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COMPONENT COMPOSITION AND BIOLOGICAL ACTIVITY OF ESSENTIAL OIL OF *ARTEMISIA TRANSILIENSIS* POLJAKOV

Abstract. The component compositions of *Artemisia transiliensis* Poljakov essential oils obtained by hydro distillation and microwave extraction were studied. The essential oils obtained by the above-mentioned methods, have a yield of 0.29% and 0.22%, respectively.

Using chromatographic-mass spectrometric analysis, it was determined that in essential oil obtained by hydro distillation, 19 components were detected, 18 of which were identified. In addition, 13 components were detected by chromatography-mass spectrometry in the essential oil obtained by microwave extraction, 12 of which were identified. The isolated samples of *Artemisia transiliensis* Poljakov essential oils are characterized by a high content of monoterpenes, where the main components are 1,8-cineole and camphor. In addition, the essential oil isolated by microwave extraction can be used as a source of 1,8-cineole.

Antimicrobial and anti-inflammatory activity of isolated essential oils was studied.

According to the results of antimicrobial activity, it was established that the essential oil of *Artemisia transiliensis* Poljakov, isolated by microwave extraction, exhibits moderate activity against gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis*. While the essential oil obtained by hydro distillation has a weak antimicrobial activity. When determining the anti-inflammatory activity, it was established that the essential oil of *Artemisia transiliensis* Poljakov, obtained by the method of hydro distillation, at a dose of 25 mg/kg, has a pronounced anti-inflammatory activity comparable to the comparison drug "Diclofenac sodium" on the model of acute exudative reaction.

Key words: *Artemisia transiliensis* Poljakov, hydro distillation, microwave extraction, essential oil, gas chromatography-mass spectrometry, biological activity.

Introduction. On the territory of Kazakhstan, 81 species of the wormwood genus (*Artemisia* L.) grow, 16 of which are endemic [1].

As objects of study, wormwood is of great interest as a source of essential oils with a high content of biologically active components.

Artemisia transiliensis Poljakov is an endemic species; according to earlier chemical studies, its essential oil is pale green or light yellow, containing organic acids - 7%, phenols - 4.65%, cineole - 58.42%, thujone - 14-17% and, presumably, isobutyraldehyde [2].

We studied the component composition of the essential oil of *Artemisia transiliensis* Poljakov, obtained by hydro distillation and microwave extraction. The antimicrobial activity and anti-inflammatory effect of essential oils samples obtained by different methods are determined.

Materials and research methods. Raw materials of the aerial part (anthodiums, buds, leaves) of *Artemisia transiliensis* Poljakov was gathered in July 2019 in the eastern outskirts of the village Tastybastau, Talgarskiy district of Almaty region.

Essential oil was obtained by hydrodistillation on a Clevenger apparatus for 2 hours, then dried over anhydrous sodium sulfate and stored in closed vials in a dark place at a temperature of 4 °C.

By a microwave extraction method on an NEOS Essential Oils System, an essential oil was obtained at atmospheric pressure of 101.325 kPa. 100 g of raw material was loaded into a 2-liter measuring cup and water was poured so that 1/3 of the cup remained empty. Technological mode: extraction time - 90 min, temperature - 100 °C, emitting power - 550 W.

Chromatography-mass spectrometric analysis of the essential oil sample was carried out using an Agilent 6890 gas chromatograph equipped with an MSD 5973 mass-selective detector on an HP5 capillary column (5% diphenyl and 95% dimethylsiloxane, 30m x 0.25mm x 0.25mm (film thickness)). The temperature of injector is 280 °C. The column temperature was programmed as follows: 2 min at 50 °C, temperature increase at a speed of 4 deg/min to 240 °C, and then at a rate of 20 deg/min to 280 °C, isothermal period of 5 min. Helium (1.0 ml/min) was used as the carrier gas. The conditions of the mass selective detector were as follows: an ionization voltage of 70 eV, a data collection range of 30–650 a.m.u., and a data acquisition speed of 1.2 scans/s. 1.0 μl of the sample (a solution of essential oil in hexane, 8.0 μl per 0.5 ml) was injected into the chromatograph with a 100:1 flow separation. A mixture of normal hydrocarbons C_8–C_{24} was added to the sample as a standard for determining linear retention indices.

The components of essential oils were identified by comparing their mass spectra and linear retention indices (relative to C_8-C_{24} alkanes) with the data presented in the database [3]. Quantitative analysis was performed by the method of internal normalization for the areas of gas chromatographic peaks calculated using the Agilent ChemStation package without using correction coefficients. The sum of the peak areas of the components with linear retention indices in the range of 900-2200 was taken for 100%.

The antimicrobial activity of essential oils samples was determined on strains of gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis*, gram-negative strains of *Escherichia coli*, *Pseudomonas aeruginosa* and on *Candida albicans* yeast fungus by agar diffusion method (wells). Comparison preparations - lincomycin hydrochloride for bacteria and nystatin for *C. albicans* yeast fungus [4].

Anti-inflammatory activity was studied on the model of acute exudative reaction with the comparison drug "Diclofenac sodium" at a dose of 25 mg/kg [5].

Results and discussion. Essential oils were obtained by hydrodistillation using a Clevenger apparatus and microwave extraction on an NEOS apparatus. The essential oils obtained by the above-mentioned methods are mobile yellow liquids with a characteristic odor. The yield of essential oils obtained by hydrodistillation and microwave extraction was 0.29% and 0.22%, respectively (in terms of air-dry raw materials).

The composition of the essential oils was studied by GC-MS method with an Agilent 6890/5973C mass selective detector.

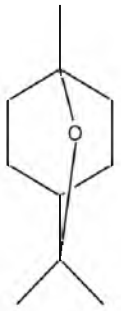
According to chromatography-mass spectrometry in essential oil obtained by hydro distillation, 19 components were detected, 18 of which were identified. The main components are (in%): 1,8-cineole (**1**) - 54.09, camphor (**2**) - 16.52, spathulenol - 4.69. The part of identified essential oil components was 98.95%. Essential oil mainly contains monoterpenes - 81.63%, sesquiterpenes - 17.32% and unidentified components - 1.04%.

In addition, 13 components were detected by chromatography-mass spectrometry in the essential oil obtained by microwave extraction, 12 of which were identified. The main components are (in %): 1,8-cineole (**1**) - 66.05, camphor (**2**) - 15.00, spathulenol - 4.23. The proportion of identified essential oil components was 99.14%. Essential oil mainly contains monoterpenes - 89.31%, sesquiterpenes - 9.83% and unidentified components - 0.84% (table).

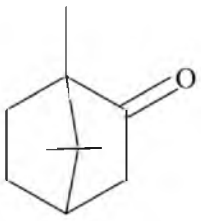
The main components of essential oils of *Artemisia transiliensis* Poljakov, isolated by hydrodistillation and microwave extraction methods

№	RT, min	RI	Component	Content, %	
				HD	MWE
1	2	3	4	5	6
1	7.789	947	camphene	1.50	1.75
2	10.438	1024	*p*-cymene	1.90	1.35
3	10.648	1031	1,8-cineole	54.09	66.05
4	10.792	1037	santolina alcohol	1.96	1.49
5	11.362	1070	*trans*-arbusculone	0.66	–
6	14.618	1144	camphor	16.52	15.00
7	15.304	1163	*cis*-chrysanthenol	0.59	–
8	15.384	1166	borneol	1.24	1.58
9	15.543	1173	santolina alcohol acetate	1.81	1.28
10	15.810	1177	terpinen-4-ol	1.36	0.81
11	17.658	1230	nordavanone	0.72	–
12	22.495	1378	α-copaene	0.37	–
13	25.809	1484	Germacrene-D	2.21	1.60
14	26.278	1500	bicyclogermacrene	2.74	1.41
15	26.834	1515	davana ether	3.29	–
16	27.079	1527	delta-cadinene	0.93	–
17	28.740	1580	spathulenol	4.69	4.23
18	28.949	1590	*cis*-davanone	2.37	2.59
19	30.343	1639	Unidentified component	1.04	0.84
HD – hydro distillation, MWE – microwave extraction.					

The table shows that in the essential oil obtained by microwave extraction, the quantitative content of 1, 8-cineole **(1)** is relatively predominant than in the essential oil extracted by hydro distillation. In contrast to previous studies [2], thujone was not found in the essential oil of *Artemisia transiliensis* Poljakov.



(1)



(2)

The antimicrobial activity of essential oils of *Artemisia transiliensis* Poljakov was studied on strains of gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis*, on gram-negative strains of *Escherichia coli*, *Pseudomonas aeruginosa* and on *Candida albicans* yeast fungi by agar diffusion method (wells).

According to the results of biological screening, it was established that essential oil of *Artemisia transiliensis* Poljakov, isolated by microwave extraction, shows moderate activity against gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis*. Whereas the essential oil obtained by hydro distillation has a weak antimicrobial activity.

Anti-inflammatory activity was studied on the model of acute exudative reaction in outbred white rats. It was found that the essential oil of *Artemisia transiliensis* Poljakov, obtained by the method of hydro distillation, at a dose of 25 mg/kg, has a pronounced anti-inflammatory activity comparable to the comparison drug "Diclofenac sodium" on the model of acute exudative reaction. And the essential oil of *Artemisia transiliensis* Poljakov, isolated by microwave extraction, at a dose of 25 mg/kg did not show anti-inflammatory activity.

Conclusion. Thus, for the first time, by the methods of hydro distillation and microwave extraction, essential oils from *Artemisia transiliensis* Poljakov were isolated and their compositions were studied.

According to GC-MS analysis, it was established that the essential oil of *Artemisia transiliensis* Poljakov contains a quantitative content of monoterpenes, where the main components of the essential oil are 1,8-cineole and camphor. However, the essential oil isolated by microwave extraction can be used as a source of 1,8-cineole. The use of the microwave extraction method is economical and shortens the process of essential oil production.

Essential oil of *Artemisia transiliensis* Poljakov isolated by hydro distillation method exhibits pronounced anti-inflammatory activity in the acute exudative reaction model.

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ARTEMISIA TRANSILIENSIS POLJAKOV ЭФИР МАЙЫНЫҢ КОМПОНЕНТТІК ҚҰРАМЫ ЖӘНЕ БИОЛОГИЯЛЫҚ БЕЛСЕНДІЛІГІ

Аннотация. Гидродистилляция және қысқа толқынды экстракция әдісі арқылы алынған *Artemisia transiliensis* Poljakov эфир майының компоненттік құрамы зерттелді. Бұл ретте эфир майының шығымы тиісінше 0,29% және 0,22% көрсетті.

Хромат-масс-спектрметрлік талдау әдісін қолдану арқылы ғидродистилляция нәтижесінде алынған эфир майында 19 компоненттің бар екендігі анықталды, олардың 18-і сәйкестендірілді. Бұл ретте хромат-масс-спектрометр әдісі арқылы микротолқынды экстракциямен алынған эфир майында 13 компонент анықталды, олардың 12-і сәйкестендірілді. Хромат-масс-спектрметрлік талдау әдісімен 1ле жусанынан бөліп алынған эфир майларының үлгілері монотерпендердің жоғары мөлшерімен сипатталатыны анықталды. Ондағы негізгі компоненттер 1,8-цинеол мен камфора болып саналады. Бұл ретте қысқа толқынды экстракция әдісі арқылы бөліп алынған эфир майын 1,8-цинеол көзі ретінде пайдалануға болады.

Бөліп алынған эфир майларының микробқа және қабынуға қарсы белсенділігі зерттелді.

Микробқа қарсы белсенділік нәтижесі бойынша қысқа толқынды экстракция әдісі негізінде бөліп алынған *Artemisia transiliensis* Poljakov эфир майы *Staphylococcus aureus, Bacillus subtilis* ғрамобактерияларына қарсы орташа айқын белсенділік танытатыны анықталды. Ал ғидродистилляция әдісімен алынған эфир майы микробқа қарсы әлсіз белсенділікке ие. Қабынуға қарсы әсерді анықтау кезінде ғидродистилляция әдісімен алынған *Artemisia transiliensis* Poljakov эфир майы 25 мғ/кг дозада жіті экссудативті реакция моделінде «Натрий диклофенағі» салыстыру препаратымен салыстыруға келетін қабынуға қарсы белсенді екендігі анықталды.

Түйін сөздер: *Artemisia transiliensis* Poljakov, ғидродистилляция, қысқа толқынды экстракция, эфир майы, ГХ-МС, биолоғиялық белсенділік.

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КОМПОНЕНТНЫЙ СОСТАВ И БИОЛОГИЧЕСКАЯ АКТИВНОСТЬ ЭФИРНОГО МАСЛА *ARTEMISIA TRANSILIENSIS* POLJAKOV

Аннотация. Изучены компонентные составы эфирных масел *Artemisia transiliensis* Poljakov (полыни заилийской), полученных методами ғидродистилляции и микроволновой экстракции. При этом выход эфирных масел составил 0.29 % и 0.22 % соответственно.

Методом хромато-масс-спектрометрического анализа установлено, что в эфирном масле, полученного методом гидродистилляции, обнаружено 19 компонентов, из них идентифицировано 18. При этом методом хромато-масс-спектрометрии в эфирном масле, полученного микроволновой экстракцией, обнаружено 13 компонентов, из них идентифицировано 12. Выделенные образцы эфирных масел полыни заилийской характеризуются высоким содержанием монотерпенов, где основными компонентами являются 1,8-цинеол и камфора. При этом эфирное масло, выделенное методом микроволновой экстракции, можно использовать в качестве источника 1,8-цинеола.

Исследована антимикробная и противовоспалительная активность выделенных эфирных масел.

По результатам биоскрининга установлено, что эфирное масло *Artemisia transiliensis* Poljakov, выделенное методом микроволновой экстракции, обладает умеренно-выраженной антимикробной активностью в отношении грамположительных бактерий *Staphylococcus aureus, Bacillus subtilis.* Тогда как эфирное масло, полученное методом гидродистилляции, обладает слабой антимикробной активностью. При определении противовоспалительного действия установлено, что эфирное масло *Artemisia transiliensis* Poljakov, полученное методом гидродистилляции, в дозе 25 мг/кг обладает выраженной противовоспалительной активностью, сопоставимой с препаратом сравнения «Диклофенак натрия» на модели острой экссудативной реакции.

Ключевые слова: *Artemisia transiliensis* Poljakov, гидродистилляция, микроволновая экстракция, эфирное масло, хромато-масс-спектрометрия, биологическая активность.

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