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CHEMICAL STUDY OF *LAVANDULA FERTILIZER*

Abstract. Genus *Lavandula* – specially grown as an aromatic and medicinal plant. In inflorescences, the content of essential oil is from 0.8 % to 2.6 %, in leaves up to 0.3 %. The main components of the essential oil are linalool (10-30 %) in the free state and its esters with acetic, butyric, valerianic, caproic acids (30-60 %), as well as geraniol, citral, borneolen, bisabolene, α-pinene and others.

Currently, the plant is used as an ornamental, as a spice in cooking, as well as for medicinal purposes. In traditional medicine, flowers, leaves and branches of lavender are used.

In Bulgaria, lavender is used as a means of calming the nervous system, relaxing baths and for skin diseases.

In Germany, ointments are made from lavender petals. In Austria, lavender leaves are collected before flowering and are used as soothing and anti-inflammatory drugs. In Poland, in combination with a pharmacy chamomile flower, the flowers of a lavender plant are used in the healing of a fresh voice and bronchial disease.

In France, an infusion of lavender flowers is used as an urolithic substance.

The object of the study is raw materials *L.angustifolia* of individual collection at the experimental site of the laboratory of medicinal plants of the Institute of Phyto-Introduction and Botany at the Ministry of Science and Education of the Republic of Kazakhstan of Almaty.

The technology for producing a biologically active complex from the plant species under study has been developed by varying the nature of the extractant, its ratio with raw materials, time and extraction ratio.

The optimal condition for obtaining a biologically active complex from a plant is: extractant – 50 % ethyl alcohol, the ratio of extractant to raw material – 1: 9, the time of double extraction – 72 hours, temperature – 25 °C.

The fractional composition of the aerial mass of *L.angustifolia*, which is represented by water-soluble and water-insoluble fractions, was studied.

The article presents for the first time the data of a qualitative and quantitative analysis of the lipophilic components of the aerial mass of *L.angustifolia*, determined by gas-liquid chromatography with mass spectrometry (GC / MS).

Analyzes were carried out in a laboratory of chemistry of natural coefficients, University of Karachi, Karachi, Pakistan, the structure and quantitative content of 16 compounds were established in the aerial mass of the plant *L.angustifolia*.

The identification of the components was carried out by analogy with the known mass spectra of the samples embedded in the computer data bank and relative retention times. Quantitative determination of the composition of the analyzed mixture was carried out by the method of normalization by peak areas.

Keywords: *Lavandula (L. angustifolia),* GC-MS, extraction, BAS, aerial parts.

Introduction

Lavandula root is a rod, a tree, and strongly branched on its support. When the new bushes are stretched to the surface, the obsolete bumps bend over. The leaves are rectangular, oval greens, bearded or rectangular, with the edges. The young leaves of the lavanta plant are gray, aged leaves – green [1-3].

Lavandula was specially crafted as aromatic and medicinal plant in the year 2000. Today *Lavandula* plant is used in many different spheres. It is widely used as lavender in lavender, as a spice in culinary, as well for therapeutic purposes, lavender flowers, leaves and branches are used in folk medicine. Collect lavender flowers at the time of flowering and dry it on a sunny day. Then, prepare the flowers, leaves and sprays separately for use in the pots [4-6].

Flowers of *Lavandula* contain uric acid, cinnamic and garnarin. Essential oils will be 0.8-2.6 % in the bouquet, 0.3 % in the leaves and 0.19 % in the class. The main components of the essential oils are linoleum (10-30 %) in vacuum and its esters (30-60 %) with acetic, oily, valerian and caproic acids, as well as alumina, citral, borneol, bisabolene, α-pinene, dihydrochrylophyllene epoxy, as healing.

It is known that the composition of plant extracts is directly related to various factors such as the temperature of the extraction process, the extraction time, the plant raw material and the nature of the solvent or solvent system used.

Depending on the tasks to be solved, a wide array of organic solvents such as hexane, chloroform or benzene is used to extract biologically active substances.

However, most organic solvents are highly toxic compounds, have a build-up effect in tissues or are carcinogens, whereby it is requireв to include additional steps for drug substance purifi cation and additional methods for quality control of such preparations. These measures lead to an imminent increase in the cost of end product [7-11].

This article analyzes the lipophilic composition of the ethanol extract Lavandula with various alcohol / water content. The aim of the study was to compare the chemical composition of the extracts from Lavandula using two solvents, which are different in polar type, to allow the two systems to be used as a basis for the medicinal forms.

Materials and Methods

The selection of the optimal technological parameters of raw plant materials ting aimed at the identification of those affecting directly the composition and the quality of the final complex of biologically active substances (BAS) [12]:

1) the nature of the solvents;
2) raw material:solvent ratio;
3) the temperature;
4) the duration of the extraction;
5) the extraction frequency.

The selection of the optimal solvent was carried out on the basis of the qualitative analysis of the main BAS groups and the quantitative extraction of extractive substances by pharmacopocial methods [13].

Determination of lipophilic components of a substance by chromatography spectrometry. The extracted extrudate is extracted with hexane (1: 2) for 72 hours at 20-24 °C. The extract is enriched in a rotary evaporator in a soft case.

A Perkin-Elemer Autosystem gas chromatograph with an XL mass-selective detector – TurboMass is used with a flare quartz capillary column (30 x 2.5 mm, 0.25 μm thick), PE-5 coating and a 99.9 % helium-filled phase. It starts at a temperature of 60 °C (works for 5 minutes), from 20 °C / min to 180 °C, from 3.5 °C/min to 290 °C. The final temperature is maintained for 40 minutes.

Mass spectra are ionized with an emission of 70 eV and a full scan in the range of 40-350 a.m. The injector temperature was 310 °C, and the RA-TiO sample was divided by 1:60 according to the model [14-20].

Methods for determining the qualitative composition of the ground part of plants and roots, determining the composition of fractions, as well as determining the structure and purity of the separation of compounds in raw materials:

– extraction of various polar solvents;

– two-dimensional and one-dimensional chromatography on FN3 paper (Germany) and with a system of solutions.

As the main method for studying chemical composition, the authors opted for the method of high performance gas chromatography with mass-selective detector as the most accurate and universal, which allows for identifi cation of the widest possible spectrum of compounds.

When selecting the optimal extractant, the following solvents are used: ethyl alcohol (50 %, 70 %, 90 %) water solution. 5 g of *Lavandula* (*L. angustifolia*) of the ground part of the plant, 50 ml capacity, packaged in sausages. The raw material and the solvent obtained in a ratio of 1:6 are kept for 24 hours at room temperature. After 24 hours, the resulting extract can be filtered through a Buchner filter and a vacuum pump. The resulting extract is measured with a measuring cylinder, poured into a porcelain dish, evaporated in a water bath, and the substance is removed.

In the technology of substance separation, the main parameter is the ratio of raw materials and extractant. In order to determine the optimal volume, the selected extractant changes the ratio of raw material and solvent from a ratio of 1:4 to a ratio of 1:10. 5 g crushed (*L. angustifolia*) – ground part of plants of various sizes (20, 30, 40, 45, 50) 50 % extraction with ethyl alcohol. In addition, during the extraction process as a stable factor: extraction time (24 hours) and temperature (20-25 °C).

Determination of technological parameters for obtaining substances

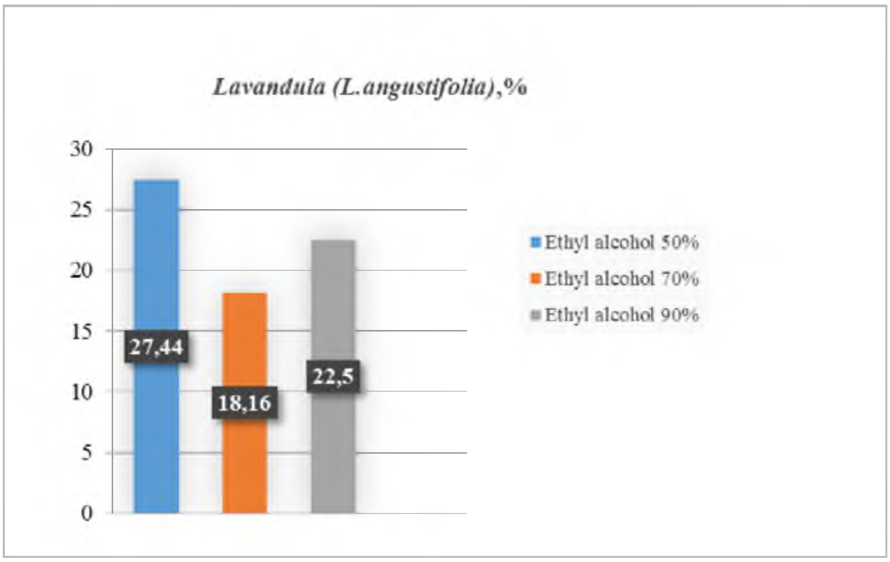
Selecting the extraction state: Obtaining the substance was carried out according to the following scheme:

50-100 g vegetable raw materials *Lavandula* (*L. angustifolia*) 250-500 ml of 50 % water-ethyl alcohol, preparation of raw materials and extractant in a ratio of 1:9 and settling at room temperature for 72 hours. The contents of the flask are thoroughly mixed, and the paper is filtered into a dry flask through a filter. This extraction process is repeated 2 times using the high-temperature method.

The resulting extracts are added and filtered with paper used at the beginning of the filter.

Results and discussion

According to the results obtained (*L. angustifolia*), during 72 hours of extraction at a temperature of 24-28 ºC.the time and multiplicity of extraction are the same. 100 g of dried and standardized plant raw materials were obtained for extraction.



Picture 1 - General provisions of *Lavandula* using various extractants origin of the substance from the ground part of the plant , %

Using the obtained extracts of *Lavandula* (L. from the aboveground part of the angustifolia plant, a substance of 50 % ethyl alcohol was taken in large quantities.

Table 1 - *Lavandula* is related to the relationship between" raw material-extractant» %

Ratio of raw material (g) and extractant (ml)	*Lavandula (L.angustifolia),%*
1:4	–
1:6	27,44
1:8	31,96
1:9	55,94
1:10	55,36

Using the selected extractant, the optimal raw material – extractant ratio is 1: 9. if you choose the right ratio of raw materials and extractant, you can save time by knowing the content and ratio of extractant in the industrial industry.

Table 2 - General provisions depending on the time of the extraction process *Lavandula* %

Time of extraction	*Lavandula (L.angustifolia),%*
12	27,24
24	55,94
48	75,52
72	88,66

Table 3 - General provisions depending on the multiplicity of extraction of *Lavandula*, %

Number of extractions	*Lavandula (L.angustifolia),%*
1 extraction	28,01
2 extraction	28,14

As the next step, the extract was examined by high-performance gas chromatography with mass selective detector Aligent Technologies 6400 Series Triple Quadrupole LC/MS under the following conditions: Poroshell 120 EC-C18 column (50 mm long, 3 mm in diameter, with the coating substance particle size of 4.0, 2.7 and 1.9 μm) was used, with 10 % aqueous solution of methanol as mother solvent and 90 % methanol as final solvent at the pressure of 11.5 mPa and the temperature of 40 °C. Components were identifi ed by mass spectra and retention times using the NIST library and Wiley LC/MS.

Based on the research of the studied plant raw materials, it was found that there are 16 compounds. Plant raw materials contain the amount of methyl ester of linoleic acid (29.34 %) and hexahydrofarrenal acetone (0.41 %). *Lavandula* plant raw material contains methyl ester of linoleic acid (29.34 %), ethyl ether of palmitic acid (21.48 %) and methyl ester of palmitic acid (15.42 %). The Lavandula plant contains β-santalol (0.41 %), which contains very small amounts of Sesquitersenoid compounds.

It is obvious that with in case of an unchanged amount of the plant material, the increase of the extragent amount in the extraction process results in increase of the substance dissolved and transported from the cell to the intercellular space. At the same time, the increase of the volume of the extragent Jeads to decrease of BAS concentration in the extract.

The ground raw material is introduced to a five-, seven-. nine- and twelve-fold amount of the solvent for studying the dependence of the raw material solvent ratio on the BAS amount in the plants studies. The results are shown in Fig. 1, The raw material solvent ratio has a positive effect. In fact, the solvent in the ratio considered brings about a greater amount of the extractive substances obtained despite the solvent used. This is consistent with the mass transfer principle as the concentration gradient between the solid and most of the liquid is the driving force.

In accordance with the mass transfer law the difference between the concentration of the extract and thesolvent increases the transition of the soluble substances into the solvent and continues until the establishment of equilibrium. It is so because the concentration difference is the driving force of the diffusion process.

However, the increase of the solvent consumption is limited by the cost of concentrating the extract obtained.

It follows that the cost of the extract evaporation is an important factor requiring consideration. Therefore, the smaller the raw material: solvent ratio, the more efficient from an economic pint of view is the extraction process.

The effect of the extraction temperature on the process of maximum extraction of BAS complex is studied. The temperature increase leads to an increase of the solubility of the various polyphenolic constituents,as well as to an increase of the rate of their diffusion. Since the boiling point of the solvents used does not exceed 80 °C no significant change of the composition of the extracted substances is expected.

Table 4 - Lipofil composition of *Lavandula angustifolia* plant

No	Connection name	RT (min)	Amount,%	Molecular formula
1	Methyl 4-propan-2-yl benzoate	17.021	0.59	$C_{11}H_{14}O_2$
2	α - terpene	19.403	1.88	$C_{10}H_{16}$
3	Caryophyllene oxide	20.427	7.87	$C_{15}H_{24}O$
4	δ - zedrol	21.173	4.03	$C_{15}H_{26}O$
5	Lancel	21.635	0.73	$C_{15}H_{24}O$
6	Caryophylline oxide	21.895	2.41	$C_{15}H_{24}O$
7	2,6,8- trimethylbicyclo [4.2.0] oct-2-en-1,8-diol	22.02	0.88	$C_{11}H_{18}O_2$
8	β - santalol	22.222	0.7	$C_{15}H_{24}O$
9	Hexahydropharnesyl acetone	24.369	0.41	$C_{18}H_{36}O$
10	8-Oxo-2' – deoxyguanosine	25.963	0.63	$C_{15}H_{22}O$
11	Palmettic acid methyl ester	26.24	15.42	$C_{17}H_{34}O_2$
12	Palmettinic acid ethyl ester	28.253	21.48	C_{18}H36O2
13	Linoleic acid methyl ester	31.516	29.34	C_{19}H32O2
14	Phytol	31.709	4.25	$C_{20}H_{40}$
15	Stearic acid methyl ester	31.902	3.98	$C_{19}H_{38}O_2$
16	Linoleic Acid Ethyl Ester	32.506	1.4	$C_{20}H_{34}O_2$

Conclusion

The lipophilic composition of the surface of the angustifolia *Lavandula* plant was determined by gas chromatography using an ion detector and an Agilent HP-5MC device at Karatekin University, Chancara, Turkey. The studied plant material contains linoleic acid methyl ether (29.34 %), palmitic acid ethyl ether (21.48 %) and palmitic acid methyl ether (15.42 %). *Lavandula* (contains a very small amount of β-santalol (0.41 %), which is part of sesquitrepenoid.

16 compounds were identified using the chromatogram shown in table 4.(methyl-4-propane-2-yl benzoate, α – terpinene, caryophyllene oxide, δ – cedrol, Lancel, 2,6,8 – trimethylbicyclo [4.2.0]Oct-2-EN-1,8-diol, β – santalol, hexahydrofarnesylacetone, 8-Oxo-2'-deoxyguanosine, methyl palmitic acid ester, ethyl palmitic acid ester, methyl ether linolenic acid, phytol, stearic acid methyl ester, linoleic acid ethyl ester). The resulting lavender essential oil contains 70-80 % saturated C6-c44 hydrocarbons. Quantitative quantities are: docosan (2.8779 %), genacosan (2.4896 %), non-docosan z-14 (2.2156 %), tetracosan (2.3894 %). Butyl-1-methylpropyl ether (4.4067 %) and cyclochloroctane (3.0660 %), 1,2-Benzenesulfonic acid. Test essential oil contains from 10 to 15 esters. In addition, korneol found in essential oils (0,0287 %) and caryophyllia (0,0123 %).

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LAVANDULA FERTILIZER-ДІҢ ХИМИЯЛЫҚ ЗЕРТТЕУІ

Аннотация. Лаванда (*Lavandula*) біздің дәуірімізге дейін хош иісті және дәрілік өсімдік ретінде арнайы өсірілген. Эфир майы құрамы гүл шоғырында – 0,8 %-дан 2,6 %-ға дейін, жапырақтарында 0,3 %-ға дейін болады. Эфир майының негізгі компоненттерінде еркін жағдайдағы линалоол (10-30 %) және сірке суы, май, валериян, капрон қышқылы (30-60 %) бар, сондай-ақ оның эфирлері – гераниол, цитраль, борнеолен, бисаболен, α-пинен. Қазіргі уақытта өсімдік сәндік өнімдерде, дәмдеуіш ретінде аспаздық үшін, сондай-ақ емдік үшін де пайдаланылады. Халықтық медицинада дәрілік мақсаттармен лаванданың гүлдері, жапырақтары мен бұтақтары қолданылады, бұтақтарын бөлек бөтелкелерге жинап, пайдалануға дайындайды. Болгарияда лаванда жүйке жүйесін тыныштандыратын, ванналар мен тері ауруларын емдейтін дәрі ретінде қолданылады. Германияда лаванда жапырақтарынан жақпа жасайды. Австрияда лаванда жапырақтары гүлденгенге дейін жиналады, олар тыныштандыратын және қабынуға қарсы препараттар ретінде пайдаланылады. Польшада дәріханалық түймедақ гүлімен бірге, лаванда өсімдіктерінің гүлдері жаңа дауыс пен бронх ауруын емдеуде қолданылады. Францияда лаванда гүлінің тұнбасы несеп айдайтын зат ретінде пайдаланылады.

Зерттеу объектісі – Қазақстан Республикасы Ғылым және Білім Министрлігі жанындағы фитоинтродукция және ботаника институты дәрілік өсімдіктер зертханасының эксперименталдық бөлімінде жеке жиналған *Lavandula (l.angustifolia)* шикізаты.

Зерттеліп жатқан өсімдік түрлерінен биологиялық белсенді кешен алу технологиясы экстракция затының табиғатын, шикізатқа қатынасын, уақытты және экстракция коэффициентін өзгерте отырып жасалды.

Өсімдіктен биологиялық белсенді кешен алудың оңтайлы шарты: экстрагент – 50 % этил спирті, экстракцияның шикізатқа қатынасы – 1: 9, қосарланған экстракция уақыты – 72 сағат, температура – 250 °С.

L.angustifolia жер үсті массасының фракциялық құрамы зерттелді, ол суда еритін және суда ерімейтін фракциялардан тұрады.

Мақалада алғаш рет *L.angustifolia* жер үсті массасының липофильді компоненттерінің сапалық және сандық талдауының деректері келтірілді, масс-спектрометриясы (GC/MS) бар газ сұйықтықты хроматография әдісімен анықталған.

Талдаулар табиғи қосылыстар химиясы зертханасында, Карачи қаласының университетінде, Пәкістан қаласында *L.angustifolia* өсімдігінің жер үсті массасында 16 қосылыстың құрылымы мен сандық құрамы орнатылды.

Компоненттерді сәйкестендіру компьютердің деректер банкіне салынған үлгілердің белгілі масс-спектрлеріне және ұстап қалу уақытына ұқсас жүзеге асырылады. Талданатын қоспаның құрамын сандық анықтау шыңдар ауданы бойынша қалыпқа келтіру әдісімен жүзеге асырылды.

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ХИМИЧЕСКОЕ ИССЛЕДОВАНИЕ *LAVANDULA FERTILIZER*

Аннотация. Род Лаванда (*Lavandula*) – специально выращенный как ароматное и лекарственное растение. В соцветиях содержание эфирного масло от 0,8 % до 2,6%, в листьях до 0,3 %. Основными компонентами эфирного масла являются линалоол (10–30%) в свободном состоянии и его эфиры с уксусной,

масляной, валерияновой, капроновой кислотами (30–60 %), а также гераниол, цитраль, борнеолен, бисаболен, α-пинен и другие.

В настоящее время растение используется как декоративное, в качестве специй в кулинарии, а также в лечебных целях. В народной медицине используются цветы, листья и ветви лаванды.

В Болгарии лаванду используют как средство, успокаивающее нервную систему, расслабляющие ванны и при кожных заболеваниях.

В Германии делают мази из лепестков лаванды. В Австрии собраны листья лаванды до цветения и используются в качестве успокаивающих и противовоспалительных препаратов. В Польше, в сочетании с аптечным цветком ромашки, цветки лавандового растения применяются при заживлении свежей раны и бронхиальной болезни.

Во Франции настой цветков лаванды используют как мочегонное вещество.

Объектом исследования является сырье *Lavandula* (*L.angustifolia*) индивидуального сбора на экспериментальном участке лаборатории лекарственных растений Института фитоинтродукции и ботаники при Министерстве науки и образования Республики Казахстан города Алматы.

Отработана технология получения биологически активного комплекса из исследуемого вида растения варьированием природы экстрагента, его соотношением с сырьем, времени и кратности экстракции.

Оптимальным условием для получения биологически активного комплекса из растения является: экстрагент – 50 % этиловый спирт, соотношение экстрагента и сырья – 1:9, время двухкратной экстракции – 72 часа, температура – 25^0С.

Изучен фракционный состав надземной массы *L.angustifolia*, который представлен водорастворимыми и нерастворимыми в воде фракциями.

В статье впервые приведены данные качественного и количественного анализа липофильных компонентов надземной массы *L.angustifolia*, определены методом газожидкостной хроматографией с масс-спектрометрией (GC/MS).

Анализы проведены в лаборатории химии природных соединений, Университета города Карачи, г. Карачи, Пакистан, в надземной массе растения *L.angustifolia* установлены структуры и количественное содержание 16 соединений.

Идентификация компонентов осуществлена по аналогии с известными масс-спектрами образцов, заложенных в банк данных компьютера и относительным временем удерживания. Количественное определение состава анализируемой смеси осуществлено методом нормализации по площадям пиков.

Ключевые слова: *Lavandula (L. angustifolia)*, ГХ-МС, экстракция, БАВ, надземная часть.

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