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INDICATORS OF BLENDING OF REFINED VEGETABLE OILS

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Abstract:

Objective. This article discusses the issues of blending refined vegetable oils and the impact on fatty acid composition. The effect on its physicochemical properties has been studied.

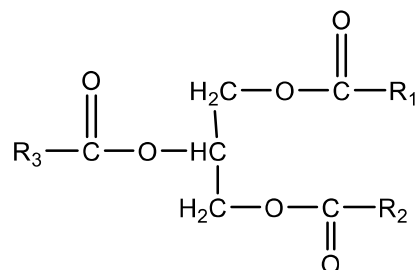
Methods. The fatty acid composition was determined on an Agilent 8860 GC gas chromatograph with a flame ionization detector using a Supelco 100m x 0.25mm capillary column with SRTm-2560 phase, helium carrier gas, column programming temperature from 1400 C to 2500 C. The acid number and peroxide number were determined according to GOST standards.

Results. It has been established that biologically valuable components are higher in unrefined oil than in refined oil. The physicochemical composition of the resulting mixtures was studied, and it was found that they correspond to the normative technical documentation.

Conclusion. Thus, based on the study of blending refined vegetable oils at different ratios (as well as unrefined), the ratio of ω -6: ω -3 is different.

Keywords: Vegetable oil, fatty acid composition, physico-chemical composition, peroxide number, acid number, biological value.

Introduction. Fats and oils, in terms of organic chemistry [1-8], are described as esters of glycerol and fatty acids, called glycerides or triglycerides. These compounds consist of glycerol linked to three molecules of fatty acids, where the hydrocarbon residues of higher carboxylic acids are R_1 , R_2 and R_3 .



Vegetable oils and products play an essential role in human nutrition, providing the necessary calorie content and the content of biologically active substances of a lipid nature, including essential ones. Nutritionists recommend adding products with a balanced fatty acid composition to the human diet, including polyunsaturated fatty acids of the omega-3 and omega-6 families in an optimal ratio of 1: (5-10), as well as biologically active substances such as vitamins, provitamins and phytosterols. Products containing oil oxidation products and trans-fatty acids should be avoided [1,2].

In the world, with an increase in the production of vegetable oils and the creation of new types of oil and fat products for various sectors of the economy, as well as taking into account recommendations for their composition, it is becoming increasingly important to ensure the high quality and safety of the original vegetable oils, as well as the constant improvement of technologies for their modification. Therefore, it is necessary to develop new methods and technologies to improve the quality and safety of vegetable oils.

Research methodology. The fatty acid composition was determined on an Agilent 8860 GC gas chromatograph with a flame ionization detector using a Supelco 100m x 0.25mm capillary column with

SRtm-2560 phase, helium carrier gas, column programming temperature from 1400 C to 2500 C. The acid number and peroxide number were determined according to GOST standards [9-12].

Results and discussion. In works [13-17] blending of unrefined vegetable oils was carried out, where a balanced mixture of vegetable oils was obtained for daily, medicinal and prophylactic purposes. Vegetable oils were blended at the same ratios to study the effect of the refining process on these compositions.

№1. Cottonseed oil + linseed oil + rapeseed oil - 70:10:20;

№2. Soybean oil + sunflower oil - 60:40;

№3. Rapeseed oil + sunflower oil - 20:80;

№4. Rapeseed oil + sunflower oil - 10:90;

№5. Cottonseed oil + linseed oil - 80:20;

№6. Cottonseed oil + soybean oil - 60:40;

№7. Cottonseed oil + soybean oil + rapeseed oil - 60:30:10;

Further, the fatty acid composition of the above-mixed vegetable oils was studied on a modern Agilent Technologies 6890 N gas-liquid chromatograph with a flame ionization detector. The results are shown in the table. 1.

Table 1

Composition of fatty acids of blended mixtures of refined vegetable oils

Fatty acids	№1 (cot.+ lin. + rape.)	№2 (soy. + sun.)	№3 (rape.+ sun.)
Lauric, 12:0	Сл.	-	-
Myristic, 14:0	0,54	0,06	0,15
Palmitic, 16:0	15,7	7,98	7,36
Palmitoleic, 16:1	0,36	0,06	0,10
Margaric, 17:0	0,08	0,07	-
Stearic, 18:0	2,35	3,54	2,88
Oleic, 18:1	19,21	22,93	16,89
Linoleic, 18:2 ω -6	42,8	59,83	61,84
Linolenic, 18:3 ω -3	10,8	4,33	3,78
Arachidonic, 20:0	0,33	0,35	0,37
Eicosenoic, 20:1	2,91	0,18	1,58
Behenic, 22:0	0,31	0,50	0,72
Erucic, 22:1	4,23	-	3,88
Lignoceric, 24:0	0,16	0,17	0,25
Nervonic, 24:1	0,21	-	0,20
Σ saturated FA	19,5	12,67	11,73
Σ unsaturated FA	80,5	87,33	88,27

Table 2

Composition of fatty acids of blended mixtures of refined vegetable oils

Fatty acids	№4 (rape.+ sun.)	№5 (cot.+ lin.)	№6 (cot.+ soy.)	№7 (cot.+ soy.+ rape.)
Myristic, 14:0	0,06	0,60	0,46	0,47
Palmitic, 16:0	4,69	17,4	17,37	16,6
Palmitoleic, 16:1	0,08	0,40	0,35	0,31
Margaric, 17:0	0,05	tr.	tr.	-
Stearic, 18:0	3,13	2,65	3,37	3,06
Oleic, 18:1	15,47	18,86	22,27	21,83
Linoleic, 18:2 ω -6	69,1	46,3	52,25	49,26
Linolenic, 18:3 ω -3	2,08	13,3	3,2	3,66
Arachidonic, 20:0	0,32	0,23	0,30	0,35
Eicosenoic, 20:1	1,65	0,05	0,12	1,64
Behenic, 22:0	0,73	0,12	0,21	0,29
Erucic, 22:1	2,30	-	-	2,27
Lignoceric, 24:0	0,22	0,07	0,10	0,15
Nervonic, 24:1	0,12	-	-	0,11
Σ saturated FA	9,2	21,1	21,81	20,92
Σ unsaturated FA	90,8	78,9	78,19	79,08

From the data obtained in Table 1 and 2, it can be seen that, with the blending of refined vegetable oils, the ratio ω -6: ω -3 is:

№1. Cottonseed oil + linseed oil + rapeseed oil - ω -6: ω -3 - 4:1;

№2. Soybean oil + sunflower oil - ω -6: ω -3 - 14:1;

№3. Rapeseed oil + sunflower oil - ω -6: ω -3 - 16:1;

№4. Rapeseed oil + sunflower oil - ω -6: ω -3 - 33:1;

№5. Cottonseed oil + linseed oil - ω -6: ω -3 - 3.4:1;

№6. Cottonseed oil + soybean oil - ω -6: ω -3 - 16:1;

№7. Cottonseed oil + soybean oil + rapeseed oil - ω -6: ω -3 - 13.1:1;

The ratio ω -6: ω -3 in more than one sample does not meet the requirements set by nutritionists and nutritionists [13]. According to him, for a healthy person, it should be ω -6: ω -3-10: 1; for therapeutic

and preventive nutrition, ω -6: ω -3-5:1 or 3:1.

In works [13-17], unrefined vegetable oils were studied at the same ratios. We compare them with the results of refined

oils (Tables 1 and 2). The refined oils ratio no longer corresponds to the required ones. Further, the change in the acid and peroxide values of the original and blended vegetable oils was studied (Tables 3-4).

Table 3

Fundamental data on refined vegetable oils

Indicator name	Vegetable oils				
	rapeseed	sunflower	cottonseed	soybean	linseed
Acid number (mg KOH/g)	0,3	0,2	0,3	0,2	0,4
Peroxide value (mmol O ₂ /kg)	2,1	1,8	3,2	1,9	2,5

Table 4

Changes in acid and peroxide values of blended vegetable oils

Name of product	Acid number (mg KOH/g)	Peroxide value (mmol O ₂ /kg)
№1 (cot.+ lin. + rape.)	0,3	2,8
№2 (soy. + sun.)	0,2	1,9
№3 (rape.+ sun.)	0,2	1,8
№4 (rape.+ sun.)	0,2	1,8
№5 (cot.+ lin.)	0,3	3,1
№6 (cot.+ soy.)	0,2	2,6
№7 (cot.+ soy.+ rape.)	0,2	2,7

As can be seen from the data obtained in Table. 3-4 you can see that all the physicochemical parameters of the original and blended refined vegetable oils correspond to the normative technical documentation.

Conclusion. Thus, based on the study of blending refined vegetable oils at different ratios (and unrefined), the ω -6: ω -3 ratio is different. This can be explained by the fact that valuable fatty acids are partially lost during refining, and therefore

the ratios made from unrefined oils need to be changed. For example: in samples No. 1 and No. 5, they need to increase the amount of linseed oil, or in samples No. 2,3,6, they need to reduce the amount of ω -6.

It has been established that biologically valuable components of unrefined oil are higher than those of refined oil. Further research will look to obtain a balanced cooking PUFA for daily consumption.

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