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THE STUDY OF CHEMICAL COMPOSITION OF FATTY OIL FROM THE SEEDS OF *ARCTIUM LAPPA* L.

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As a result of the study of the chemical composition of fatty oil from the seeds of Arctium lappa L. *by gas-liquid chromatography it was found that it contains 9 fatty acids and trans-isomers. The main part of fatty acids is made up of linoleic (63,6%) and oleic acids (22,6%). The rest of the fatty acids are palmitic (5,4%), stearic (2,2%), palmitoleic (0,3%), eicosenoic (0,2%), linolenic (0.1%), myristic (0, 08%), heptadecanoic (0,03%) of acids and trans-isomers (0,4%). The saponification quantity of fatty oil was determined as 190.6, free fatty acids 3.5%, peroxides number 27.8, iodine number 130.8, mass fraction of phosphorus containing substances - 81 mg / kg.*

***Keywords**: Arctium lappa, seeds, fatty oil, gas-liquid chromatography, fatty acids*

Actium lappa (common name: Burdock) is a flowering plant that belongs to the family Asteraceae (Compositae). *Arctium lappa* is a biennial plant with a height of 100-180 cm. It has large, alternating, cordiform leaves that have a long petiole and are pubescent on the underside. The flowers are purple and grouped in globular capitula, united in clusters. It blooms in July-August and yields fruit in August-September. In Azerbaijan burdock is spread in all regions of the Greater Caucasus, in the central regions of the Lesser Caucasus, in the mountainous part of Lankaran and Nakhchivan. It finish from the middle mountain to the subalpine belt. This plant is kseromezofit. It found in forest and meadow species, as well as weed plants in gardens. Mainly subdivided into subalpine meadows, forests and bushs, and forms small groups [1].

The principal components of *A. lappa* are represented by the caffeoylquinic acids, composed of polyphenols such as chlorogenic, caffeic, isochlorogenic and other derivatives of caffeic acid. Also present are elevated quantities of inulin, measuring from 27-45%, and mucilage, for a total of about 69% carbohydrates; about 15 polyacetylenes; ten different sulphuric acetylene compounds, such as arctinal, acetic acid, arctinol, arctinone; an essential oil rich in bitter oils; guainolides, dehydrocostus-lactone, costic acids; and 11, 13- dehycrodihydrocostus-lactone, the bitter principles of the drug; lignans (arctigenin, arctiin, neoarctin, matairesinol, daucosterol and lappao). Also present are sitsterol, stigmasterol and γ-guanidino-n-butyric acid [13]. Roots contain up to 50% inulin, volatile acids (butyric, acetic, isovaleric, proprionic), polyacetylenes, non-hydroxyl acids (stearic, palmitic, lauric, myristic), tannin and polyphenolic acids. Seeds have 15- 30% fixed oils, a bitter glycoside (arctiin) and chlorogenic acid [11]. Many health benefits of *A. lappa* have been reported due to different classes of bioactive secondary metabolites (e.g. flavonoids, lignans and phenolic compounds) [5].

Commonly known as burdock and is being recommended as a healthy and nutritive food in Chinese societies and many other countries [3]. Several studies have reported that the plant possesses various pharmaceutical activities including an antibacterial activity, antifungal activity [12], antioxidant [8], anti-inflammatory activity [4], hepatoprotective efficacy [9] and antiplatelet- aggregating effect [10].

A. lappa is now in use for treating cancer and upper respiratory infections and pneumonia in China. The plant was used to treat leprosy, fevers a variety of dermatologic conditions (scrapes, burns and baldness,), gonorrhea and syphilis. Herbalists used the plant as a diuretic and to treat arthritis, lice, ringworm, urinary

tract problems, and eczema. Furthermore, the plant is traditionally used as a liver tonic, diaphoretic and diuretic, laxative, blood purifier, antipyretic and antimicrobial. *A. lappa* has also been incorporated into the Canadian cancer remedy (Essiac) [6]

Arctium lappa seed has been used in traditional medicine, and it is known to exert beneficial effects, such as anticancer, antioxidant and anti-inflammatory effects. During the development of tumors, very large amounts of nutrients (oxygen and nutrients) are required to sustain the rapid proliferation of tumor cells. However, tumor cells can still survive under extreme conditions such as low oxygen and low carbohydrate availability due to their relatively high tolerance to hostile environment. Arctigenin, an active compound found in the seeds of *A. lappa*, has the ability to eradicate nutrient-deprived cancer cells [2].

In current western cultures, burdock is used both internally and externally for many conditions of the skin, such as acne, boils, abscesses, and eczema, for situations of chronic inflammation, such as arthritis, rheumatism, and gout, as an antimicrobial, and as a treatment for cancer, stomach ulcers, urinary tract infections, premenstrual symptoms, and HIV [7, 15].

Materials and methods

Vegetable material for obtaining fatty oil was collected in August 2016 in the phase of full ripeness of seeds in the vicinity from Chukhururd of Shamakhi region (Azerbaijan). The air-dried seeds were dried at a temperature of 105^0 C to a residual moisture of 2%. The dried seeds were then ground and subjected to extraction with n-hexane. The extract was evaporated using an evaporator on a Soxhlet apparatus. Qualitative composition and quantitative determination of methyl esters of fatty acids was determined on a chromatograph "HP" 6890 series with a flame ionization detector. A 100-meter capillary column, "Agilent 112-88A7", was used for the separation. The column temperature is programmed as follows: initial temperature 140ºC - 5 minutes stable, temperature rise 4ºC / min to 240ºC - 15 minutes stable. The analysis time is 45 minutes. Carrier gas is H2, injection is split.

Preparation of the sample for analysis was carried out in accordance with GOST 31663-2012. In a 20 ml test tube, weighed a 1 g sample of the product and dissolved in 10 ml of heptane. The resulting solution was pipetted with 0.5 ml of a methanolic potassium hydroxide solution, capped with a stopper and shaken vigorously for 2 minutes. After a five-minute settling, a top layer was selected for gas chromatographic analysis.

The content of the components was calculated by normalizing the areas of gas chromatographic peaks without using the sensitivity coefficients. For the identification of methyl esters of fatty acids, the standard "Supelco 37 Component FAME Mix" was used. Physicochemical and organoleptic parameters were determined by standard methods.

Results and discussion

With the help of gas-liquid chromatographic studies of fatty acid methyl esters, greater separation efficiency at a lower temperature and shorter duration of analyses is achieved. The results of gas-liquid chromatographic analyses of fatty acid methyl esters of burdock oil showed that complete separation takes place within 30 minutes. The spectrum of chromatography shows the presence of myristic, palmitic, stearic, oleic, linoleic, linolenic, eicosenoic, palmitoleic, heptadecanoic acids and trans isomers (Fig. 1).

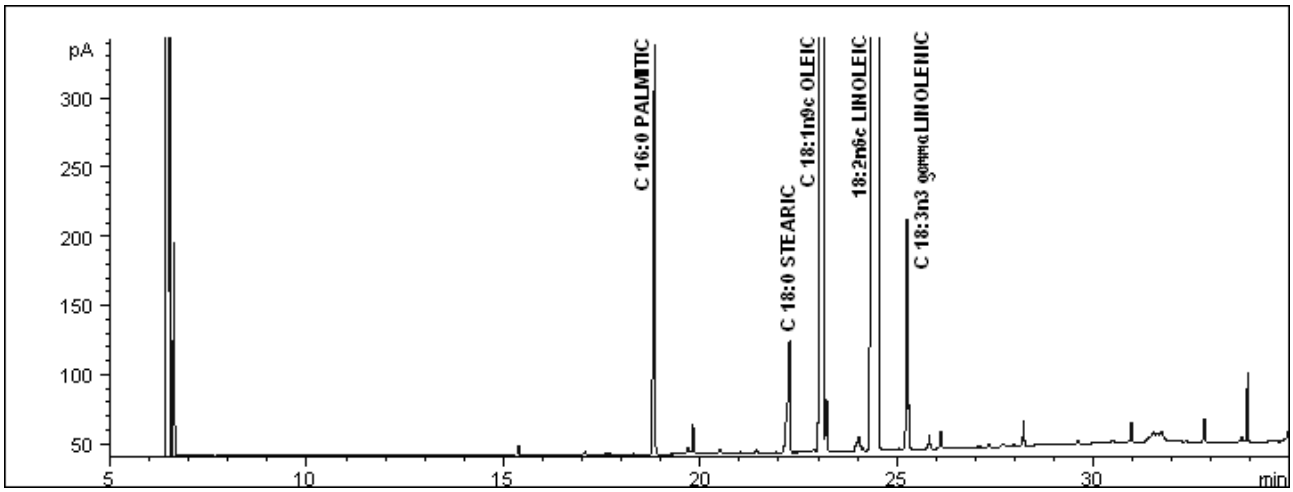

Fig.1. Gas-liquid chromatogram of fatty methyl esters acids of oil *Arctium lappa*

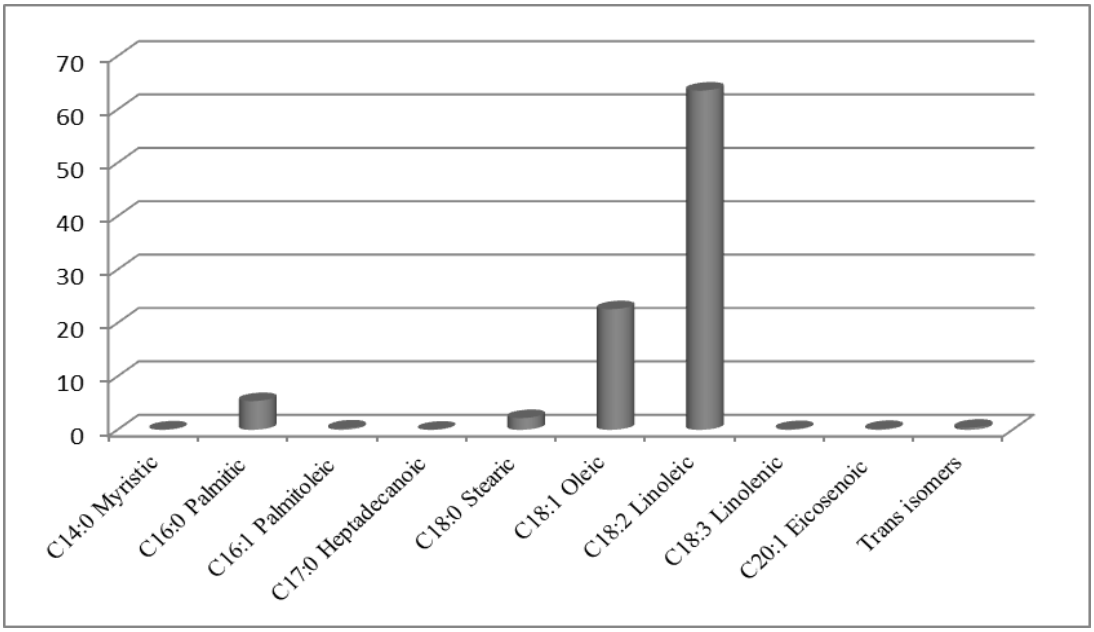

Fig. 2. The content of fatty acids from total in (in%)

From the spectrum of the chromatogram, the amount of fatty acids in fatty oil is different. The amount of components in the fatty acids range varies from 0.03% to 63.6% (Fig. 2).

As can be seen from Fig. 2, in the composition of fatty acids (from the total amount), predominante linoleic (63,6%) and oleic (22,6%) acids. The rest of fatty acids are in the share of palmitic (5,4%) and stearic (2,2%) acids. The content of palmitoleic, linolenic, eicosenoic, heptadecanoic, myristic acids and trans isomers varies from 0.03% to 0.4% in fatty acids. It is well known that dietary fats rich in linoleic acid prevents disorders such as coronary heart disease, atheroselerosis and high blood pressure and also linoleic acid derivatives serve as structural components of the plasma membrane and as precursors of some metabolic regulatory compounds [14]. To determine the field of application of vegetable oil, it is very important to determine its physicochemical and organoleptic characteristics. These data are very valuable for the standardization of oil. The results of the physicochemical and organoleptic parameters of the oil are given in the following table.

Table

Physicochemical characteristics of fatty oil obtained from *Arctium lappa* seeds

	Experiment name	unit of measurement	Test method	Result
1.	Organoleptic indicators		GOST 5472-50	seed oil - a clear liquid of bright yellow color, pleasant to taste
2.	Free fatty acids (such as oleic acid)	(%)	GOST R 50457-92	3,5
3.	Peroxide number	$mMolO_2$ / kg	GOST R 51487-99	27,8
4.	Colour (Lovibond, ¼ inc)	Red /Yellow	GOST 5477-2015	0,8 Red, 6 Yellow
5.	Iodine number	İV	GOST 5475-69	130,8
6.	Number of saponification	KOH	GOST 5478-2014	190,6
7.	Mass fraction of phosphorus containing substances	mg / kg	GOST R 52676-2006	81

As a result of the analysis of fatty oil, its quantity of saponification - 190.6, free fatty acids 3.5%, peroxide number 27.8, iodine number 130.8, mass fraction of phosphorus containing substances - 81 mg / kg.

REFERENCES

1. Flora of Azerbaijan. Publishing House of the Azerbaijan SSR Academy of Sciences, Baku, 1961, v.VIII, 360 p. (in Russian).
2. *Awale S, Lu J, Kalauni S, Kurashima Y, Tezuka Y, Kadota S, Esumi H.* Identification of arctigenin as an antitumor agent having the ability to eliminate the tolerance of cancer cells to nutrient starvation // Cancer Research, 2006. 3, pp. 1751-1757.
3. *Chan Y.S., Cheng L.N., Wu J.H., Chan E., Kwan Y.W., Lee S.M., Leung G.P., Yu P.H., Chan S.W.* A review of the pharmacological effects of *Arctium lappa* (burdock) // Inflammopharmacology, 2011. 5, pp. 245- 254.
4. *Chen F.A., Wu A.B., Chen C.Y.* The influence of different treatment on the free radical scavenging activity of burdock and variations of its active components // Food Chemistry, 2004. 86, pp. 479-484.
5. *Ferracane R., Graziani G., Gallo M., Fogliano V., Ritieni A.* Metabolic profile of the bioactive compounds of burdock (*Arctium lappa*) seeds, roots and leaves // J. Pharma. Biomedical Analysis, 2010, 2, pp. 399-404.
6. *Kathi J., Mitchell R.* Alternative asthma therapies: An evidence-based review // Contemporary Pediatrics, 1999, 3, pp. 162-195.
7. *Kemper K. J.* Burdock (*Arctium lappa*). The Longwood Herbal Task Force. The Center for Holistic Pediatric Education and Research. 1999, pp. 1-2.
8. *Leonard S.S., Keil D., Mehlman T., Proper S., Shi X., Harris G.K.* Essiac tea: scavenging of reactive oxygen species and effects on DNA damage // J. Ethnopharmacol, 2006. 103, pp. 288–296.
9. *Lin S.C., Chung T.C., Lin C.C., Ueng T.H., Lin Y.H., Lin S.Y., Wang L.Y.* Hepatoprotective effects of *Arctium lappa* on carbon tetrachloride- and acetaminophen-induced liver damage // American Journal of Chinese Medicine, 2000. 2, pp.163–173.
10. *Lin S.C., Lin C.H., Lin C.C., Lin Y.H., Chen C.F., Chen I.C., Wang L.Y.* Hepatoprotective effects of *Arctium lappa* Linne on liver injuries induced by chronic ethanol consumption and potentiated by carbon tetrachloride tetrachloride // Journal of Biomedical Science, 2002. 9, pp. 401-409.
11. *Mabey R., McIntyre M., Michael P., Duff G., Stevens J.* The New Age Herbalist; How to Use Herbs for Healing, Nutrition, Body Care, and Relaxation. Macmillan Publishing Co. New York, NY. 1988, 288 p.
12. *Pereira J .V., Bergamo D. C., Pereira J. O., França S. C.* Pietro RCLR Silva-Souza YTC Antimicrobial activity of *Arctium lappa* constituents against microorgan-

isms commonly found in endodontic infection // Brazilian Dental Journal, 2005. 16, pp. 192-196.
13. *Umehara K., Nakamura M., Miyase T., Kuroyanagi M., Ueno A.* Studies on differentiation inducers. VI. Lignan derivatives from *Arctium fructus* (2). School of Pharmaceutical Sciences University of Shizuoka, Japan // Chemical and Pharmaceutical Bullettin, 1996. 44, pp. 2300-2304.
14. *Viles R.O., Gottenbos J.J., Robblen G. and Downey R. K.* Nutritional characteristics and food uses of vegetable oils. In Oil crops of the world, Mc. Graw Hill, New York, USA, 1989, 36 p.
15. *Wua Y.C., Lin L.F., Yeh C.S., Lin Y.L., Chang H.J, Lin S.R., Chang M.Y., Hsiao C.P., & Lee S.C.* Burdock essence promotes. gastrointestinal mucosal repair in ulcer patients// Fooyin Journal of Health Sciences. 2010. 2, pp. 26-31.

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ARCTİUM LAPPA L. BİTKİSİNİN TOXUMLARINDAN ALINAN PİY YAĞLARININ KİMYƏVİ TƏRKİBİNİN ÖYRƏNİLMƏSİ

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Qaz-maye xromatoqrafiyası vasitəsi ilə Arctium lappa L. bitkisinin toxumlarından alınan piy yağının kimyəvi tərkibinin tədqiqi nəticəsində 9 yağ turşusunun və trans izomerlərinin olduğu aşkar edilmişdir. Yağ turşularının əsas hissəsini linol (63,6%) və olein (22,6%) turşuları təşkil edir. Digər yağ turşuları isə palmitin (5,4%), stearin (2,2%), palmitolein (0,3%), eikosik (0,2%), linolen (0,1%), myristin ,% 08), heptadekan (0.03%) turşuları və trans izomerləri (0.4%) ilə təmsil olunmuşlar. Piy yağının sabunlaşma ədədi - 190,6, sərbəst yağ turşuları 3,5%, peroksid ədədi 27,8, yod ədədi 130,8, fosfor tərkibli maddələrin kütlə payı - 81 mq / kq olması müəyyən edilmişdir.

Açar sözlər: *Arctium lappa, toxum, piy yağı, qaz-maye xromatoqrafiyası, yağ turşuları*

ИЗУЧЕНИЕ ХИМИЧЕСКОГО СОСТАВА ЖИРНОГО МАСЛА ИЗ СЕМЯН *ARCTİUM LAPPA* L.

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В результате исследования химического состава жирного масла из семян *Arctium lappa* L. методом газожидкостной хроматографии установлено, что оно содержит 9 жирных кислот и транс-изомеры. Основную часть жирных кислот составляют линолевая (63,6%) и олеиновая кислоты (22,6%). Остальная часть жирных кислот приходится на долю пальмитиновой (5,4%), стеариновой (2,2%), пальмитолеиновой (0,3%), эйкозиновой (0,2%), линоленовой (0,1%), миристиновой (0,08%), гептадекановой (0,03%) кислот и транс-изомеры (0,4%). Количество омыления жирного масла определяли как 190,6, свободные жирные кислоты - 3,5%, пероксидное число 27,8, йодное число 130,8, массовая доля фосфора - 81 мг / кг.

Ключевые слова: *Arctium lappa, семена, жирное масло, газожидкостная хроматография, жирные кислоты*