

## Research of Content Biologically Active Components of Oils

Iryna Radziewska, Tetiana Lazarenko, Olena Gromova

National University of food technologies, Kyiv, Ukraine

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### ABSTRACT

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Abstract. Liposoluble vitamins constitute an important part of vegetable oils. Fats contain liposoluble vitamins A, D, E, K in the active and nonactive form (as provitamins). Eight connections are known under the name of the vitamin E: four connections of tocopherol ( $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$ ) and four connections of tocotrienols ( $\alpha$ ,  $\beta$ ,  $\gamma$  and  $\delta$ ). Alpha-tocopherol is the most widespread and biologically active, therefore the vitamin E is named also alpha-tocopherol or tocopherol. The highest content of tocopherols among the investigated standards is educed in corn oil; soybean oil is a little inferior to her. The least content of tocopherols was fixed in olive oil. In sunflower-seed oil the general concentration of tocopherols does not exceed 95 mgs%, that on 90 % is presented  $\alpha$ -tocopherols. In soy-bean, rape and mustard oils in prevailing concentrations contained  $\beta$ -isomer.  $\gamma$ - and  $\delta$ - isomers at the investigated standards presented in a negligible quantity from 2,4% in mustard press oil to 12,1% in aquated soy-bean. The results can be applied for prognostication of warranty expiration of sunflower date, soy-bean, flax, rape, mustard, corn and olive oils.

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#### Corresponding author:

Tetiana Lazarenko  
E-mail:  
tanjy@ukr.net

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### Introduction

First the relevancy of vitamin E was set in 1920 due to inhibition of the reproductive processes in the healthy organism. Reproduction interrupting of the white rat that is usually very fruitful was marked during the protracted suckling diet (fat free milk) after the development of an avitaminosis E.

In 1936 the first preparations of vitamin E was received by oil extraction method of cereal embryos.

The synthesis of vitamin of E is carried out in 1938 by Karrer.

It was found at further researches that the role of vitamin E is not only control of reproductive function. Vitamin E also improves blood circulation, it is necessary for tissue regeneration, is useful in the treatment of premenstrual syndrome and fibrotic mammary gland disease. It provides a normal hemopexis and wound repair /cicatrization reduces the possibility of scarring from some wounds; reduces piasis, helps to prevent cataract, paroxysm, regulates the functions of nerves and muscles, strengthens capillary walls, prevents anaemias.

As an antioxidant vitamin E protects cells from damage, slowing the oxidation of lipids and the formation of free radicals. It protects other liposoluble vitamins from destruction of the oxygen, assists absorption of vitamin A, takes part in the formation of collagenous and elastane fibers, takes part in the biosynthesis of haem and proteins, formation of gonadotropins, development of placenta, favourably influences on peripheral blood circulation. In 1997 there was shown an ability of vitamin E to facilitate the flow of Alzheimer's disease and diabetes, as well as to improve the immune function of organism.

The daily requirement in the vitamin E for children of age under 1 year – 0,5 mg / kg (usually completely got from mother's milk), for adults – 0,3 mg / kg.

However it should be remembered that the vitamin E plays the preventive role only doesn't able to renew the destroyed fabrics. In particular, daily reception 400 MO of vitamin E can prevent the conversion of nitrites to carcinogenic nitrosamines, but it did not lead to a backlash conversion of nitrosamines in nitrite. Thus efficiency of vitamin E rises in presence other antioxidants. Its anti-cancer protective effect is particularly noticeable increases vitamin C.

## Materials and methods

Having regard to the known positive effects of vitamin E on human health, we examined seven vegetable oils that are traditional for the market of Ukraine to establish the content of tocopherol isomers in them. It was selected the next subjects of researches : sunflower, soybean, flax, rape, mustard, corn, olive oil with retail trade network. In terms of quality and safety of the investigated samples meet the following technical standards:

- It is Standard Codex Alimentarius in oil with name CODEX-STAN 210-1999;
- DSTU GOST 8808: 2003 "Corn oil. Technical requirements(GOST 8808-2000, IDT)";
- DSTU 4598: 2006 "Mustard oil. Technical requirements".
- DSTU 4534: 2006 "Soybean oil. Technical requirements".
- DSTU 4492: 2005 "Sunflower oil. Technical requirements".
- DSTU ISO 150-2002 "Flax raw oil, purify and polymerized for varnishes and paints. Technical requirements and methods of test (ISO 150: 1980, IDT) ".
- GOST 8988-2002 "Rape oils. Technical requirements ".

Content tocopherol isomers was determined by DSTU ISO 9936:2004 "Animal fats and vegetable oils. Defining containing tocopherols and tocotrienols by the method of liquid chromatography of high-division ability (ISO 9936:1997, IDT). Sample preparation was as follows: the sample was saponified for 40 min with potassium hydroxide in the presence of methanol and antioxidant at the temperature 80–100 ° C. Tocopherols were extracted with a mixture of hexane and diethyl ether volumes of 50–150 ml. Extraction was repeated 3–4 times, merging ethereal layer in the separatory funnel. United extracts were washed 2–4 times with distilled water to the neutral reaction of flushing water.

The resulting extract was evaporated on the rotary evaporator, traces of water were removed by drying with sodium sulfate. Re residue obtained was dissolved in tetrahydrofuran to obtain a final concentration of 1 mkh/sm<sup>3</sup> to 10 mkh/sm<sup>3</sup> each tocopherols. Detection of tocopherols was carried out using liquid chromatography manufactured by Hewlett-Packard NR1100 with fluorescence and diode-array detector, reverse-phase column Hypersil MOS diameter 2,1 mm, length 200 mm. We can define the next conditions of chromatography: mobile phase of acetonitrile: water (70:80), flow rate 0,4 ml / min, temperature of thermostat is 40°C. Fluorescence detector, excitation wavelength 295 nm, 330 nm absorption.

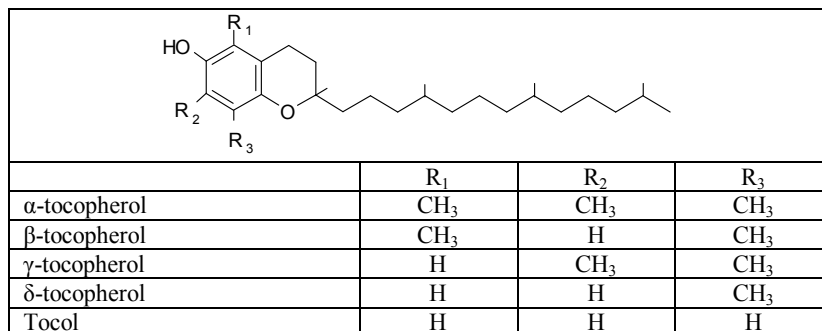
Preparation of the chromatographic system to work performed according to the instruction manual liquid chromatography NR1100. The calibration solutions were prepared with tocopherols stock solution in methanol and analyzed under the same conditions as the samples. Standards of tocopherols are pure substances produced by Supelco. Quantification was performed by measuring the area of the peaks, the result took the average of the two inputs, if the difference between them does not exceed 10%.

### Results and discussions

Vitamin E is presented as tocopherols (connections that have the hydroxyl structural system of aromatic rings and isoprenoid lateral chain). Tocopherols are well soluble in fats and organic non-polar solvents and insoluble in water. They are not destroyed even at the brief heating of oil to 120 °C.

Tocopherols (tokos is a descendant, phero is to carry) are macromolecular cyclic alcohols. We know seven famous forms of tocopherols. And only four of them ( $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ , and  $\epsilon$ ,  $\zeta$ ) were found in fatty part of seeds and garden-stuffs accurately in the lipids of cereal embryos. Unlike tocopherols, the term "vitamin E" is general for tocopherols and tocotrienols. Molecule of tocopherol is the basis of tocol and tocotrienols is the basis of tocol with a lateral, partially saturated isoprene chain.

Structural formula of tocopherols:



$\alpha$ - tocopherol (C<sub>29</sub>H<sub>50</sub>O<sub>2</sub>) has the most biological activity among the indicated isomers of tocopherols. It was found that the stronger the biological activity of tocopherol, the weaker its antioxidant action. The strongest antioxidant is  $\delta$ -tocopherol [1].

We conducted the study of the tocopherol isomers in sunflower, soy-bean, flax, rape, mustard, corn and olive oils (Table 1).

Due to the table data the highest content of tocopherols among the investigated standards is deduced in corn oil; soybean oil is a little inferior to her. The least content of tocopherols was fixed in olive oil. In sunflower-seed oil the general concentration of tocopherols does not exceed 95 mg%, that on 90 % is presented  $\alpha$ - tocopherols. In soy-bean, rape and mustard oils in prevailing concentrations contained  $\beta$  -isomer.  $\gamma$ - and  $\delta$ - isomers at the investigated standards presented in a negligible quantity from 2,4% in mustard press oil to 12,1% in aquated soy-bean.

Table 1

**Tocopherols Content in the standards of the investigated oils**

Oil	General content, mgs%	Isomers, % general content			Total content, mgs%, (Codex Alimentarius)
		$\alpha$	$\beta$	$\gamma + \delta$	
Sunflower press	94	91,5	8,5	—	40,3–102,1
The soy-bean is aquated	364	12,1	70,5	12,1	25,2–362,7
Flax press	109	46,4	48,0	5,6	56,0–113,0
Rape press	56	27	73	—	28,9–130,1
Mustard press	84	26,3	71,3	2,4	34,0–90,2
The corn is refined	655	49,1	42,4	8,5	31,4–347,2
The olive is unrefined	10	73,7	26,3	—	13,0–45,3

Property tocopherols, which are added to fats, depending on their content in the most natural fats. So, beyond the rules to enter tocopherols to oil a cow (a more than 500 mg is on 1 kg) antioxidant effect inversely proportional to the prooxidant [2].

For soybean, cotton, corn, mustard oil containing tocopherols respectively  $2,2 \cdot 10^{-3}$ ,  $1,6 \cdot 10^{-3}$ ,  $2,0 \cdot 10^{-3}$ ,  $2,38 \cdot 10^{-3}$  mol/dm<sup>3</sup> any additions  $\alpha$ -tocopherol supplements accelerated oxidation in proportion to their concentration. Maximum stability of soybean oil was observed at concentrations of natural tocopherols  $(1,0-1,4) \cdot 10^{-3}$  mol/dm<sup>3</sup>, cotton - if  $(0,8-1,4) \cdot 10^{-3}$  mol/dm<sup>3</sup> natural tocopherols [3]. In vegetable oils natural tocopherol concentration corresponds to the concentration at which the maximum stability is achieved [3, 4]. However stabilizing of lipids with subzero content of tocopherols can be conducted by means of antioxidant with their high maintenance [5].

Value content of isomers of tocopherol is well correlated with the index of equivalent tocopherol (vitamin E is an equivalent), which takes into account all group of the tocopherols connections incorporated by the general name "vitamin of E" [6]. For this indicator, the following conversion factors:  $\alpha$ -tocopherol – 1,0;  $\beta$ -tocopherol – 0,4;  $\gamma$ -tocopherol – 0,1;  $\delta$ -tocopherol – 0,01;  $\alpha$ -tocotrienols – 0,3;  $\beta$ -tocotrienols – 0,05;  $\gamma$ - and  $\delta$ -tocotrienols – 0,01 [7].

## Conclusions

Vitamin E is essential to man, its completion is largely due to the use of oils; it is one of the strongest natural antioxidants so the substances that inhibit or stop the oxidation of fats. Therefore, fortification of fats (including refined oils containing low concentrations of tocopherol isomers) not only increases their biological value, but also contributes to the slow process of oxidative damage, that can increase their allowable storage time.

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