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DEVELOPMENT OF TECHNOLOGY FOR OBTAINING PHITOSUBSTANTS FROM RAW ARTEMISIA GMELINII WEBER EX STECHM

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The article presents the results of producing phitosubstants as extracts and essential oil from medicinal plants of Artemisia gmelinii. Antibacterial and antifungal screening of the received phitosubstants has shown pronounced bactericidal activity against microorganisms Staphylococcus aureus ATCC 25923, Staphylococcus aureus ATCC 6538, Staphylococcus epidermidis ATCC 12228, Micrococcus luteusATCC 10240, Bacillus subtilis ATCC 6633, Bacillus cereus ATCC 10876, Streptococcus pyogenes ATCC 19615, Streptococcus pneumoniae ATCC 49619, Streptococcus mutans ATCC 25175, Candida albicans ATCC 10231, Candida parapsilosis ATCC 22019 of the dry extract obtained by the percolation with the use of the solvent - 70% alcohol. The results obtained allowed selecting the dry extract of Artemisia gmelinii as active pharmaceutical substance to create a dental gel based on Carbomer.

Key words: *wormwood Gmelini, phytosubstansies, extract, essential oil.*

Isolation of biologically active substances (BAS) from the plants is one of the important processes in the preparation of phytosubstances. Analysis and search for modern effective methods for producing BAS and the development of pharmaceutical substances are, undoubtedly, of theoretical and scientifically-practical interest [1].

Currently, more than 30% of medicines are derived from natural raw materials, including plants. As a rule, substances extracted from plants are a complex of physiologically active compounds containing two or more components for different plants. These substances have different solubility and can therefore be extracted with selective solvents [2,3]. The extractive substances extraction process depends on the plant material itself (the extractable substances content in the raw material, the morphological and anatomical features of the feedstock structure) and on technological factors (solvent viscosity, extraction temperature, raw material dispersion, density, porousness of the raw material layer, porosity, solvent nature, extraction time and others) [4-8].

The main goal of the study was the development of an optimal technology for obtaining extracts in the form of phytosubstances of pharmacopoeial quality.

Different methods of extraction from the same plant raw materials can lead to the production of BAS with different chemical composition and properties [9].

A phytochemical analysis was applied to the extracts from the raw materials obtained by various extraction methods: by carbon dioxide extraction using liquid carbon dioxide under subcritical conditions, by percolation using an alcohol solvent of 70%, by circulating extraction using a chloroform solvent, hydro distillation (a method of obtaining essential oil).

To obtain the extracts was used the raw material of wormwood gmelinii harvested in July-August 2015 in the generative phase in the foothills of the Trans-Ili Alatau of the Republic of Kazakhstan. The harvesting was produced in accordance with the principles of the GACP standard. The collected raw materials are standardized in accordance with the requirements of the State Pharmacopoeia of the Republic of Kazakhstan.

1. Using the method of carbon dioxide extraction a technology for obtaining a thick extract from wormwood gmelinii has been developed at the enterprise "PhytoAromat" in accordance with the standard of the enterprise ST 27658 - 1910 - LLP-02-2011 "Extracts" in the industrial installation UPE 5L.

Crushing of the raw materials was carried out on a KDU-2 crusher up to a size of 3-5 mm. Liquid carbon dioxide (CO_2) was used as the solvent, which is a good selective solvent for most aromatic substances [10]. The parameters of the technological process under subcritical conditions were selected experimentally, table 1.

The extraction results and the characteristics of the product obtained are shown in table 2.

As can be seen from the table, in the case of carbon dioxide extraction the technological output of the finished product was 1.85%, 22 compounds were found, 20 of them were identified. The final product was a thick dark brown extract with a specific odor. A principal technological scheme for obtaining carbon dioxide extract was developed, Fig. 1.

2. A technology for extracting dry extract from the raw

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Table 1 – **Parameters of CO_2 - extraction under subcritical conditions**

Parameters	Subcritical extraction
Solvent	CO2 in the liquefied state
Pressure	66 atm
Temperature	16 0 C
Extraction time	18 h
Solvent flow	None
Degree of grinding	3- 5 mm
Volume of flowability	340 g/dm3
Water flow (circulation system)	20L
Dissolved substances	Partially lipids, terpenoids, fat-soluble vitamins
Possibility of fractionating extracts	None

Table 2 – **Process output and product characteristics**

Kind of wormwood A. gmelinii L.	Raw materials for extraction, (g).	Obtained product (g)	Compounds found		Technological output, %
			Total	Identified	
Thick extract	2161,0	40r	22	20	1,85

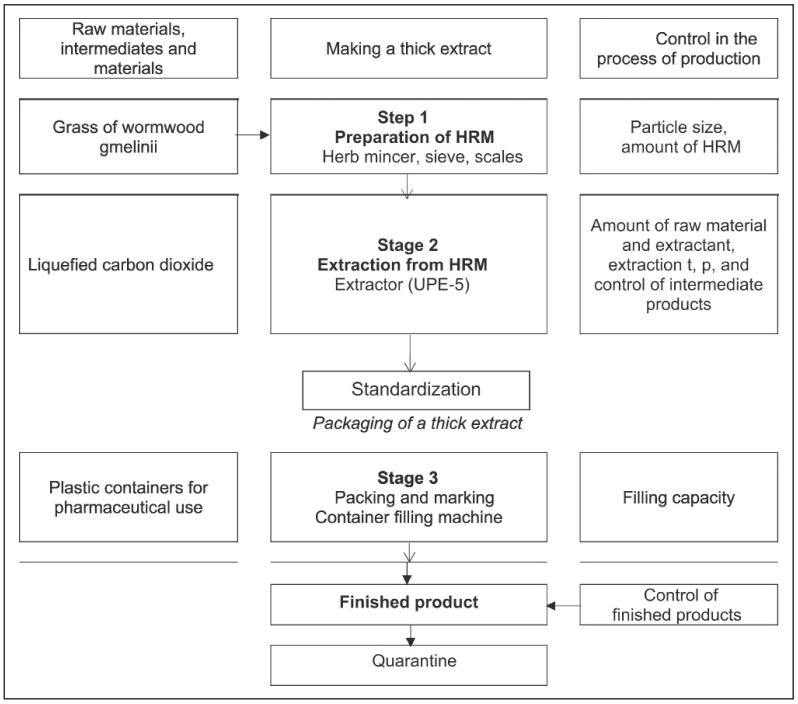

Figure 1 – Technological scheme for obtaining carbon dioxide extract from the raw material of wormwood gmelinii

material of wormwood gmelinii with the use of 70% ethanol by percolation has been developed. Extraction of BAS was due to convective diffusion to complete depletion, then further purification and thickening of the extract to a moisture content of no more than 5% (dry extract) was carried out.

The method of obtaining a dry extract consisted of the following steps: soaking of raw materials, maceration pause (infusion), percolation (direct transition of the extractant through the raw material layer), purification and thickening of the extract, standardization of the extract.

This method allows the maximum extraction of biologically active substances; the output of the finished product and the number of compounds found are shown in table 3.

As can be seen from Table 3, the output of the extract was 2.5%, the number of compounds found was 13, and the number of identified compounds was 13. The technological scheme for obtaining a dry extract by percolation using an alcohol solvent of 70% from Artemisia wormwood is shown in Figure 2.

3. The preparations of a thick extract by the method of circulation extraction with the use of a volatile chloroform solvent were carried out in a classical manner in a "Soxclette" type installation. The resulting thick extract is a viscous mass of dark brown color, with a specific smell of a bitter taste.

The output of the final product and the number of compounds found are shown in Table 4.

As can be seen from Table 4, the extract output was 2.1%. The number of found compounds - 13, identified - 13.

4. Essential oil was obtained by hydro distillation under laboratory conditions in the Clevenger apparatus. The finished product is an oily liquid of a dark yellow color with a specific odor. The output and characteristics of the essential oil are shown in Table 5.

As can be seen from Table 5, the technological output of essential oil was 1.76%, the number of compounds detected was 48, and 36 were identified.

Thus, a thick extract was obtained by the method of carbon dioxide extraction under subcritical conditions with a technological output of 1.85%, the output of the dry extract obtained by percolation using an ethyl alcohol solvent of 70% was 2.5%. The method of circulating extraction with the use of a volatile chloroform solvent made it possible to obtain a thick extract with a technological output of 2.1%. The production of essential oil was developed by steam distillation (hydrodistillation), output - 1.76%. The obtained extract and essential oil substances were screened for antibacterial and antifungal activity (Staphylococcus aureus ATCC 25923, Staphylococcus aureus ATCC 6538, Staphylococcus epidermidis ATCC 12228, Micrococcus luteusATCC 10240, Bacillus subtilis ATCC 6633, Bacillus cereus ATCC 10876, Streptococcus pyogenes ATCC 19615, Streptococcus pneumoniae ATCC 49619, Streptococcus mutans ATCC 25175, Candida albicans ATCC 10231, Candida parapsilosis ATCC 22019).

It has been found that the activity is shown by all the extracts and essential oil of Artemisia gmelinii, expressed antimicrobial and antifungal activity is shown by the dry extract, obtained by percolation with an ethyl alcohol solvent of 70% [12]. The results obtained allowed selecting the dry extract as an active substance for the creation of a new drug dental gel based on the carbomer.

Table 3 – **Process output and product characteristics**

Kind of wormwood A. gmelinii L.	Raw materials for extraction, (g).	Obtained product (g)	Compounds found		Technological output, %
			Total	Identified	
Dry extract	4005,0	100г	13	13	2,5

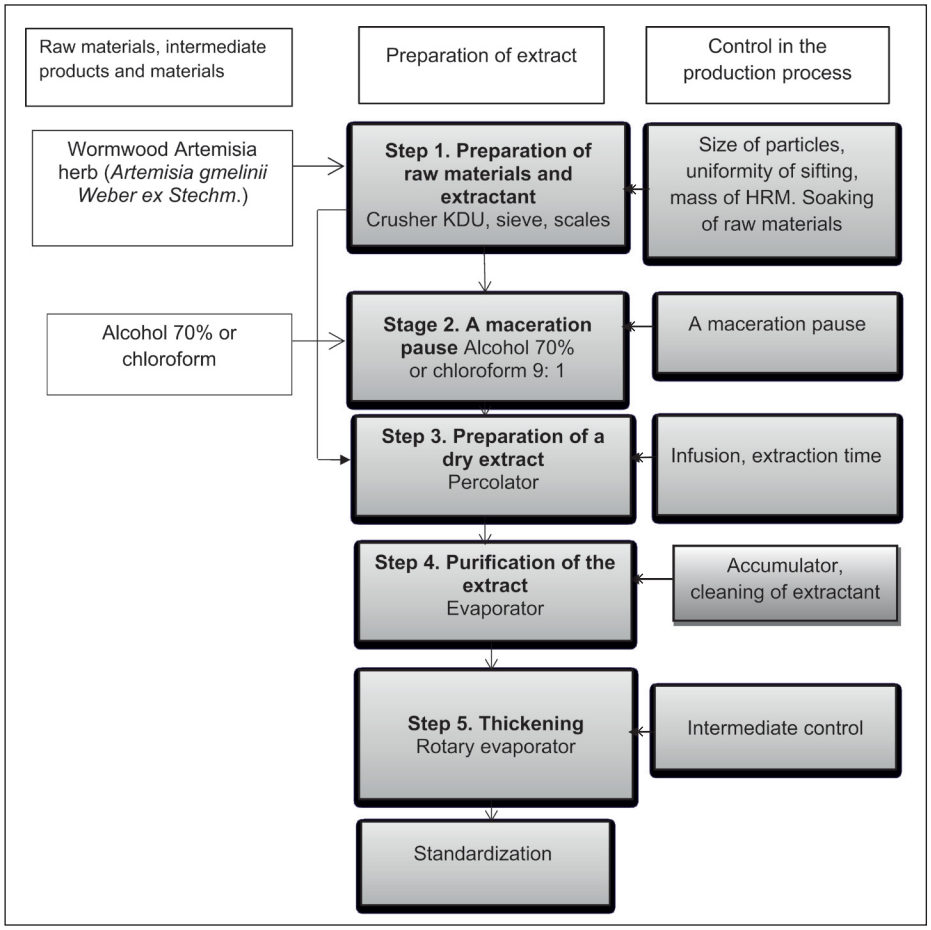

Figure 2 - Technological scheme of obtaining a dry extract with alcohol from the raw material of Artemisia gmelinii.

Table 4 – **Technological output and characteristics of the finished product**

Kind of wormwood A. gmelinii L.	Raw materials for extraction, (g).	Obtained product (g)	Compounds found		Technological output, %
			Total	Identified	
Thick extract	1455,0	30g	13	13	2,1

Table 5 – **Output and characteristic of essential oil**

Kind of wormwood A. gmelinii L.	Raw materials for extraction, (g).	Obtained product (g)	Compounds found		Technological output, %
			Total	Identified	
Essential oil	17589	310,0	48	36	1,76

Research transparency

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Declaration about financial and other relations

All authors took part in elaboration of article conception and writing the script. The release script was approved by all authors. The authors did not get the honorary for the article.

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ТҰЖЫРЫМ

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ARTEMISIA GMELINII WEBER EX STECHM ШИКІЗАТЫНАН ФИТОСУБСТАНЦИЯ АЛУ ТЕХНОЛОГИЯСЫН ӘЗІРЛЕУ

Мақалада Гмелин жусанының өсімдіктекетес дәрілік шикізатынан экстракт түріндегі фитосубстанциясын және эфир майларын алу жұмысының нәтижелері берілген.

Алынған фитосубстанцияларды антибактериалды және антифунгальды скрининг жүргізу нәтижесінде Staphylococcus aureus ATCC 25923, Staphylococcus aureus ATCC 6538, Staphylococcus epidermidis ATCC 12228, Micrococcus luteusATCC 10240, Bacillus subtilis ATCC 6633, Bacillus cereus ATCC 10876, Streptococcus pyogenes ATCC 19615, Streptococcus pneumoniae ATCC 49619, Streptococcus mutans ATCC 25175, Candida albicans ATCC 10231, Candida parapsilosis ATCC 22019 құрғақ, 70% спирттің еріткішін қолдана отырып перколяуия ідісімен алынған микроорганизмдерге айқын бактериоцидтік әдіс көрсетті.

Зерттеу барысында алынған нәтижелер Гмелин жусанының құрғақ экстрактын карбомер негізіндегі стоматологиялық гельді жасап шығаруға қажетті белсенді фармацевтикалық субстанция ретінде таңдауға мүмкіндік берді.

Негізгі сөздер: *Гмелини жусаны,фитоқұрамды заттар, сығынды, эфир майы.*

РЕЗЮМЕ

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РАЗРАБОТКА ТЕХНОЛОГИИ ПОЛУЧЕНИЯ ФИТОСУБСТАНЦИЙ ИЗ СЫРЬЯ ARTEMISIA GMELINII WEBER EX STECHM

В статье представлены результаты получения фитосубстанций в виде экстрактов и эфирного масла из лекарственного растительного сырья полыни Гмелина.

Антибактериальный и антифунгальный скрининг полученных фитосубстанций показал выраженную бактерицидную активность к микроорганизмам Staphylococcus aureus ATCC 25923, Staphylococcus aureus ATCC 6538, Staphylococcus epidermidis ATCC 12228, Micrococcus luteusATCC 10240, Bacillus subtilis ATCC 6633, Bacillus cereus ATCC 10876, Streptococcus pyogenes ATCC 19615, Streptococcus pneumoniae ATCC 49619, Streptococcus mutans ATCC 25175, Candida albicans ATCC 10231, Candida parapsilosis ATCC 22019 экстракта сухого, полученного методом перколяции с использованием растворителя спирта 70%. Полученные результаты позволили выбрать экстракт сухой полыни Гмелина в качестве активной фармацевтической субстанции для создания геля стоматологического на основе карбомера.

Ключевые слова: *полынь Гмелина, фитосодержащие вещества, экстракт, эфирное масло.*

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