ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
ҰЛТТЫҚ ҒЫЛЫМ АКАДЕМИЯСЫНЫҢ

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

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
АО «Институт топлива, катализа и
электрохимии им. Д.В. Сокольского»

N E W S

OF THE ACADEMY OF SCIENCES
OF THE REPUBLIC OF KAZAKHSTAN
JSC «D.V. Sokolsky institute of fuel, catalysis
and electrochemistry»

SERIES
CHEMISTRY AND TECHNOLOGY

2 (446)

MARCH – APRIL 2021

PUBLISHED SINCE JANUARY 1947

PUBLISHED 6 TIMES A YEAR

ALMATY, NAS RK

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ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

Меншіктенуші: «Қазақстан Республикасының Ұлттық ғылым академиясы» Республикалық қоғамдық бірлестігі (Алматы қ.).

Қазақстан Республикасының Ақпарат және қоғамдық даму министрлігінің Ақпарат комитетінде 29.07.2020 ж. берілген **№ KZ66VPY00025419** мерзімдік басылым тіркеуіне қойылу туралы куәлік.

Тақырыптық бағыты: ***химия және жаңа материалдар технологиясы саласындағы басым ғылыми зерттеулерді жариялау.***

Мерзімділігі: жылына 6 рет.
Тиражы: 300 дана.

Редакцияның мекенжайы: 050010, Алматы қ., Шевченко көш., 28; 219, 220 бөл.; тел.: 272-13-19; 272-13-18, http://chemistry-technology.kz/index.php/en/arhiv

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Редакцияның мекенжайы: 050100, Алматы қ., Қонаев к-сі, 142, «Д. В. Сокольский атындағы отын, катализ және электрохимия институты» АҚ, каб. 310, тел. 291-62-80, факс 291-57-22, e-mail:orgcat@nursat.kz

Типографияның мекенжайы: «Аруна» ЖК, Алматы қ., Муратбаева көш., 75.

«Известия НАН РК. Серия химии и технологий».

ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

Собственник: Республиканское общественное объединение «Национальная академия наук Республики Казахстан» (г. Алматы).

Свидетельство о постановке на учет периодического печатного издания в Комитете информации Министерства информации и общественного развития Республики Казахстан **№ KZ66VPY00025419**, выданное 29.07.2020 г.

Тематическая направленность: ***публикация приоритетных научных исследований в области химии и технологий новых материалов.***

Периодичность: 6 раз в год.
Тираж: 300 экземпляров.

Адрес редакции: 050010, г. Алматы, ул. Шевченко, 28; ком. 219, 220; тел. 272-13-19; 272-13-18,
http://chemistry-technology.kz/index.php/en/arhiv

Адрес редакции: 050100, г. Алматы, ул. Кунаева, 142, АО «Институт топлива, катализа и электрохимии им. Д.В. Сокольского», каб. 310, тел. 291-62-80, факс 291-57-22, e-mail:orgcat@nursat.kz

Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75.

News of the National Academy of Sciences of the Republic of Kazakhstan. Series of chemistry and technology.

ISSN 2518-1491 (Online),
ISSN 2224-5286 (Print)

Owner: RPA "National Academy of Sciences of the Republic of Kazakhstan" (Almaty).

The certificate of registration of a periodical printed publication in the Committee of information of the Ministry of Information and Social Development of the Republic of Kazakhstan **No. KZ66VPY00025419**, issued 29.07.2020.

Thematic scope: ***publication of priority research in the field of chemistry and technology of new materials***

Periodicity: 6 times a year.
Circulation: 300 copies.

Editorial address: 28, Shevchenko str., of. 219, 220, Almaty, 050010, tel. 272-13-19; 272-13-18,
http://chemistry-technology.kz/index.php/en/arhiv

Editorial address: JSC «D.V. Sokolsky institute of fuel, catalysis and electrochemistry», 142, Kunayev str., of. 310, Almaty, 050100, tel. 291-62-80, fax 291-57-22, e-mail: orgcat@nursat.kz

Address of printing house: ST "Aruna", 75, Muratbayev str., Almaty.

N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES CHEMISTRY AND TECHNOLOGY
ISSN 2224-5286
Volume 2, Number 446 (2021), 155 – 160 **https://doi.org/10.32014/2021.2518-1491.41**

UDC 615.322

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OBTAINING FLAVONOID FROM TARAXACUM KOK-SAGHYZ RODIN PLANT GROWING IN KAZAKHSTAN

Abstract. In recent years, the interest of researchers in the herbal preparation has grown significantly. Plants are sources of biologically active substances (BAS). In previous articles, the chemical composition and biologically active substances of plants endemic Taraxacum kok-saghyz Rodin growing in Kazakhstan has been studied. Among the BAS of plant origin, inulin and flavonoids occupy a special place. The article examines the release of inulin and flavonoid from the stem of Taraxacum kok-saghyz Rodin plants. In order to isolate a flavonoid, you first need to extract inulin. Due to the fact that in our plants, inulin accumulates up to 40%. Therefore, the first stage was to isolate inulin: with extractions 1:10 with distilled water for 60 minutes, and in the second stage, the further isolation of the residue was first dried, the dry residue was 1:10 with a ratio of 70% ethanol for 3 hours. The inulin yield was - 5%, the melting point was 1300C. A The yield of flavanoid is 0.66%, the melting point is 1700 C, the aggregate state is acicular light brown light. The structure of the isolated flavonoid was determined on a Uviline 9100 spectro-photometer; the highest absorption was observed at a wavelength of 364 nm. Consequently, the structure of the isolated flavonoid coincides with the literature data. The maxima of the UV, IR, ^{13}C -NMR. spectrum show that flavonol is a derivative.

Key words: medicinal plants, Taraxacum koksaghyz rodin, biologically active substances, flavonoids, IR spectrum, ^{13}C -NMR.

Introduction. There are many types of medicinal plants. Among them Taraxacum kok-saghyz rodin (blue-gum) belongs to the family of complex flowers [1-2]. Along with other types of blue-gum variety, it is widely used in ethno science. Data on its medicinal value have not yet been fully studied. However, its biological studies [3-6] and the extraction of rubber from its roots are being carried out in the United States, neighboring Russia and our country.

Other parts have not yet been fully explored. Therefore, it is necessary to study the chemical composition of this plant in more detail and scientifically determine its value for pharmacology.

The ways of synthesizing rubber from its roots are being intensively studied [1].

Species belonging to the genus Orchard are widespread in different regions of the world, and contain biologically active substances: flavonoids, inulin, polysaccharides, etc. compounds are widely studied today. Based on this, we consider the separation of flavonoids from Taraxacumkok-saghyz Rodin, which belongs to this family. Flavanoids belong to the phenolic class of natural compounds, due to their diverse structure and low toxicological properties and high biological activity [10]. The antioxidant properties of flavonoids are broader than those of powerful antioxidants such as vitamins C and E, selenium and zinc. Flavons are a common group of flavonoids, usually light yellow, yellow or yellow-green [2]. The antioxidant properties of flavonoids isolated from the leaves of Hibiscus rosa sinensis by column chromatography have been studied. The study showed that the isolated flavonoid compounds have effective absorption properties, their absorption property depends on the presence of phenolic compounds, their flavonoid content can be used as an anti-cancer agent [3].

Flavonoids are used in medicine as drugs containing vitamin P (strengthens capillaries and regulates vascular permeability). Catechins, leukoanthocyanins, flavonols (rutin) and flavonoids (hesperidin) promote activeness in vitamin P. On the basis of flavonoids there are drugs with anti-inflammatory, anti-influenza, choleretic, diuretic effect (fire, licorice, etc.) are developed [4].

They have the ability to suppress many diseases, even in low concentrations [5]. The peculiarity of such drugs is that they are natural, i.e they are not artificially synthesized [6]. Flavonoid plants have become widely known in recent years in the field of medicinal plants and world medicine. In recent years, a lot of work is being done in the field of standardization of flavonoids. These natural substances and their analogues are essential for the body, i.e organism requires a constant intake of them as food or medicines and food supplements [7-8].

In the process of modernization, it is important to identify the active components in various herbal medicines. Antibacterial and anti-rheumatic drugs made of herbs are commonly used in the clinical treatment. Therefore, it is important to develop effective distribution methods to control the quality of herbal medicines [9]

Based on these references, we consider the extraction of flavonoids from the plant Taraxacum kok-saghyz rodin. The full chemical composition of Taraxacum koksaghyz rodin has been studied in our previous work [10].

The purpose of the study: To obtain flavonoids from Taraxacum koksaghyz rodin growing in Kazakhstan, identification of its composition, structure.

Materials and methods. Object of research: The object of study was the plant (stem) Taraxacum kok-saghyz rodin, collected in September-October 2018–2019 in the Small Almaty gorge.

Flavonoids are found in all parts of plants, the method of extraction depends on distribution of flavonoids in the bark, leaves, roots, stems of the plant and the type. If dry grass is processed, it changes the method of extraction to stop the action of the enzyme that causes hydrolysis. The choice of solvent for extraction depends on the polarity of flavonoids. Multi-polar solvents are used for the extraction of glycosides and anthrocyans. In order to separate flavonoids adsorption-regulatory chromatography based on polyamide, silica gel is used.

Separation of flavonoids. To separate flavonoids, we must first extract inulin from 20 g of raw material. To do this, the raw material is dried at room temperature. Grind the dried raw material, add distilled water in a ratio of 1:10 and extract for 60 minutes. Inulin is extracted from the resulting solution. The amount of inulin is determined by the dry residue in the extract, the yield is 6.6%. After drying the rest of the raw material at room temperature, flavonoids are isolated by pouring 70% ethanol in a ratio of 1:10 and extraction for 3 hours. The resulting solution is evaporated in a vacuum until aqueous residue remains. Aqueous substances in the aqueous residue are cleaned 3 times with petroleum ether and separated with a separating funnel. The separated solution is passed through adsorbents (polyamide, silica gel) in the column. Then first rinse the adsorbent in the column several times with distilled water, and then pass the resulting solution. Then washed with ethyl alcohol of different concentrations (5,10,15,20,30,50,70%). The resulting flavonoid appears as a yellow crystal or yellow powder [11-16].

The melting point of flavonoids was determined optically by spectroscopy in a unit PTP (M) TU-92 [17].

To determine the structure of flavonoids IR - spectrometer "Bruker ALFA" was recorded in KBr tablets in the range of 400-4000 cm-1.

IR spectra of flavonoids are aromatic rings, which are determined by the pairing of carbonyl with hydroxyl groups. On the basis of the characteristic frequency in their IR spectra are determined: functional groups (carbonyl, hydroxyl, methoxy, methyl groups), complex-ether groups (in acylated flavonoids), a series of substitution of the benzene ring.

It allows to determine the aromatic rings A and B in the IR spectrum of flavonoids, the -C-O-C-bond in the central -C-ring, the C = O-group (flavonoids, favonols) or (flavonols), functional groups and their relationship.

^{13}CNMR spectroscopy is also used to identify the structure of flavonoids

^{13}C-NMR is another informative method to prove the structure of flavonoids. This method gives detailed information about the carbon skeleton of the substance. C13 -NMR is used to determine the location of glycosidation in C- and O-glycosides, active groups with the help of the spectrum. The inconvenience of the method is 15 mg of substance is needed for analysis. Solutions required for spectral

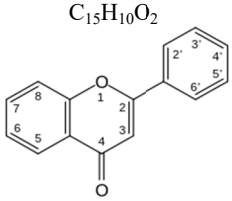
capture: DMSO-d6, acetone-d6, CD3OD and CDCl3, the choice of solution takes into account the solubility of the test substance. Tetramethylsilane (TMS) is used as a standard and it is marked as 0 m.u..^{13}C-NMR -spectral signs are determined in the interval of 0 - 210 m.u (comparing TMS) [18-20].

Results of discussion.

Table 1 - The amount of flavonoids in the stems of the plant Taraxacum koksaghyz rodin

Name of raw material	humidity	Ashes, %	flavonoid, %
stem	10,00	14,00	2,08

Table 2 - Elemental content of flavonoids isolated from the stem of Taraxacum koksaghyz rodin

Name of raw material	yield %	Melting point^{0}C	calculated%		Brutto formula	identified %	
			C	H		C	H
stem	6,6	170	81,10	4,50	$C_{15}H_{10}O_2$  Flavon	81,08	4,51

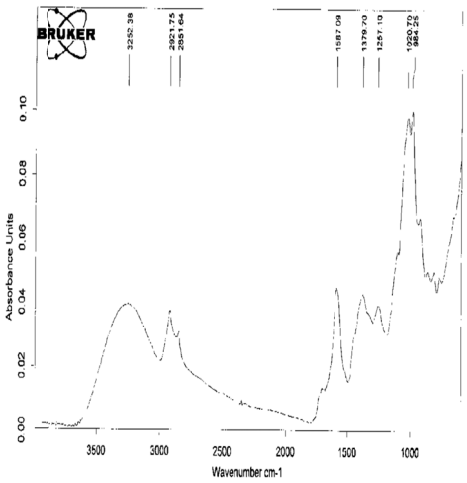


Figure 1 - IR spectrum of flavonoids isolated from the stem of Taraxacum koksaghyz rodin

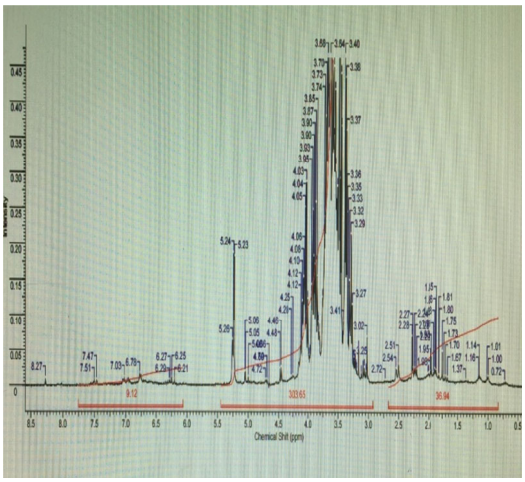


Figure 2 - NMR spectrum of flavonoid isolated from the stem of Taraxacum koksaghyz rodin

Figure 1. The formula of flavonoid isolated from the stem of Taraxacum koksaghyz rodin is C15H10O2. This is flavon. The flavon is light brown, the physical state is crystalline. Melting point is 1700C [21].

In the IR spectrum, the oscillation frequency 3336 cm-1 indicates the valence oscillations of the OH group, the CH2 group shows 2921 cm-1 oscillations, the C = C group oscillates 1657 cm-1, and the 1737 cm-1 oscillation frequency corresponds to the C = O group. In the IR spectrum of the stem of Taraxacum koksaghyz rodin shows 3328 cm-1 oscillations of OH group, 1713 cm-1 shows the oscillation frequency of the C = O group, 1650 cm-1 -C = C- oscillations.

Figure 2. As shown in figure 2, as a result of the analysis of the NMR spectrum, there is a signal of flavanoid compounds. For protons of the methoxy group 1.5-2.8 m.u. according to the resonance zone. Methyl groups show L-ramnopyranose residues in the strong region of the resonance line (1-1.4 m.u.). The spectrum of the high-intensity signal (3-5.5 mA) corresponded to the protons of the pyranose rings [20-21]. The signal of aromatic enzymes (6.0-7.5 m.u.) is also shown. The results of the analysis are given in table 3.

Table 3 - Analysis of the content of functional groups

Functional groups	Content (%)
	Flavonoid
CH_3	1,14
OCH_3	2,84
CH_{Arom}	2,82

Conclusion. The article examines the release of inulin and flavonoid from the stem of Taraxacum kok-saghyz Rodin plants. In order to isolate a flavonoid, you first need to extract inulin. Due to the fact that in our plants, inulin accumulates up to 40%. Therefore, the first stage was to isolate inulin: with extractions 1:10 with distilled water for 60 minutes, and in the second stage, the further isolation of the residue was first dried, the dry residue was 1:10 with a ratio of 70% ethanol for 3 hours. The inulin yield was -5%, the melting point was 1300C. A The yield of flavanoid is 0.66%, the melting point is 1700 C, the aggregate state is acicular light brown light. The structure of the isolated flavonoid was determined on a Uviline 9100 spectrophotometer; the highest absorption was observed at a wavelength of 364 nm. Consequently, the structure of the isolated flavonoid coincides with the literature data. The maxima of the UV, IR spectrum show that flavonol is a derivative.

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ҚАЗАҚСТАН АЙМАҒЫНДА ӨСЕТІН TARAXACUM KOK-SAGHYZ RODIN ӨСІМДІГІНЕН ФЛАВАНОИДТЫ БӨЛУІНУІ

Аннотация Соңғы жылдары зерттеушілердің дәрілік өсімдіктерге деген қызығушылығы едәуір өсті. Өсімдіктер - биологиялық белсенді заттардың көзі (БАЗ). Алдыңғы мақалаларда Қазақстанда өсетін эндемикалық Taraxacum kok-saghyz Rodin өсімдіктерінің химиялық құрамы мен биологиялық белсенді заттары зерттелген. Өсімдік тектес БАЗ арасында инулин мен флавоноидтар ерекше орын алады. Мақалада инулин мен флавоноидтың Taraxacum kok-saghyz Rodin өсімдіктерінің сабағынан бөлінуі зерттелген. Флавоноидты бөліп алу үшін алдымен инулинді бөліп алу керек. Біздің өсімдіктерде инулин 40% дейін жиналады. Сондықтан бірінші саты инулинді оқшаулау болды: экстракциялармен 1:10 дистилденген сумен 60 минут бойы, ал екінші кезеңде қалдықтың одан әрі оқшауланууы алдымен кептірілді, құрғақ қалдық 70% этанолдың 1:10 қатынасы болды 3 сағат ішінде. Инулиннің шығымы - 5%, балқу температурасы 1300С құрады. А Флаваноидтың шығымы - 0,66%, балқу температурасы - 1700 С, агрегаттық күйі - ацикулярлы ақшыл қоңыр түсті. Оқшауланған флавоноидтың құрылымы Uviline 9100 спектрофотометрінің көмегімен анықталды, ең жоғары сіңіру 364 нм толқын ұзындығында байқалды. Демек, оқшауланған флавоноидтың құрылымы әдебиет мәліметтерімен сәйкес келеді. УК, ИҚ, ^{13}С-ЯМР спектрінің максимумдары флавонолдың туынды екенін көрсетеді.

Түйін сөздер: дәрілік өсімдіктер, Taraxacum koksaghyz rodin, биологиялық активті заттар, флаваноидтар, ИК спектр, ^{13}С-ЯМР.

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ВЫДЕЛЕНИЕ ФЛАВОНОИДОВ ИЗ РАСТЕНИЯ TARAXACUM KOK-SAGHYZ RODIN, ПРОИЗРАСТАЮЩИХ В КАЗАХСТАНЕ

Аннотация. В последние годы значительно вырос интерес исследователей к препаратом растительного происхождения. Растения являются источниками получения биологически активных веществ (БАВ). В предыдущие статьях изучен химический состав и БАВ растений эндемика Taraxacum kok-saghyz Rodin произрастающие в Казахстане. Среди БАВ растительного происхождения особое место занимают инулин и флавоноиды. В статье изучено выделение инулина и флавоноида из стебля растений Taraxacum kok-saghyz Rodin.

Для того чтобы выделить флавоноиды, сначала надо извлечь инулин, так как в растениях концентрация инулина доходит до 40%. Поэтому первый этап – это выделение инулина: с экстракций 1:10 дист.водой 60 минут, а на втором этапе – дальнейшее выделение остатка, т.е. сначала высушили до сухого остатка 1:10 сотношение 70% этанолом 3 часа. Выход инулина составил -5%, температура плавления 130^0C. А выход флаваноида – 0,66%, температура плавления 170^0 С, агреагатное состояние – игольчатый, светло-коричневого цвета .

Строение выделенного флавоноида было определено на спектрофотометре марки "Uviline 9100", на длине волны 364 нм наблюдалось самое высокое поглощение. Следовательно, строение выделенного флавоноида совпадает с литературными данными. Максимумы спектра УФ-, ИК, ^{13}С -ЯМР-спектрах показывают, что флавонол является производным.

Ключевые слова: лекарственные растения, Taraxacum koksaghyz rodin, биологически активные вещества, флавоноиды, ИК спектр, ^{13}С -ЯМР.

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ISSN 2518-1491 (Online), ISSN 2224-5286 (Print)

Редакторы: *М. С. Ахметова, Д. С. Аленов, Р.Ж. Мрзабаева*
Верстка на компьютере *Д. А. Абдрахимовой*

Подписано в печать 12.04. 2021.
Формат 60x881/8. Бумага офсетная. Печать – ризограф.
10,2 п.л. Тираж 300. Заказ 2.

Национальная академия наук РК
050010, Алматы, ул. Шевченко, 28, т. 272-13-18, 272-13-19