UDC 006.83-035.83

QUALITY AND SAFETY OF NEW BLENDED OILS

S. Lehnert, PhD, Associate Professor, Doctoral student[1]
O. Khomenko, PhD, Associate Professor[1]
A. Dubinina, Doctor of Technical Sciences, Professor[1]
V. Vinnikova, PhD, Associate Professor[1]
L.Tatar, PhD, Assistant[2]
[1]Department of Commodity, quality management and environmental safety
[2]Department of Merchandising and Goods' Examination
Kharkiv State University of Food Technology and Trade
333 Klochkivska str., Kharkiv, Ukraine, 61051

DOI: http://dx.doi.org/ 10.15673/fst.v13i3.1479

Article history

Received 25.10.2018
Reviewed 05.12.2018
Revised 10.04.2019.
Approved 03.09.2019

Correspondence:

V. Vinnikova
E-mail: vladavinnikova77@gmail.com

Cite as Vancouver Citation Style

Lehnert S, Khomenko O, Dubinina A, Vinnikova V, Tatar L. Quality and safety of new blended oils. Food science and technology. 2019;13(3):112-117. DOI: http://dx.doi.org/ 10.15673/fst.v13i3.1479

Cite as State Standard of Ukraine 8302:2015

Quality and safety of new blended oils / Lehnert S. et al. // Food science and technology. 2019. Vol. 13, Issue 3. P. 112-117. DOI: http://dx.doi.org/ 10.15673/fst.v13i3.1479

Abstract. The article characterizes the peanut (*Arachis hypogaea*) as an oilseed crop widely spread in the world. It describes its biological value as well as the chemical and fatty acid composition. The study proves the practical importance of developing and introducing new blended functional purpose oils for Ukrainian people. It has been shown that blended oils contain significant amounts of monounsaturated and polyunsaturated fatty acids. The use of blended oils will correct the deficiency of essential fatty acids in the diet of our country's population. It has been pointed out how promising it is to create new types of blended oils, with a balanced fatty acid composition, by combining peanut and linseed oils. The article describes the characteristics of the new blended peanut-linseed oils with additives made from vegetable raw materials. The evaluated parameters are the quality and safety of the new blended peanut-linseed oils with a garlic extract, rosehip extract, sorrel leaf extract, and black currant leaf extract. The fatty acid composition of the fat in the new blended oils has been studied to determine their quality. The safety assessment of the new oils with the additives from vegetable raw materials has been determined by the content of pesticides (HCH-gamma isomer, heptachlor, and DDT), mycotoxins (aflotoxin B_1 and zearalenone), toxic elements (lead, cadmium, arsenic, mercury, and zinc), iron, and radionuclides (cesium-137 and strontium-90). The results obtained confirm that the new blended oils are safe. The blended oils have a high biological value when the ratio of ω-6 to ω-3 fatty acids is 4.9:1, and the ratio of monounsaturated fatty acids to polyunsaturated fatty acids is 1:1, which meets the standards of healthy nutrition. In terms of chemical and radiation safety, the new oils do not exceed the maximum permissible concentrations, confirming the safety of the newly developed oils.

Keywords: peanut, peanut oil, linseed oil, blended oils, fatty acid composition, safety.

Introduction. Formulation of the problem

In today's world, there is an acute shortage of complete proteins, polyunsaturated fatty acids, vitamins, minerals, dietary fibre, and other nutrients. Balancing nutrients and vitamins in people's diet is one of the most pressing problems in the third millennium. A source of these substances is nuts. However, their potential has not been fully used yet to produce healthy food. A promising raw material to expand the range of such products is the peanut. The most important component of the peanut as for its nutritional value is oil. In its content, the prevailing substances are unsaturated acids, which makes this nut an important product to fight against atherosclerosis and other cardiovascular diseases, as it helps reduce the level of excess cholesterol in the blood. Peanut proteins are characterized by a high content of essential amino acids, which brings them similar to animal proteins The peanut is a source of vitamins and minerals that have a positive effect on the activity of the nervous system, heart, liver, and other organs, and accelerate cell growth [1,2].

There are a lot of technologies for peanut products: confectionery, peanut oil, snacks. Peanuts are also used as a multifunctional supplement in bakery products, lactose-free dairy drinks, cheese products, dairy desserts, and condensed dairy products. However, the creation of polyfunctional peanut products in Ukraine is rather limited. There are no directions for the rational use of peanuts in certain technologies of the food industry that would take into account its varietal properties and the specific features of its chemical composition. Solving this problem will help expand the range of domestic healthy foods using peanuts and increase, by the rational use of raw materials, the economic efficiency of its processing for nutritional purposes.

Analysis of recent research and publications

Peanuts are grown around the world primarily as an oilseed crop. Peanut fat contains about 20% of saturated fatty acids and 80% of unsaturated fatty acids, of which oleic and linoleic are the largest fractions. Proteins contained in peanut kernels are globulins, namely arachine and conarachine, and glutenins [1,2]. The biological value of peanut proteins is due to the content of essential amino acids, which are essential for human activity but cannot be synthesized by the body itself. The vitamin composition of peanuts is characterized by the presence of vitamin E and B vitamins. Their average quantitative content is: E – 6.93 mg/100 g, B_1 – 0.438 mg/100 g, B_2 – 0.098 mg/100 g, B_3 – 13.5mg/100 g, B_5 – 1.4 mg/100 g, B_6 – 0.256 mg/100 g, and B_9 – 145 mg/100 g. This makes peanuts an important product in the struggle against atherosclerosis, cardiovascular diseases, and high cholesterol in the blood [1, 2].

Due to the rich chemical composition, peanut kernels are widely used in various industries for the production of both conventional and health-improving food.

Worldwide, about 40 % of the peanut is processed into so called peanut butter, 20% is used in confectionery, 10% is for peanut oil, 10 % is for snack products, and the rest is for other peanut based products.

More than one hundred peanut butter formulations have been developed and patented; they include, in particular, the known method of making oil (USA) that is non-allergenic due to a significant reduction or complete elimination of allergenic peanut proteins [3].

Chinese scientists are also working on formulations of this product. One of their formulations includes peanut kernels, garlic, hot pepper, and salt. The obtained peanut oil is rich in nutrients; it has a spicy taste and long shelf life [4].

Peanut oil is widely used in cosmetology, medicine, and food industry, which testifies to its useful properties. Unrefined peanut oil is obtained by extraction, by cold pressing of peanut pulp or fermented peanut flour. It has a colour ranging from light yellow to red brown, rich sweet aroma, distinct nutty taste, and it is a very popular and traditional ingredient in the exotic Indian, Japanese, Chinese, Korean, and Thai cuisines [5].

Refined peanut oil, which is, unlike unrefined, light yellow incolour, has a less distinct taste and aroma, and is the most popular in American and European cooking. It is often used by vegetarians because of its rich chemical composition and high energy value. It is best to use peanut oil in salads, hot vegetable dishes, meat sauces, and pancakes with fruit fillings. If refined peanut oil is used in deep frying, it does not smoke and allows you to reduce the amount of the oil twice.

Peanut oil is also blended with various vegetable oils; the components added are milk, medicinal herb concentrates (including roots of red sage, garden angelica, and luffa). Enriching peanut oil with vitamins and minerals enhances its biological value and oxidative stability [6].

Many scientists have studied the chemical composition of the peanut. Of particular interest is the study of the fatty acid composition of its fat. Musa Özcan and Serap Seven studied the peanut varieties ÇOM and NC-7 from Turkey. The fatty acid composition of fat was investigated, and the following fatty acids were identified and quantified in it: myristic (0.13–0.33%), palmitic (8.70–13.13%), palmitoleic (0.23–0.47%), stearic (3.77–4.53%), oleic (43.13–55.10%), linoleic (25.13–35.20%), linolenic (0.20–0.30%), arachidonic (1.53–1.90%), gadoleic (0.40–1.37%), and behenic (2.40–3.47 %)[2].

The Argentine scientist N. R. Grosso with co-authors also studied the fatty acid composition of peanut fat from the Uruguay varieties 1Uv, 2Uv, 5Uv, 6Uv, 7Uv, 8Uv, and 9Uv. 7Uv was found to be characterized by a higher content of oleic acid (42.53%), whereas 2Uv and 5Uv contained higher percentages of linoleic acid (43.67% and 43.40%, respectively). The content of other acids was as follows: palmitic – 9.33–10.43%, behenic – 2.23–3.40%, stearic – 2.33–2.60%, and arachidonic – 1.0–1.17% [6,7].

Studies of the peanut fat of varieties from Nigeria (Boro Red, Boro Light, Mokwa, Ela, Campala, and Guta) have shown a rather high concentration of oleic and linoleic acids in it [8].

A group of authors [9,10] investigated new varieties of peanuts in Mexico (Col-24-Gro, Col-61-Gto, VA-81-B, Ranferi Díaz, NC-2, and Florunner) and found that the peanuts contained 50–55 % of fat, in which the total amount of saturated and unsaturated fatty acids was, on average, 17% and 79%, respectively; the latter contained approximately 30 % of linoleic acid and 45% of oleic acid.

The analysis of the above sources indicates that peanut oil contains very little linolenic acid (ω-3). Linseed oil is the best source of this fatty acid.

One of the modern trends in the oil and fat industry is blending of oils in order to obtain optimized fatty acid compositions.

In the Kharkiv State University of Food Technology and Trade, mathematical modelling has helped determine that to produce blended oil with an optimized fatty acid composition, the required ratio of oils (wt. %) is 86% of peanut and 14% of linseed oil.

A significant drawback of polyunsaturated fatty acids ω-3 and ω-6 is an extreme tendency for oxidation. Maintaining the quality of the blend implies protecting the lipids from oxidation, as it produces substances that not only impair the quality of the oil, but can also be detrimental to human health. In this regard, the achievement of oxidative stability of oils is necessary and highly important.

To prevent oxidation, antioxidants are widely used; the mechanism of their action consists in breaking the molecular chains of the reaction. Based on the literature and previous experimental studies, extracts of sage leaves, black currant leaves, garlic, and rosehips were selected as inhibitors. The choice of these plant raw materials is due to their unique chemical composition and known antioxidant properties.

To stabilize the developed blend, the oil extracts of sage leaves, black currant leaves, garlic, and rosehips were added in the amount of 5% to the weight of the blend, which made it possible to increase its oxidation stability 1.2–1.7 times. The ratio ω-6:ω-3 `fatty acids in the new blends is 4.9:1, and MUFAs:PUFAs is 1:1, which meets the standards of healthy nutrition [11,12].

The purpose of the present study was to determine the quality and safety of the new blended oils.

To determine the quality of the blended oils, the first objective was to study the fatty acid composition of their fat.

To determine the safety of the blended oils, the objective of our tests was to determine the content of pesticides (HCH-gamma isomer, heptachlor, and DDT), mycotoxins (aflotoxin B_1 and zearalenone), toxic elements (lead, cadmium, arsenic, mercury, and copper), iron, and radionuclides (cesium-137 and strontium-90).

Research materials and methods

As the materials, the 4 types of the new blended peanut oils were used namely peanut-linseed oils with extracts of garlic, rosehips, sorrel leaves, and black currant leaves.

The new peanut-linseed oils have the following content of unsaturated fatty acids, %: oleic – 46.8; palmitoleic – 0.17; erucic – 0.04; linoleic – 37.22; and linolenic – 7.65.

The fatty acid composition of the oil fat was determined by gas chromatography according to GOST (State Standard) 30418-96.

The contents of toxic substances and iron were determined by the atomic absorption method according to GOST 30178-96.

The specific activity of cesium-137 and strontium-90 was determined using a gamma spectrometer (SET-002 AKP-P No. 3268) and a beta-spectrometer (SEB-01-150 No. 17603) [13-15].

Mycotoxins were determined by thin layer chromatography on Silufol plates according to GOST 30711-2001.

Pesticides were determined by the gas chromatographic method according to DSTU EN 12393:2003.

Results of the research and their discussion

The basic criterion of the nutritional value of the oils developed is their fatty acid composition given in Table 1. The results on the content of toxic elements, pesticides, mycotoxins, and radionuclides are given in Table 2.

Table 1 – The fatty acid composition of the fat of the blended peanut oils (n = 3, P ≥ 0.95, and ε ≤ 10)

Fatty acid	Peanut linseed oil with an extract of			
	garlic	rosehips	sorrel leaves	black currant leaves
Saturated fatty acids, g/100 g				
myristic	0.58	0.38	0.33	0.34
palmitic	4.63	4.52	4.91	4.80
stearic	2.42	2.90	2.39	2.62
lauric	0.23	0.24	0.18	0.17
behenic	0.04	0.06	0.03	0.04
arachidic	0.05	0.05	0.08	0.07
Total	7.95	8.15	7.92	8.05
Monounsaturated fatty acids, g/100 g				
oleic	45.26	44.93	45.17	45.60
erucic	0.03	0.04	0.03	0.03
palmitoleic	0.32	0.34	0.42	0.20
Total	45.61	45.31	45.62	45.83
Polyunsaturated fatty acids, g/100 g				
linoleic	36.72	36.0	36.33	35.83
linolenic	7.43	7.32	7.38	7.30
Total	44.15	43.32	43.71	43.13
SFAs:MUFAs:PUFAs	0.17:1:1	0.18:1:1	0.17:1:1	0.18:1:1
ω-6:ω-3	4.9:1	4.9:1	4.9:1	4.9:1

Table 2 – The content of the residual amounts of toxic substances in the blended peanut oils

Parameter	Requirements of regulatory documents	Peanut linseed oil with an extract of			
		garlic	rosehips	sorrel leaves	black currant leaves
HCH-gamma isomer, mg/kg	< 0.05	not found	not found	not found	not found
Heptachlor, mg/kg	not allowed	not found	not found	not found	not found
DDT, mg/kg	< 0.1	not found	not found	not found	not found
Aflatoxin $B_{1,\ mg/kg}$	< 0.005	not found	not found	not found	not found
Zearalenone, mg/kg	< 1.0	not found	not found	not found	not found
Cesium-137, Bq/kg	< 30	4.23	3.66	4.98	4.82
Strontium-90, Bq/kg	< 100	10.95	12.27	12.81	11.94
Lead, mg/kg	< 0.1	0.04	0.013	0.03	0.04
Cadmium, mg/kg	< 0.05	0.003	0.004	0.004	0.003
Arsenic, mg/kg	< 0.1	not found	not found	not found	not found
Mercury, mg/kg	< 0.03	not found	not found	not found	not found
Copper, mg/kg	< 0.5	0.32	0.30	0.28	0.23
Zinc, mg/kg	< 5.0	2.1	1.82	1.90	1.43
Iron, mg/kg	< 5.0	2.5	2.8	3.0	2.2

The new blended oils are characterized by a low content of fatty acids of a low molecular weight, which is 7.92–8.15 g/100 g of the oil. MUFAs are represented by oleic (44.93–45.60 g/100 g) and palmitoleic (0.2–0.42 g/100 g) acids. A small amount of erucic acid was found in the content ranging from 0.03–0.04 g/100 g. PUFAs were presented by linoleic (35.83–36.72 g/100 g) and linolenic (7.3–7.43 g/100 g) acids. The total content of unsaturated acids in the blended oils is 88.63–89.76%, of which PUFAs are 43.13–44.15%, with the ratio of ω-6:ω-3=4.9:1 and the ratio of MUFAs:PUFAs=1:1, which meets the standards of healthy nutrition.

Of the monounsaturated acids, the composition of fat in the blends studied also contains palmitoleic acid. In the largest amount (0.42 g/100 g), it is contained in the blend with the sorrel leaf extract; in the smallest amount (0.2 g/100 g), it is in the blend with the black currant leaf extract.

Of the saturated fatty acids, palmitic is predominant, but its content is insignificant, ranging from 4.52 g/100 g to 4.91 g/100 g.

The content of stearic acid in the blends tested is in the range of 2.39 g/100 g to 2.90 g/100 g.

Other saturated fatty acids identified in the blends under study are lauric and myristic. It has been shown that their content does not exceed 0.58 g/100 g.

It is known that the fat content in food should provide 30% of the energy value of the daily diet [16]. To characterize the fatty acid composition of the fat of the blends under study, it can be stated that an average of 100 g of oils consumed as food satisfies the body's daily requirement in 9–33 % of SFAs, 43–93% of MUFAs, and 39–100% of PUFAs.

The result of determining the content of pesticides (HCH-gamma isomer, heptachlor, and DDT) shows that they are absent in the newly blended oils. This leads to the conclusion that they are not used for growing the peanut. The results of the tests also indicate the absence of mycotoxins (aflatoxin B_1 and zearalenone) in the new blended oils. This means that good quality raw materials, i. e. freshly harvested, were used to produce the blended oils. The content of radionuclides (cesium-137 and strontium-90) in the new blended oils does not exceed the maximum permissible concentrations; the difference in their quantity depends on the type of the extract used. Thus, cesium-137 is the least found in the blend with the garlic extract. No toxic elements such as arsenic and mercury have been detected in the new blended oils, whereas lead, cadmium, copper, zinc, and iron are present in quantities not exceeding the maximum permissible concentrations; and lead and cadmium are by one order less. The copper content varies, depending on the type of oil (the type of the extract used), 0.27–0.32 mg/kg; the zinc content – 1.43–2.1 mg/kg; and the iron content – 2.2–3.0 mg/kg. The results show the safety of the new blended oils with the extracts of garlic, rosehips, sorrel leaves, and black currant leaves.

Conclusion

Thus, the new blended peanut-linseed oils with extracts of garlic, rosehips, sorrel leaves, and black currant leaves are characterized by a low content of saturated fatty acids, among which palmitic acid is predominant. Monounsaturated fatty acids make up 44–45% of all fatty acids and are represented mainly by oleic acid (99.2%). Polyunsaturated fatty acids make up 43–44% of all fatty acids and are represented mainly by linoleic (83%) and linolenic (16.8%) acids. The ratio ω-6:ω-3=4.9:1, and the ratio MUFAs:PUFAs=1:1, which complies with the standards of healthy nutrition [16].

The content of toxic elements, pesticides, mycotoxins, and radionuclides in the blended oils does not exceed the maximum permissible concentrations set in MBV No. 5061 and HN 6.6.1.1-130, which proves the safety of the newly developed blends.

The results of determining the quality and safety of the new blended peanut-linseed oils with extracts of garlic, rosehips, sorrel leaves, and black currant leaves are of practical importance and can be used in the production of blended functional oils.

References:

1. Shin E-C, Pegg RB, Phillips RD et al. Commercial Runner peanut cultivars in the USA: Fatty acid composition. European Journal of Lipid Science and Technology. 2010;112(2):195-207. DOI: doi.org/10.1002/ejlt.200900141
2. Ayoola PB, Adeyeye A, Onawumi OO. Chemical evaluation of food value of groundnut (Arachi hypogaea) seeds. American journal of food and nutrition. 2012;2(3):55-57. DOI: doi.org/10.5251/ajfn.2012.2.3.55.57
3. Pat. 2010080870 US MPK A23J3/14. Process for preparing hypoallergenic and/or non-allergenic peanut butter and associated products / Ahmedna M., Yu J., Goktepe I. ; patent owner Ahmedna M., Yu J., Goktepe I. – № 20090631325; appl. 04.12.2009; publ. 01.04.2010.
4. Pat. 101946928 China, MPK A23L1/308, A23L1/38. Preparation method of household peanut butter. Qingli Yang, Feng Zhu, Jie Sun [et al.]; patent owner Shandong Peanut Res Inst. – № 20101272828 ; appl. 02.09.2010 ; publ. 19.01.2011.
5. Pat. 103509646 (A) China, MPK A23D9/02, C11B1/06. Extraction manufacturing technology of peanut oil. Zhang Wenwei, Mao Hui; Danyang Zhengda Oil Co LTD. No 20131494745 20131020 ; appl. 20.01.2013 ; publ. 15.01.2014. 4 p.
6. Grosso NR, Zygadlo JA, Burroni LV, Guzman CA. Fatty acid, sterol and proximate compositions of peanut species (Arachis L.) seeds from Bolivia and Argentina. Grasas y Aceites. 1997;48:219-225. DOI: doi.org/10.3989/gya.1997.v48.i4.792
7. Grosso NR, Zygadlo JA, Lamarque AL et al. Proximate, fatty acid and sterol compositions of aboriginal peanut (Arachis hypogaea L) seeds from Bolivia. J. Sci. Food Agric. 1997;73:249-56. DOI: doi.org/10.1002/(sici)1097-0010(199703)73:3 %3C349::aid-jsfa736 %3E3.0.co;2-e
8. Mora-Escobedo R et al. Physicochemical properties and fatty acid profile of eight peanut varieties grown in Mexico. CyTA - Journal of Food. 2014;13(2):1-5. DOI: doi.org/10.1080/19476337.2014.971345
9. Chaiyadee S et al. Soil moisture affects fatty acids and oil quality parameters in peanut. International Journal of Plant Production. 2013;7(1):1735-8043.
10. Singkham N et al. Genotypic variability and genotype by environment interactions in oil and fatty acids in high, intermediate and low oleic acid peanut genotypes. J. Agric. Food Chem. 2010;58:6257-6263. DOI: doi.org/10.1021/jf903728e
11. Dubinina AA, Lenert SO, Homenko OO. Nova kupazhovana oliya z optimizovanim zhirnokislotnim skladom . Naukovi pratsi NUHT. 2014;20(4):211-216.
12. Dubinina AA, Lenert SO, Homenko OO. Stabilizatsiia do okysnennia lipidiv arakhisovo-llianoho kupazhu. Tekhnolohichnyi audyt ta rezervy vyrobnytstva. 2014; 4/2(18):10-14.
13. Metodyka yzmerenyia aktyvnosty hamma-yzluchaiushchykh radyonuklydov yly aktyvnosty prob, soderzhashchye smes radyonuklydov s yspolzovanyem attestovannoho hamma-spektrometra : MVY 4/86. M. : VNYY metrolohyy ym. D. Y. Mendeleeva; 1986.
14. Aktyvnist radionuklidiv 90Sr ta 90Y v lichylnykh zrazkakh, oderzhanykh metodom selektsii nuklidiv. Metodyka vykonannia vymiriuvan z vykorystanniam stsyntyliatsiinykh spektrometriv ta prohramnoho zabezpechennia AK-1. MI-12-08-99 / Babenko V. V., Kazymyrov O. S., Rudyk O. F. [ta in.]. Kyiv; 1999.
15. Aktyvnost, udelnaia aktyvnost y obъemnaia aktyvnost beta-yzluchaiushchykh radyonuklydov v schetnыkh obraztsakh obъektov tekhnolhycheskykh y pryrodnikh sred. Metodyka vipolnenyia yzmerenyi s yspolzovanyem spektrometra эnerhyi beta-yzluchenyia stsyntyliatsyonnoho typa SEB-01. – MY-12-05-99 / Kravchenko N. Y., Kovalenko H. D., Lykhtarev Y. A. HNPO «Metrolohyia», Ukraynskyi NYY эkolohycheskykh problem, Ynstytut radyatsyonnoi zashchyty ATN Ukrayny. Kyiv; 1999.
16. Dudenko NV. Nutrytsiolohiia. Svit Knyh. Kharkiv; 2013.

ЯКІСТЬ ТА БЕЗПЕЧНІСТЬ НОВИХ КУПАЖОВАНИХ ОЛІЙ

С.О. Ленерт, кандидат технічних наук, докторант[1], *E-mail*: svitlana.dubinina@googlemail.com
О.О. Хоменко, кандидат технічних наук, доцент[1], *E-mail*: tovaroved206@ukr.net
А.А. Дубініна, доктор технічних наук, професор[1], *E-mail*: tovaroved206@ukr.net
В.О. Віннікова, кандидат технічних наук, доцент[1], *E-mail*: vladavinnikova77@gmail.com
Л. В. Татар кандидат технічних наук, ассистент[2], *E-mail*: tornago1972@gmail.com
[1]Кафедра товарознавства та експертизи товарів
[2]Кафедра товарознавства, управління якістю та екологічної безпеки
Харківський державний університет харчування та торгівлі, вул. Клочківська, 333, м. Харків, 61051

Анотація. У статті надано характеристику арахісу, як олійної культури, наведено його біологічну цінність, хімічний та жирнокислотний склад. Обгрутовано доцільність розроблення та впровадження нових купажованих олій функціонального призначення для населення України. Показано, що купажовані олії містять значну кількість мононенасичених та поліненасичених жирних кислот. Вживання купажованих олій дозволить коригувати дефіцит незамінних жирних кислот в раціоні населення нашої країни. Зазначено, що перспективним є створення нових видів купажованих олій зі збалансованим жирно кислотним складом при поєднанні арахісової та лляної олії. У роботі наведено характеристику нових купажованих арахісово-лляних олій з добавками з рослинної сировини. Проведено оцінку якості і безпеки нових арахісово-лляних купажованих олій з екстрактом часнику, з екстрактом плодів шипшини, з екстрактом листя щавлю, з екстрактом листя чорної смородини. Для визначення якості купажованих олій було досліджено жирно кислотний склад їх жиру. Оцінку безпечності нових купажованих олій з добавками з рослинної сировини було визначено за вмістом пестицидів (ГХЦГ-гамма ізомер, гептахлор, ДДТ), мікотоксинів (афлотоксин В1, зеараленон), токсичних елементів (свинець, кадмій, миш'як, ртуть, мідь, цинк), заліза, радіонуклідів (цезій-137, стронцій-90). Отримані результати свідчать про безпечність нових купажованих олій. Доведено високу біологічну цінність купажованих олій в співвідношенні ω-6 ω-3 жирних кислот становить 4,9:1, а мононенасичених жирних кислот до поліненасичених жирних кислот – 1: 1, що відповідає нормам здорового харчування. За показниками хімічної і радіаційної безпеки нові олії не перевищують гранично допустимих концентрацій, що свідчить про безпечність нових розробок.

Ключові слова: арахіс, арахіс, лляна олія, купажовані олії, жирнокислотний склад, безпека.

Список літератури:

1. Commercial Runner peanut cultivars in the USA: Fatty acid composition / Shin E.-C. et al.] // European Journal of Lipid Science and Technology. 2010. Vol. 112, Is. 2. P. 195-207. DOI: doi.org/10.1002/ejlt.200900141

2. Ayoola P.B., Adeyeye A., Onawumi O.O. Chemical evaluation of food value of groundnut (Arachi hypogaea) seeds // American journal of food and nutrition. 2012. No. 2(3). P. 55-57. DOI: doi.org/10.5251/ajfn.2012.2.3.55.57
3. Pat. 2010080870 US MPK A23J3/14. Process for preparing hypoallergenic and/or non-allergenic peanut butter and associated products / Ahmedna M., Yu J., Goktepe I. ; patent owner Ahmedna M., Yu J., Goktepe I. – № 20090631325 ; appl. 04.12.2009 ; publ. 01.04.2010.
4. Pat. 101946928 China, MPK A23L1/308, A23L1/38. Preparation method of household peanut butter / Qingli Yang, Feng Zhu, Jie Sun [et al.] ; patent owner Shandong Peanut Res Inst. – № 20101272828 ; appl. 02.09.2010 ; publ. 19.01.2011.
5. Pat. 103509646 (A) China, MPK A23D9/02, C11B1/06. Extraction manufacturing technology of peanut oil / Zhang Wenwei, Mao Hui ; Danyang Zhengda Oil Co LTD. – № 20131494745 20131020 ; appl. 20.01.2013 ; publ. 15.01.2014. 4 p.
6. Fatty acid, sterol and proximate compositions of peanut species (Arachis L.) seeds from Bolivia and Argentina / N. R. Grosso et al. // Grasas y Aceites. 1997. Vol. 48. P. 219-225. DOI: doi.org/10.3989/gya.1997.v48.i4.792
7. Proximate, fatty acid and sterol compositions of aboriginal peanut (Arachis hypogaea L) seeds from Bolivia / Grosso N.R. et al. // J. Sci. Food Agric. 1997. Vol. 73. P. 249-356. DOI: doi.org/10.1002/(sici)1097-0010(199703)73:3 %3C349::aid-jsfa736 %3E3.0.co;2-e
8. Physicochemical properties and fatty acid profile of eight peanut varieties grown in Mexico / Mora-Escobedo R. et al. // CyTA - Journal of Food. 2014. Vol. 13(2). P. 1-5. DOI: doi.org/10.1080/19476337.2014.971345
9. Soil moisture affects fatty acids and oil quality parameters in peanut / Chaiyadee S. et al. // International Journal of Plant Production. 2013. Vol. 7(1). P. 1735-8043.
10. Genotypic variability and genotype by environment interactions in oil and fatty acids in high, intermediate and low oleic acid peanut genotypes / Singkham N. et al. // J. Agric. Food Chem. 2010. Vol. 58. P. 6257-6263. DOI: doi.org/10.1021/jf903728e
11. Дубініна А.А., Ленерт С.О., Хоменко О.О. Нова купажована олія з оптимізованим жирнокислотним складом // Наукові праці НУХТ. 2014. Том 20, №4. С. 211-216
12. Дубініна А.А., Ленерт С.О., Хоменко О.О. Стабілізація до окиснення ліпідів арахісово-лляного купажу // Технологічний аудит та резерви виробництва. 2014. № 4/2(18). С. 10-14.
13. Методика измерения активности гамма-излучающих радионуклидов или активности проб, содержащие смесь радионуклидов с использованием аттестованного гамма-спектрометра : МВИ 4/86. М. : ВНИИ метрологии им. Д. И. Менделеева, 1986. 10 с.
14. Активність радіонуклідів 90Sr та 90Y в лічильних зразках, одержаних методом селекції нуклідів. Методика виконання вимірювань з використанням сцинтиляційних спектрометрів та програмного забезпечення АК-1. – МІ-12-08-99 / Бабенко В. В., Казимиров О. С., Рудик О. Ф. [та ін.]. Київ., 1999. 33 с.
15. Активность, удельная активность и объемная активность бета-излучающих радионуклидов в счетных образцах объектов технолгических и природных сред. Методика выполнения измерений с использованием спектрометра энергий бета-излучения сцинтиляционного типа СЕБ-01. МИ-12-05-99 / Кравченко Н. И., Коваленко Г. Д., Лихтарев И. А. ГНПО «Метрология», Украинский НИИ экологических проблем, Институт радиационной защиты АТН Украины. Київ., 1999. 69 с.
16. Дуденко Н. В. Нутриціологія. Світ Книг,. Харків. 2013. 560 с.