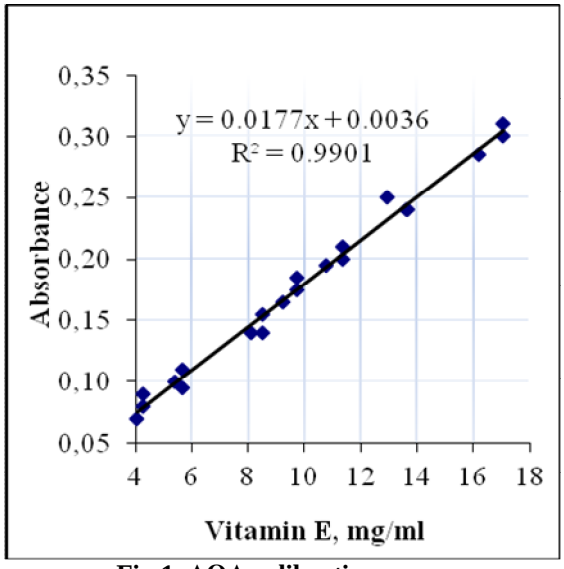

Fig.1. AOA calibration curve

3. Results and discussion

The dependence of chlorophyll content on the amount of aromatic raw materials was investigated in 5 samples of sunflower oil with basil and 5 samples of sunflower oil with parsley (Fig. 2, 3).

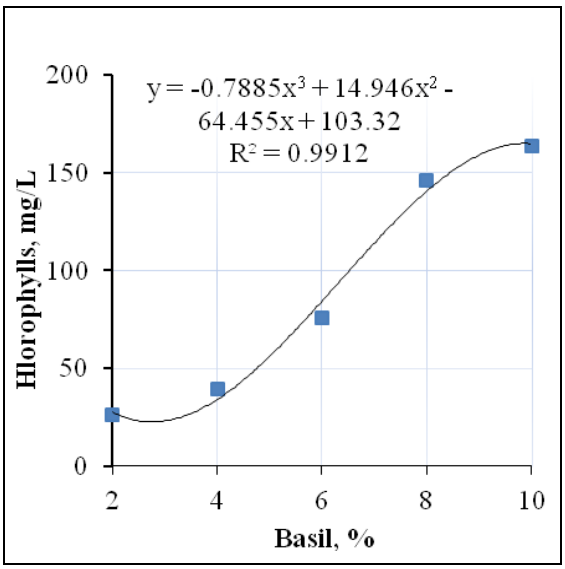

Fig.2. Influence of the amount of basil on chlorophyll content in sunflower oil with basil

The results show the dependence of the amount of chlorophyll content on raw materials taken for extraction.

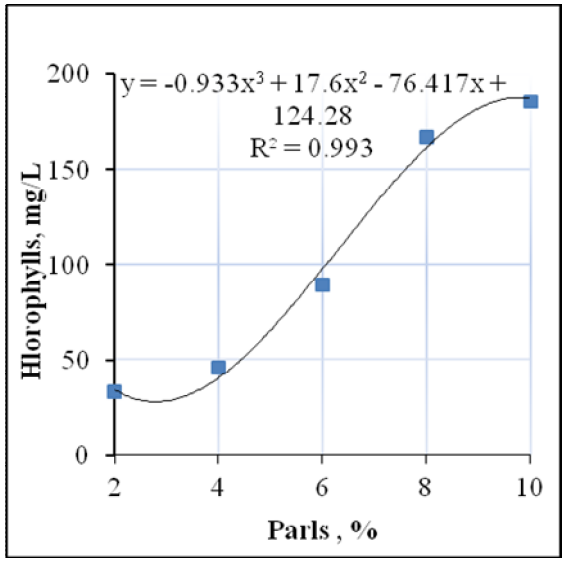

Fig. 3. Influence of the amount of parsly on chlorophyll content of sunflower oil with parsly

The smallest amount of chlorophyll (26.5 mg/L) was found in oil with 2 % of dried basil added. And the highest chlorophyll content (185.4 mg/L) has been found in oil with 10 % of dried parsley added. Moreover, oils obtained with dried parsley have high chlorophyll content in comparison with oils enriched by BAS of basil.

The antioxidant activity of 10 samples of unrefined sunflower oil with aromatic raw materials is shown in Fig. 4.

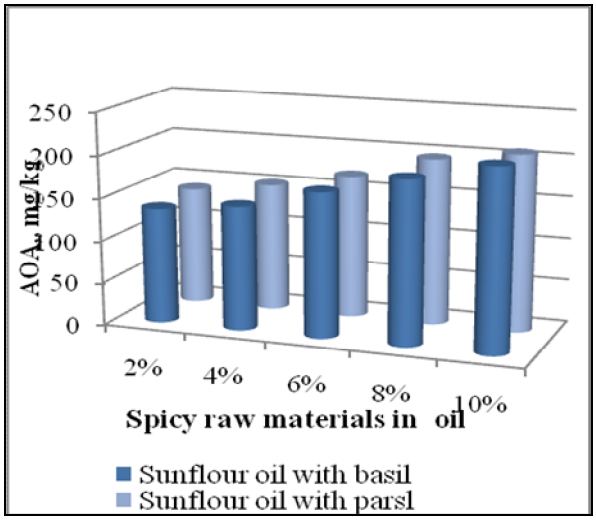

Fig.4. Antioxidant activity of sunflour oil with aromatic raw materials

The antioxidant activity of the oil under research has high values in the range of 100...200 mg/kg. The highest antioxidant activity was found in the sample of sunflower oil with 10 % of parsley added because of the high chlorophyll content.
It should be noted that the values of the AOA of oils with basil and parsley with the same amount of plant materials added are very close, considering the difference in the content of chlorophyll. This fact can be explained by transition of basil essential oils which have high antioxidant activity to sunflower oil.

4. Conclusion

The use of aromatic plant materials such as dried basil and parsley as the valuable source of chlorophyll in the technology of sunflower oil increases the biological value of final product. Addition of raw materials in the amount of 8...10% reaches the chlorophyll content in the finished product to 146...163 dm^3 for oils with basil and to 167...185 dm^3 for oil with parsley. The research results also shown a high antioxidant activity of the obtained samples. With increasing the amount of plant materials added from 2 to 10% the antioxidant activity increases of 1.57 times for oils with basil and 1.48 times for oil with parsley. Thus, the significant effect of amount and type of aromatic raw materials on the antioxidant activity of spice oils has been conducted.

5. References

[1] USATIUK S., PELEKHOVA L., Technology of vegetable oils of high biological value with the use of aromatic raw materials, *Food science, engineering and technologies. Sientific works*, LX, 836-839 (2013).
[2] LEVENT İ. Chlorophyll: Structural Properties, Health Benefits and Its Occurrence in Virgin Olive Oils, *Academic Food Journal*, 9, 26-32 (2011).
[3] TYCHOMYROVA N.A. Functional Food Technology, Frantera, Moscow, 213 p (2002).
[4] ROSU A., NISTOR N., MIRON N., POPA R., Ultrasound assisted extraction of photosynthetic pigments from dried dill (anethum graveolens). *J. of Faculty of Food Engineering*, 11, 4, 5-9 (2012).
[5] PAPONIAN V., VOSKANIAN O. Analisys of influence of various factors on the quality of fats, *Oil Industry*, 2, 10-11, (2004).
[6] NEKRASOVA T. Natural antioxidants for oil and fat products, *Oils and Fats*, 4(50), 1-2, (2005).
[7] TIUTIUNNIKOV B. Chemistry of fats, Kolos, Moscow, 447 p, (1966).
[8] IEVTIEVA N. Oxidative stability of commercial vegetable oils, *Oil Industry*, 5. 14-17 (2006).
[9] KHAZZA I., VAINSHTEIN V., CHIBILIAEV T. Extraction of lipophilic biologically active substances from St. John's wort by water-oil emulsions, *Pharmaceutical Chemistry Journal*, T. 37, 7, 20-23 (2003).
[10] SZYDLOWSKA-CZERNIAK A., DIANOCZKI C., RECSEG K., KARLOVITS G., SZLYK E. Determination of antioxidant capacities of vegetable oils by ferric-ion spectrophotometric methods, Talanta, 76, 899-905 (2008).