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Д.В.Сокольский атындағы «Жанармай,
катализ және электрохимия институты» АҚ

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ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
АО «Институт топлива, катализа и
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NEWS

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NAS RK is pleased to announce that News of NAS RK. Series of chemistry and technologies scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of chemistry and technologies in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of chemical sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабарлары. Химия және технология сериясы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Химия және технология сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді химиялық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия химии и технологий» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по химическим наукам для нашего сообщества.

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erbol.ih@gmail.com, erlanbur@mail.ru, sitigulnaz@mail.ru, rumex1978@gmail.com,**COMPARATIVE ANALYSIS OF BIOLOGICALLY ACTIVE COMPLEXES
OBTAINED BY THE SCF COF METHOD - PLANT EXTRACTION
OF PLANTS OF DAUCUS CAROTA, SOLANUM LYCOPERSICUM,
CRATAEGUS TURKESTANICA A. POJARK SPECIES**

Abstract. The article presents the results of a study of the qualitative and quantitative extracts obtained by the method of supercritical fluid extraction by carbon dioxide from the fruits of the plant *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. *Pojark*.

Extraction on a Thar SFE-1000 CO₂-extraction unit under the following conditions: temperature range in the reactor is 40-80 ° C, CO₂ pressure is 180-200 bar, with a gas flow of 100 ml / min, ethyl alcohol was used as a co-solvent.

The obtained extract was investigated by gas chromatography on a gas chromatograph with an Agilent Technologies 7890N / 5973N GC / MS mass-selective detector.

The studied extracts identified in *Daucus carota*: carotenoids, limonene (0.2%), o-cymol (0.29%), cariofillen (0.3%), phytol acetate (4.25%), eicosane (1.2 %), falkarinol (4.5%), squalene (0.8%), vitamin E (0.6%), campesterol (0.8%), stigmaterol (2.34%), gamma sitosterol (2.49 %).

Crataegus turkestanica A. *Pojark*: Limonene (0.42%), o-cymol (0.28), phytol acetate (1.45%), eicosane (3.65%), falkarinol (0.255%), squalene (2, 0%), vitamin E (0.57%), campesterol (0.78%), alpha-tocopherol (1.83%), gamma-sitosterol (4.83%).

Solanum lycopersicum: Carotenoids, fatty acid esters (oleic, linolenic, hexadecanoic, octadecadienoic), eicosane (2.65%), lupeol (2.33%), phytol acetate (1.61%), alpha-amyrin (7.46 %), vitamin E (1.08%), tetracosane (3.81%)

For a more complete study of the chemical composition of supercritical extracts of the extract, gas chromatography with a mass selective (GC-MS) detector was used.

Work on the study of extracts obtained under other conditions of extraction is currently ongoing.

Key words: *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. *Pojark*, SFE, HPLC-MS.

Introduction

One of the most important humanitarian tasks that directly affect the quality of life is a high level of provision of high-quality drugs. In part, this task can be solved by producing a number of drugs from widely used and affordable starting materials by processing them using modern methods. In particular, in the Republic of Kazakhstan, natural, renewable plant resources are the richest source of biologically active substances. Therefore, at present, interest has increased in the search for new drugs based on plant raw materials of the Republic of Kazakhstan, since they, in most cases, are much less toxic, cause allergic reactions much less frequently. Therefore, the search for new technologies for the isolation of safe bioactive complexes is considered an important task at the present time [1].

Supercritical fluid extraction is a technological process consisting in converting one or more components of a solid or liquid mixture into a "supercritical gas-fluid". Produced by contacting a mixture

of components to be separated with a gaseous extractant at a temperature and pressure above the critical point. The most widely used as extractants (solvents) are CO₂, ethane, ethylene, propane, SF₆, etc [2-3].

Features of supercritical carbon dioxide. Supercritical gas has the characteristic of more rapid mass movement compared with traditional liquid organic solvents. Despite a slightly lower density compared to a liquid, the dynamic viscosity of the compressed gases most likely corresponds to the values of the normal gaseous state. The diffusion coefficient of supercritical gas is more than ten times higher than that of a liquid [4].

A gas in a supercritical state, better than a classical solvent penetrates into the extracted material, is able to more effectively absorb and transport soluble components of the substance [5-8].

The use of carbon dioxide allows completely and sparingly separating it from the extract and carrier material as opposed to classical solvents, the elimination of which is not always complete. In other words, the extracts obtained using this technique are completely free of solvent [9-10].

Supercritical fluid extraction is controlled, which allows you to adjust the extraction of a component from plant materials. It is precisely this that allows to obtain not only natural food ingredients, such as natural antioxidants, preservatives, dyes, flavoring substances, but also pharmaceutical ingredients. [11].

The objects of research were Kazakhstani plant species *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. Pojark.

Material and methods

The supercritical extraction method was carried out on a Thar SFE-1000 CO₂-extraction unit under the following conditions: the temperature range in the reactor was 40–80 ° C, the CO₂ pressure was 180–200 bar, with a gas flow of 100 ml / min, as a co-solvent ethanol

The obtained extract was investigated by gas chromatography on an Agilent Technologies 7890N / 5973N GC / MS gas chromatograph with a mass selective detector under the following conditions: a DB-35MS column (30 mx 250 mm x 0.25 mm) was used, the helium carrier gas velocity was 1 ml / min The temperature of chromatography is programmed from 40 ° C (holding 0 min) to 300 ° C with a heating rate of 5 ° C / min (holding 5 min). Detection is carried out in SCAN m / z mode 34-800. The Agilent MSD Chem Station software (version 1701EA) was used to control the gas chromatography system, record and process the obtained results. Data processing includes the determination of retention time, peak areas, as well as the processing of spectral information obtained using a mass spectrometric detector. The Wiley 7th edition and NIST'02 libraries were used to decipher the mass spectra obtained (the total number of spectra in the libraries is more than 550 thousand). It was also carried out quantitative determination by UV spectrometry [12-13].

Results and discussion

The purity of the objects under study are determined in the framework of the State Pharmacopoeia of the Republic of Kazakhstan 1 edition. [14].

The results of the study of supercritical extracts obtained from objects of *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. Pojark species are presented in Tables 1-3 and in Figures 1-3.

The quantitative content of the main BAS groups was determined by the HPLC-MS method. The table contains the substances that have the greatest amount.

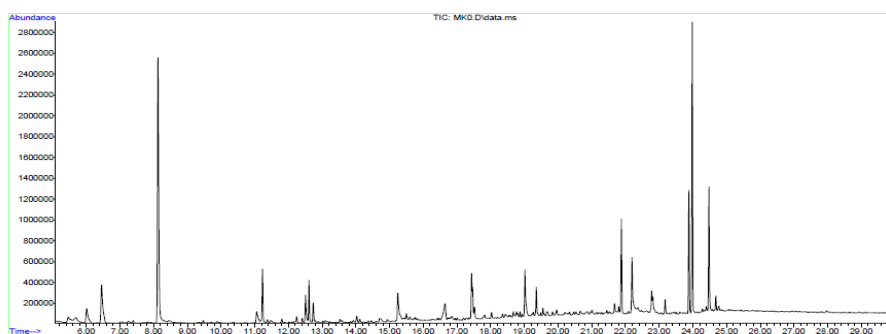


Figure 1- Chromatogram of supercritical extract obtained from the plant *Daucus carota*

From the results of the chromatographic analysis, it can be seen that many substances were identified in the supercritical extract obtained from the fruits of the *Daucus carota* plant;

Table 1 - Characteristics of the supercritical extract obtained from the plant *Daucus carota*

Raw material	<i>Daucus carota</i>
Production	Supercritical fluid extraction with carbon dioxide, in the absence of inorganic salts, without solvent residues, reproducible microorganisms.
Type of extract	Liquid from light yellow to yellow salad color.
Composition	PUFA, carotenoids, limonene (0.2%), o-cymol (0.29%), caryophyllen (0.3%), phytol acetate (4.25%), eicosane (1.2%), falkarinol (4 , 5%), squalene (0.8%), vitamin E (0.6%), campesterol (0.8%), stigmasterol (2.34%), gamma sitosterol (2.49%).
Using	It is recommended to use in the care of fading, flaky and problem skin.
Naturalness	The product is 100% natural, does not contain impurities and is not manufactured according to the chemical formula.
Storage	In a sealed package in a cool dark place at least 2 years.

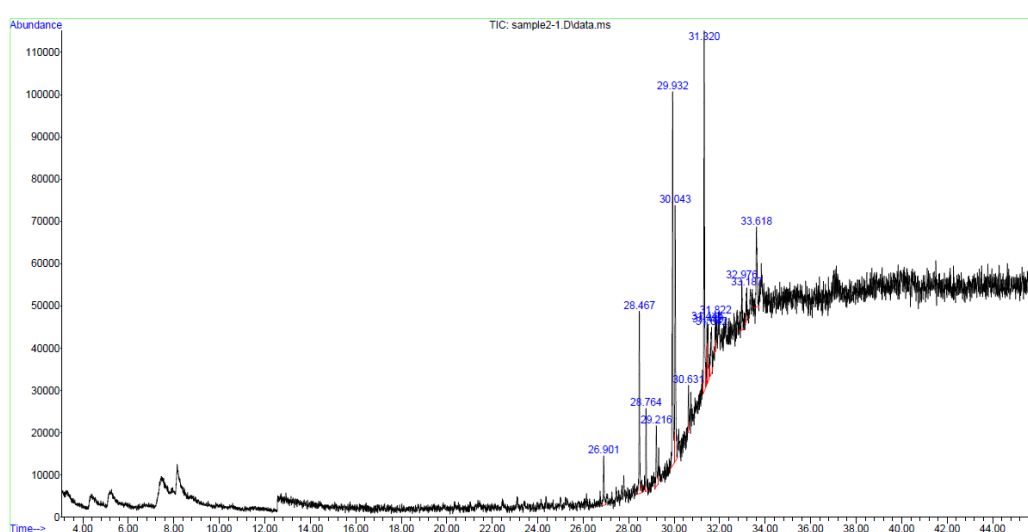


Figure 2- Chromatogram of supercritical extract obtained from plant *Crataegus turkestanica* A. Pojark

From the results of the study of the supercritical extract obtained from the fruit of the plant *Crataegus turkestanica* A. Pojark by HPLC, it was found that the largest number of compounds are identified at 23-34 minutes of the process. A more detailed analysis of the extract is presented in table 2.

Compared with previous samples, the largest number of signals is noted, the total analysis is presented in table 3.

Table 2 - Characteristics of the supercritical extract obtained from the plant *Crataegus turkestanica* A. Pojark

Raw material:	<i>Crataegus turkestanica</i> A. Pojark
Production:	Supercritical fluid extraction with natural carbon dioxide, in the absence of inorganic salts, without solvent residues, reproducible microorganisms.
Type of extract:	Liquid from light yellow to yellow.
Composition:	Limonene (0.42%), o-cymol (0.28), phytol acetate (1.45%), eicosane (3.65%), falkarinol (0.255%), squalene (2.0%), vitamin E (0.57%), campesterol (0.78%), alpha-tocopherol (1.83%), gamma-sitosterol (4.83%).
Using:	It is recommended to use in the care of fading, flaky and problem skin.
Naturalness:	The product is 100% natural, does not contain impurities and is not manufactured according to the chemical formula.
Storage:	In a sealed package in a cool dark place at least 2 years.

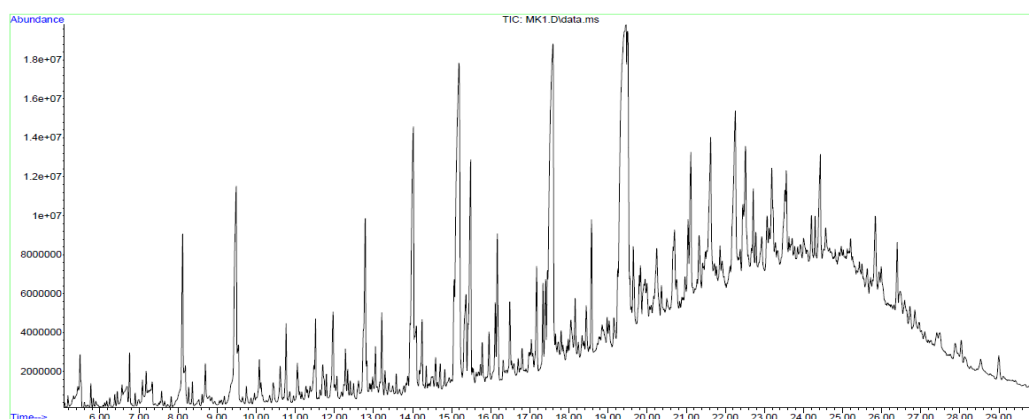


Figure 3 - Chromatogram of supercritical extract obtained from plant *Solanum lycopersicum*

Table 3 - Characteristics of the supercritical extract obtained from the plant *Solanum lycopersicum*

Raw material:	<i>Solanum lycopersicum</i>
Production:	Supercritical fluid extraction with natural carbon dioxide, in the absence of inorganic salts, without solvent residues, reproducible microorganisms.
Type of extract:	Oily mass from orange-yellow to orange-red color with a faint characteristic odor.
Composition:	Carotenoids, fatty acid esters (oleic, linolenic, hexadecanoic, octadecadienoic), eicosane (2.65%), lupeol (2.33%), phytol acetate (1.61%), alpha-amyrin (7.46%), vitamin E (1.08%), tetracosane (3.81%).
Using:	Components can have anti-inflammatory, antioxidant, wound healing agent, improves skin elasticity and elasticity ..
Naturalness:	The product is 100% natural, does not contain impurities and is not manufactured according to the chemical formula.
Storage:	In a sealed package in a cool dark place at least 2 years.

From the results presented in Table 3, there is a significant presence of esters of fatty acids, hydrocarbons, as well as plant steroids and biologically active micronutrients.

The results allow us to draw the following conclusions.

Conclusion

Firstly, essential oils are found in the extracts of *Daucus carota*, as well as in a sufficient amount of falkarinol - 4.5%. According to British scientists, falkarinol is a natural pesticide that kills cancerous tumors. Cariofillen, a bicyclic sesquiterpene, which affects the taste and smell of the product, is found in carrots.

Secondly, in the extracts of *Crataegus turkestanica* A. Pojark, *solanum lycopersicum* found: essential oils, carotenoids, squalene, vitamins and sterols. Squalene is the strongest anti-tumor agent. Stervalene triterpene has emollient, bactericidal, wound healing, antioxidant properties.

Sterols have anti-inflammatory, anti-allergic, anti-edematous, analgesic properties. Plant sterols, or phytosterols, are alcohols containing 28-30 carbon atoms. These include β -sitosterol, stigmasterol, campesterol, spinsterol, and others.

Vitamin E (tocopherols) has anti-inflammatory action, antioxidant activity, is involved in the biosynthesis of heme and proteins, cell proliferation, tissue respiration, and other important processes of tissue metabolism.

For the first time, supercritical fluid extraction was used to study Kazakhstani species of three edible products, the obtained extracts were studied by HPLC.

Analysis of supercritical fluid extracts of three edible products by HPLC indicates the presence of interesting compounds.

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DAUCUS CAROTA, SOLANUM LYCOPERSICUM, CRATAEGUS TURKESTANICA A. POJARK ӨСІМДІК ТҮРЛЕРІНЕН ЖҚФ СО₂-ЭКСТРАКЦИЯ ӘДІСІМЕН АЛЫНҒАН БИОЛОГИЯЛЫҚ БЕЛСЕНДІ КЕШЕНДІ САЛЫСТЫРМАЛЫ САРАПТАУ

Аннотация. Мақалада жоғарғыкритикалық флюидті әдіс көмегімен көмірқышқыл газы қатысында *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. *Pojark* өсімдік жемістері экстракциясының сапалық және сандық құрамын зерттеу нәтижелері келтірілген.

Экстракциялау Thar SFE-1000 қондырғысында келесі жағдайда жүргізілді: реактордағы температура аралығы - 40-80°C, қысым СО₂ – 180-200 бар, газдың ағыны 100 мл/мин, со-ертінді есебінде пайдаланылған ертінді этил спирті.

Алынған экстракт масс-селективті детектор Agilent Technologies 7890N/5973N GC/MS газды хроматографта газ хроматографиясы әдісімен зерттелді

Daucus carota - дан алынған экстрактіде ең көп мөлшерде келесі заттар анықталды: каротиноидтар, лимонен (0,2%), о-цимол (0,29%), кариофиллен (0,3%), фитол ацетаты (4,25%), эйкозан (1,2%), фалькаринол (4,5%), сквален (0,8%), Е дәрумені (0,6%), кампестерин (0,8%), стигмастерин (2,34%), гамма ситостерол (2,49%).

Crataegus turkestanica A. *Pojark* экстрактісінде ең көп мөлшерде келесі заттар табылған: лимонен (0,42%), о-цимол (0,28%), фитол ацетаты (1,45%), эйкозан (3,65%), фалькаринол (0,255%), сквален (2,0%), витамин Е (0,57%), кампестерин (0,78%), альфа-токоферол (1,83%), гамма ситостерол (4,83%).

Ал *Solanum lycopersicum* экстрактісінде анықталған мына заттар: каротиноидтар, май қышқылдарының эфирлері (олеин, линолен, гексадекан, октадекадиен), эйкозан (2,65%), лупеол (2,33%), фитол ацетаты (1,61%), альфа-амирин (7,46%), Е дәрумені (1,08%), тетракозана (3,81%)

Басқа жағдайларда алынған экстрактілер құрамын зерттеу жұмыстары жалғасуда.

Түйін сөздер: *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. *Pojark*, СКФ-экстракция, хромато-масс спектрометр.

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СРАВНИТЕЛЬНЫЙ АНАЛИЗ БИОЛОГИЧЕСКИ АКТИВНЫХ КОМПЛЕКСОВ, ПОЛУЧЕННЫХ МЕТОДОМ СКФ СО₂ -ЭКСТРАКЦИЕЙ РАСТЕНИЙ ВИДОВ DAUCUS CAROTA, SOLANUM LYCOPERSICUM, CRATAEGUS TURKESTANICA A. POJARK.

Аннотация. В статье представлены результаты исследования качественного и количественного экстрактов, полученных методом сверхкритической флюидной экстракции углекислым газом из плодов растения *daucus carota*, *solanum lycopersicum*, *crataegus turkestanica* A. *Pojark*.

Экстракция проведена на установке Thar SFE-1000 при следующих условиях: температурный диапазон в реакторе-40-80°C, давление СО₂ – 180-200 бар, при потоке газа 100 мл/мин, в качестве со-растворителя был использован этиловый спирт.

Полученный экстракт исследован методом газовой хроматографии, на газовом хроматографе с масс-селективным детектором Agilent Technologies 7890N/5973N GC/MS.

В изучаемых экстрактах идентифицированы в *Daucus carota*: каротиноиды, лимонен (0,2%), о-цимол (0,29%), кариофиллен (0,3%), ацетат фитола (4,25%), эйкозан (1,2%), фалькаринол (4,5%), сквален (0,8%), витамин Е (0,6%), кампестерин (0,8%), стигмастерин (2,34%), гамма ситостерол (2,49%).

Crataegus turkestanica A. *Pojark*: Лимонен (0,42%), о-цимол (0,28%), ацетат фитола (1,45%), эйкозан (3,65%), фалькаринол (0,255%), сквален (2,0%), витамин Е (0,57%), кампестерин (0,78%), альфа-токоферол (1,83%), гамма ситостерол (4,83%).

Solanum lycopersicum: Каротиноиды, эфиры жирных кислот (олеиновая, линоленовая, гексадекановая, октадекадиеновая), эйкозан (2,65%), лупеол (2,33%), ацетат фитола (1,61%), альфа-амирин (7,46%), витамин Е (1,08%), тетракозана (3,81%)

Работы по исследованию экстрактов, полученных при других условиях извлечения, в данный момент продолжаются.

Ключевые слова: *Daucus carota*, *Solanum lycopersicum*, *Crataegus turkestanica* A. *Pojark*, СКФ-экстракция, хромато-масс спектрометрия.

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