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ANALYSIS OF THE LIPOPHILIC COMPONENTS OF THE AERIAL PARTS OF THE PLANT *ORIGANUM VULGARE*

Annototion. The volatile oil constitutes extracted from the aerial parts of *Origanum vulgare* by water steam distillation were analyzed by GC-MS method. Fifty compounds were separated. Their relative contents were determined by area normalization in which 43 volatiles were identified. The major volatile oils of *O.vulgare* are 1-Docosene (69.85%), β-Sitosterol (5.26%), Nonadecane (2.59%), Heptacosane (2.47%), 1-Hexacosene (1.35%), Benzoic acid, hexadecyl ester (1.31%), 14-methyl-5α-Cholest-8-en-3-one (1.12%).

Key words: *Origanum vulgare*; lipophilic composition; volatile oils; mass spectrometer; gas-liquid chromategraphy; Almaty region.

Introduction

The traditionally natural products have always played an important role in development of the chemistry of natural products expanding new boundaries of medicine. In Kazakhstan 45 genuses, 232 species of plants grow. They belong to Lamiaceae family [1].

The aim of this study is the analysis of lipophilic substances of Kazakhstan's plant species of *Origanum* genus [2].

In this study an attempt has been made to investigate the chemical constituents of volatile oils from Kazakh traditional medicinal plants of *O.vulgare,* which were grown in Almaty region.

O.vulgare is a perennial rhizomatous herb with quadrangular stems up to 60 cm. Flowers are small, violet purple, in dense corymbs. It grows in the European part of the CIS (Commonwealth of Independent States) in open places, clearings, roadside slopes [3].

O.vulgare is widely used in folk and scientific medicine. It stimulates the appetite, stimulates the activity of the intestine, improves digestion, especially in secretory insufficiency of the gastro-intestinal tract. It helps to get rid of nausea and produces a good effect. When curring the diseases of nervous system [4, 5].

The plants of *O.vulgare* genus are characterized by the accumulation of volatile oils, triterpene compounds, flavonoids, tannins [6].

The volatile oil content in *O.vulgare* was determined by many authors. When analyzing the results of their research it can be concluded that the accumulated amount of volatile oil depends on the climate zone and growing conditions. Thus, regions of temperate climates, the number ranged from 0,10 to 0,71%. In the *O.vulgare* growing in Uzbekistan, 0,86% of volatile oils was found [7].

In the composition of volatile oil of *O.vulgare*, grown in the conditions of middle taiga subzone of the Komi Republic, the predominant components are 1,8-cineole (17,2%), ß-caryophyllene (11,8%) and the detected low content of phenols were from 0.4 to 2.3%, and some samples were less than 0.1% [8, 9].

In the volatile oil of *O.vulgare* from the Altai territory phenolic fraction is less than 0,5%, the main components of the oil are sabinin (13,5%), 1,8-cineole (8,2%), trans-β-olmen (16,2%), caryophyllene (9,9%) [10].

The volatile oil of this plant has sedative properties, eliminating fear and neurosis. This is the only tool to struggle insomnia [11]. It has antiviral and antibacterial effect on the flu, colds and herpes. With the help of this oil you can say goodbye to toothache. The *O.vulgare* oil is used for inflammation of the respiratory tract because it eliminates the processes of inflammation and normalizes breathing, exerting expectorant action [12-14].

Table 1 – The volatile constituents of aerial parts of *O.vulgare*

Peak No.	Constituents	t_R (min)	Molecular Formula	MW	Content (%)
1	Neophytadiene	18.093	$C_{20}H_{38}$	278	0.42
2	3,7,11,15-Tetramethyl-2-hexadecen-1-ol	18.596	$C_{20}H_{40}O$	296	0.16
3	Neophytadiene	18.949	$C_{20}H_{38}$	278	0.26
4	Butyl 2-ethylhexyl phthalate	20.501	$C_{20}H_{30}O_4$	334	0.43
5	Trimethylsilyl palmitate	22.139	$C_{19}H_{40}O_2Si$	328	0.23
6	Tricosane	26.527	$C_{23}H_{48}$	324	0.21
7	4,8,12,16-Tetramethylheptadecan-4-olide	27.415	$C_{21}H_{40}O_2$	324	0.20
8	Hentriacontane	28.154	$C_{31}H_{64}$	436	0.16
9	Pentacosane	29.727	$C_{25}H_{52}$	352	0.52
10	Diisooctyl phthalate	30.487	$C_{24}H_{38}O_4$	390	0.34
11	Tetracosane	30.840	$C_{24}H_{50}$	338	0.36
12	11-decyltetracosane	31.247	$C_{34}H_{70}$	478	0.25
13	Tetracosane	32.157	$C_{24}H_{50}$	338	0.23
14	Heptacosane	32.714	$C_{27}H_{56}$	380	1.52
15	13-dodecylhexacosane	33.752	$C_{38}H_{78}$	534	0.57
16	Tetratetracontane	34.116	$C_{44}H_{90}$	618	0.32
17	1,21-Docosadiene	34.640	$C_{22}H_{42}$	306	0.49
18	Octadecane	34.983	$C_{18}H_{38}$	254	0.26
19	1-Docosene	35.593	$C_{22}H$	308	69.85
20	1-Hexacosene	36.139	$C_{26}H_{52}$	364	1.35
21	Octacosane	36.470	$C_{28}H_{58}$	394	0.64
22	Triacontane	36.802	$C_{30}H_{62}$	422	0.46
23	1-Hexacosene	36.973	$C_{26}H_{52}$	364	0.62
24	l-Leucine, N-(3-fluorobenzoyl)-, isohexyl ester	37.295	$C_{13}H_{16}FNO_3S$	285	0.24
25	1-Bromoeicosane	37.605	$C_{20}H_{41}Br$	361	0.23
26	1H-Indeno[2,1-a]phenantren-9(10H)-one, 4,4a,5,5a,5b,6,7,11,11a,11b,12,13,13a,13b-tetradecahydro-13b-ac	37.840	$C_{27}H_{38}O_2$	394	0.18
27	Nonadecane	38.087	$C_{19}H_{40}$	268	2.59
28	1-Hexacosene	38.172	$C_{26}H_{52}$	364	0.72
29	2,6,10-Trimethylundeca-1,3-diene	38.397	$C_{14}H_{26}$	194	0.47
30	3-ethoxy-3,7-dimethyl-1,6-octadiene	38.632	$C_{12}H_{22}O$	182	0.99
31	13-undecylpentacosane	39.007	$C_{36}H_{74}$	506	0.43
32	1,1,1,2,2,3,3,4,4,5,5,6,6-Tridecafluorotetradecane	39.317	$C_{14}H_{17}F$	432	0.46
33	14-methyl-5α-Cholest-8-en-3-one	39.863	$C_{28}H_{46}O$	398	1.12
34	5-butyl-6-hexyloctahydro-1H-Indene	40.077	$C_{19}H_{36}$	264	0.32
35	3-methylheneicosane	40.217	$C_{22}H_{46}$	310	0.40
36	Heptacosane	40.538	$C_{27}H_{56}$	380	2.47
37	β-Sitosterol	40.934	$C_{29}H_{50}O$	414	5.26
38	β-Sitosterol	41.051	$C_{29}H_{50}O$	414	1.61
39	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyloctasiloxane	42.860	$C_{16}H_{50}O_7Si_8$	578	0.19
40	Eicosane	43.460	$C_{20}H_{42}$	282	0.67
41	1,1,3,3,5,5,7,7,9,9,11,11,13,13,15,15-hexadecamethyloctasiloxane	44.519	$C_{16}H_{50}O_7Si_8$	578	0.20
42	Eicosamethyl-cyclodecasiloxane	46.414	$C_{20}H_{60}O_{10}Si_{10}$	741	0.28
43	Hexadecyl benzoate	46.606	$C_{23}H_{38}O_2$	346	1.31

Materials and Methods

Plant material: *O.vulgare* was collected in Almaty botanical garden, in September 2015. The oils were isolated by water-distillation for 4 hrs and then dried over anhydrous sodium sulphate.

GC-MS analysis: the aerial part of *O.vulgare* was analyzed by Electron Impact Ionization (EI) on Perkin-Elemer Autosystem XL–TurboMass (Gas Chromatograph coupled to Mass Spectrometer) fused silica capillary column (30m x 2.5mm; 0.25 μm film thickness), coated with PE-5 ms was utilized. The gas carrier was helium (99.999%). The column temperature was programmed from 60°C (held for 5min), at 2°C/min to180°C, at 3.5°C /min to 290°C.

The latter temperature was maintained for 40min (The parameters of obtaining were the following: full scan; scan range 40-350 amu). The injector temperature was 310°C. Injection: with a 0.1ul: detector ion source (EI-70eV). Samples were injected by splitting with the split ratio 1:60.

Identification of the compounds: Identification of compounds was done by comparing the NIST and Wiley library data of the peaks and mass spectra of the peaks with those reported in literature. Percentage composition was computed from GC peak areas on PE-5 ms column without applying correction factors.

Results and discussion

Volatile oils from the aerial parts of *O.vulgare* were analyzed by GC-MS. Fifty compounds were separated. Their relative contents were determined by area normalization. Obtained data are presented in Table 1. The yield from whole herbs of *O.vulgare* was found to be 0,9 %.

Table 1 reports the composition of the volatiles of the aerial parts of *O.vulgare.* Forty three components have been identified in the volatiles of *O.vulgare.* The major constituents are 1-Docosene (69.85%), β-Sitosterol (5.26%), Nonadecane (2.59%), Heptacosane (2.47%), Heptacosane (1.52%), 1-Hexacosene (1.35%), Hexadecyl benzoate (1.31%), 14-methyl-5α-Cholest-8-en-3-one (1.12%).

Conclusion. The volatile oils constitutes extracted from the aerial parts of *O.vulgare* by water steam distillation which were analyzed by GC-MS method. Fifty compounds were separated. Their relative contents were determined by area normalization in which 43 volatiles were identified. Active principles of the Kazakh traditional medicinal plant (*O.vulgare*) that are responsible for the activity were determined. The major volatile constituents are 1-Docosene (69.85%), β-Sitosterol (5.26%), Nonadecane (2.59%), Heptacosane (2.47%), Heptacosane (1.52%), 1-Hexacosene (1.35%), Hexadecyl benzoate (1.31%), 14-methyl-5α-Cholest-8-en-3-one (1.12%).

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REFERENCES

[1] Flora Kazakhstan, Almaty, **1963**. Vol.3. P. 204-213.

[2] Xu X., Konirbay B., Jenis J., etal. The Kazakh Materia Medica, The Ethnic Press: Beijing. **2009**. P. 357.

[3] Karluk B.B. Pharmacognosy. Minsk BSU. **2011**. P. 150.

[4] Papanov V.A., Antonova I.V., Suslova T.A., Repina N.N., Hammermeister Yu.G. Recursivedescent characterization of medicinal plants of the Vologda region. Vologda, VSPU. P. 38.

[5] P. Rubiolo, B. Sgorbini, E. Librto, C. Cordero, C. Bicchi. Essential oils and volatiles: sample preparation and analysis// Flavour Fragr. J. **2010**. Vol. 25. P. 282-290.

[6] Mirovich V.M., Konenkina T.A., Fedoseeva G.M., Golovnov N.N., The study of the qualitative composition of the essential oil of origanum vulgare, native to Eastern Siberia// Chemistry of plant raw materials. **2008**. №2. P. 61-64.

[7] Cosge B., Turker A., Ipek A., Gurbuz B., Arslan N. Chemical compositions and antibacterial activities of the essential oils from aerial parts and corollas of *Origanum acutidens* (Hand.-Mazz.) Ietswaart, an Endemic Species to Turkey// Molecules. **2009**. Vol.14: P. 1702-1712.

[8] Tumanova E.L., Kuchin A.V., Punegov V.V. The allocation monoterpenov of the essential oil of *Origanum vulgare* L. by solid-phase extraction// Dendrochemistry and organic synthesis, Syktyvkar. **1998.** P. 57.

[9] Kesselmeier J., Staudt M. Biogenic volatile organic compounds (VOC): An overview on emission, physiology and ecology// Journal of Atmospheric Chemistry. **1999**. 33(1). P. 23–88.

[10] Tkachev, A.V., Korolyuk, E. A., Yusubov M. S., Guriev, A. M. Changes in the composition of the essential oil at different storage periods of raw materials// Chemistry of plant raw materials. **2002**. Vol.1. P. 19-30.

[11] Bergström G., Rothschild M., Groth I., Crighton C. Oviposition by butterflies on young leaves: investigation of leaf volatiles// Chemoecology. **1994**. Vol. 5. P. 147-158.

[12] Leung A.Y. Encyclopedia of Common Natural Ingredients Used in Food, Drugs and Cosmetics// John Wiley & Sons, **1980**, New York.

[13] Lorenzetti B.B., Souza G.P., Sarti S. J., Santos-Filho D. & Ferreira S.H. Myrcene mimics the peripheral analgesic activity of lemongrass tea// Journal of Ethnopharmacology. **1991**. 34. P. 43-48.

[14] Miguel M.G. Antioxidant and anti-inflammatory activities of essential oils: a short review// Molecules. **2010**. Vol.15. P. 9252-9287.

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АНАЛИЗ ЛИПОФИЛЬНЫХ КОМПОНЕНТОВ НАДЗЕМНОЙ ЧАСТИ РАСТЕНИЯ *ДУШИЦА ОБЫКНОВЕННАЯ*

Аннотация. В статье приведены данные количественного и качественного анализа липофильных компонентов надземной части *душицы обыкновенной,* определены методом газожидкостной хроматографией с масс–спектрометрией (GC-MS). Идентифицировано сорок три химических соединений. По данным анализа, в составе липофильной фракции надземной массе *душицы обыкновенной*, в наибольшем количестве следующие компоненты: Докозен-1 (69.85%), β-Ситостерин (5.26%), Гептакозан (2.47%), Гексакозан (1.35%), Гексадецил бензоат (1.31%), 14-метил-5α-Холест-8-ен-3-он (1.12%). Обнаруженные вещества могут использоваться для изготовления новых медицинских препаратов с наименьшим токсическим эффектом.

Ключевые слова: *душица обыкновенная;* липофильный состав; эфирное масло; масс-спектрометрия; газожидкостная хроматография; Алматинский регион.

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КӘДІМГІ ЖҰПАРГҮЛ ӨСІМДІГІНІҢ ЖЕРҮСТІ БӨЛІГІНІҢ ЛИПОФИЛЬДІ ҚҰРАМЫН ТАЛДАУ

Аннотация. Мақалада масс-спектрометриялық газ-сұйықты хроматографиямен анықталған *Кәдімгі жұпаргүлдің* жерүсті бөлігінің липофильді құрамдастарының сапалық және сандық анализдері көрсетілген. Өсімдіктің жерүсті бөлігінде қырық үш құрамдас анықталды. Анализ нәтижесі бойынша *Кәдімгі жұпаргүл өсімдігінің* жерүсті бөлігінің липофильді фракциясында ең көп мөлшерде келесі компоненттер: Докозен-1 (69.85%), β-Ситостерин (5.26%), Гептакозан (2.47%), Гексакозан (1.35%), Гексадецил бензоат (1.31%), 14-метил-5α-Холест-8-ен-3-он (1.12%) кездеседі. Анықталған заттарды улы әсері аз жаңа медициналық препараттар дайындауға қолдануға болады.

Тірек сөздер: *Кәдімгі жұпаргүл,* липофильді құрам, масс-спектрометр, газ-сұйықты хроматография, Алматы аймағы.