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Selecting the Optimal Method and Technology for Obtaining Dry Extract of Epilobium Angustifolium

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Abstract: This article describes the development of a method and technology for obtaining a dry extract, the yield of extractives, the content of flavonoids in the extract using various methods and different extractors. Traditional methods of treatment, as well as traditional recipes for treatment, are widely used today. Plant-derived compounds are often more biocompatible with human cells compared to synthetic drugs. Treatment of diseases with medicinal plants, as a rule, does not cause allergies and addiction, is well tolerated, acts more gently, and in some cases, especially in chronic diseases, has a good lasting effect. According to the principles of rational pharmacotherapy, the drug should be highly effective, harmless, economically viable and not worsen the quality of life. And herbal preparations fully meet all these criteria. Physiologically active substances contained in plants can have a comprehensive effect on various pathological links in the development of diseases [2,3].

Keywords: Extractant, extraction, ethanol, various factors, maceration, percolation, flavonoid.

Introduction: Today, chronic prostatitis is one of the most common diseases in men. According to WHO, about 9-32% of the male population of the Earth suffers from chronic prostatitis. Today, prostatitis is commonly diagnosed in men aged 20 to 40, largely due to sedentary lifestyles, irregular sexual activity, and concomitant diseases of the genitourinary system. Prostate adenoma occurs in every 10 men over 40, in half of men from 50 to 60 years old, and by the age of 80 already in 80% of cases. In this regard, in order to increase the range of drugs without side effects for the treatment of these diseases is relevant. Pharmaceutical science is constantly looking for new effective drugs, one of the sources of which is traditional medicine, which has a lot of information on the use of natural objects in the treatment of diseases. Natural drugs in the overwhelming majority of cases have long established themselves as low-toxic, usually mildly affecting the human body. In this regard, along with drugs of synthetic, microbiological and animal origin, the creation of drugs based on plant components is a very urgent task. Modern drugs based on plant raw materials were created as a result of generalization of the historical experience of the peoples of the world, as well as research work of domestic and foreign scientists. Medicinal plants attract the attention of many. [1-3].

When considering medicinal plants as natural sources of mineral complexes, it should be borne in mind that macro- and microelements are in them in an organically bound, i.e. most accessible and digestible form, as well as in a set composed by nature. In the fruits of many plants, the balance and quantitative content of mineral substances is such that it is not found in other food products. Currently, 71 chemical elements have been found in plants [1]. This synergistic interaction of

biologically active substances from one or more plants is referred to as phytokinetic synergy. [4,5].

Currently, research into medicinal plants and the development of drugs that are used in folk medicine in the form of infusions and decoctions are relevant [6]

In modern medical practice, an important place is given to drugs based on plant materials. In this regard, opportunities are opening up for the creation of highly effective dosed drugs with a targeted pharmacological effect. The solution to this complex problem is due to the requirement for a scientifically based approach to drug creation. In this regard, the development of drugs of plant origin is of interest. The mild therapeutic effect of drugs from medicinal plant materials with long-term use and the gradual development of the effect is most relevant for the treatment of chronic diseases [7,8].

Today, male infertility has become a serious health problem worldwide, with about 45-80 million couples recognized as infertile according to WHO. Benign prostatic hyperplasia and chronic prostatitis are common diseases of the genitourinary system in men. Previously, it was believed that this disease occurs only in old age. The male factor accounts for 50% of cases of infertility in a couple. A study conducted by Sun H et al., from 1990 to 2017, including more than 195 countries, reported an increase in male infertility by 0.291% per year, with an upward trend in most countries (136/195). A potential cause of male infertility may be inflammatory reactions of the urogenital tract, the prevalence of which ranges from 6 to 10%, and the cause of the development of these reactions may be chronic prostatitis [9].

The problem of chronic prostatitis at the stage of primary health care is made even more relevant by the problem of male infertility. In the structure of infertile marriages, male infertility accounts for about 45%, and recently there has been a tendency for its constant growth. Over the past 50 years, the concentration of spermatozoa in 1 ml has decreased by more than 50%, which required a revision of normal ejaculate parameters [8,9]. According to WHO, chronic prostatitis occurs in 8-10% of men, but taking into account asymptomatic forms, the prevalence may be higher. Most often, the disease is detected in patients aged 30-50. According to WHO, chronic prostatitis affects about 9% of the male population of the Earth. Previously, it was believed that this disease occurs only in old age. Today, prostatitis is diagnosed in 20-40-year-old men, which is due to low levels of physical activity, dysrhythmia of sexual life, and concomitant diseases of the genitourinary system.

According to the World Health Organization, prostatitis is the leading disease of the male genitourinary system. According to WHO statistics, prostatitis occurs in the male population from 22 to 60 years old and exceeds the number of diagnosed cases of sexually transmitted diseases and other diseases of the genitourinary system. According to WHO, urologists diagnose chronic prostatitis in every tenth patient [10].

Traditional multi-component herbal medicines popular all over the world are herbal infusions and extraction preparations, the latter being the most convenient and well standardized among galenic preparations [5]. Extracts - concentrated extracts, are one of the oldest medicinal forms of official medicine. After the discovery of the method for obtaining alcohol, the ancient Roman physician Galen first introduced the use of alcoholic extracts from plants - galenic preparations - into medicine. The result of the further development of this type of extraction of biologically active substances from plant material were alcoholic extracts. In our time, these ancient medicinal categories have not lost their relevance, they are constantly developing and, as a result, in many countries they have pharmacopoeial status [6,7].

When obtaining dry extracts, the maximum yield of biologically active substances is ensured, which increases the pharmacotherapeutic effect. The advantages of dry extracts and dosage forms based on it are the ease of use and stability during storage. In addition, standardization of active substances allows for control at the production stages and the accuracy of dosing of the finished product, so standardization of dry extracts and dosage forms is an equally important task. According to scientific literature, the proportion of herbal preparations is about 90%, their high physiological activity is due to the harmonious combination and interaction of biologically active substances contained in the drugs used. Therefore, plants remain an indispensable source for obtaining drugs with various directions of action. Providing the population with highly effective, harmless drugs is the main goal of the modern pharmaceutical industry. The completeness of the isolation of active substances depends on a number of factors, the most important of which are the extraction method, the grinding of raw materials, the ratio of raw materials and extractant, etc. [7,8]. Currently, all known extraction methods are divided into official (traditional) and unofficial (modern). Traditional extraction methods (percolation and maceration) are very long and labor-intensive. The average duration of extraction is from 6 hours to several days [9].

Experimental section

METHODS

Nowadays, modern extraction methods such as

ultrasound, filtration extraction, supercritical filtration, etc. are widely used. Using ultrasound with a frequency of 19-44 kHz, flavonoids, tannins, phenol glycosides, bound coumarins, anthocyanins, and phenol carboxylic acids can be extracted from plants with a reduction in the extraction process by 1-2 orders of magnitude. At the same time, the yield of extractive substances increases significantly. For example, the yield of rose and sea buckthorn oil increases by 10-15%, atropine by 18-25%, valerianic acid by 20%, platifillin by 15%, furanochromones by 30%, quercetin by 47%, ergosterol by 45-60%, and ursolic acid by 10% [10].Процесс экстрагирования, как правило, включает две фазы:

- osmotic swelling with dissolution of the cell contents (movement of the solvent into the cell);

- extraction (dialysis), during which extractive substances are transported from the cell through cell membranes, pores and capillaries into the volume of the solvent.

The swelling phase typically lasts 4 to 6 hours and is influenced by the rate of air displacement from plant cells. In addition, some air remains inside the cell.

When using ultrasound, a sound capillary effect occurs, which not only accelerates the displacement of air bubbles, but also creates conditions for their dissolution in the liquid. As a result, there is a sharp reduction in the swelling process of the raw material.

The efficiency of the extraction process is affected by the morphological and anatomical structure of the raw material and its dispersion.

For plants, the grass of which has a thin, loose leaf blade with soft cell membranes and a large number of intercellular spaces, the particle size does not play a significant role and can vary from 2 to 8 mm. Such plants include lily of the valley, wormwood, peppermint, St. John's wort, Japanese pagoda tree fruits, belladonna, foxglove, adonis, yarrow, chamomile, marigold, etc. Such raw materials swell quickly [11,12].

RESULTS AND DISCUSSIONS

The research began with obtaining a liquid extract using maceration, percolation and repercolation methods. Improvement and intensification of production in order to increase the product yield requires a detailed consideration of various factors affecting the process of extracting active substances [4,5,6]. Therefore, we studied the effect of the extractant, its ratio with the raw material, the degree of grinding of the raw material, the duration and frequency of extractions on the yield of bioactive substances, which was determined by extractive substances, as well as by the previously developed method for the quantitative determination of the amount of flavonoids. Based on the data obtained, it was determined that the method of extracting herbal collection using maceration and percolation methods is close in its characteristics to most known methods and can be used to obtain small batches of extracts of medicinal plant raw materials. [7,8]. The main parameters that play a significant role in this extraction are the extraction conditions, such as temperature, pressure, fluid flow rate and process duration.

The type of sample, choice of solvent, method of fraction collection, degree of raw material grinding, and raw material humidity are also of certain importance. High intensity of extraction with a change in the hydromodulus was noted, which made it possible to increase the yield of extractive substances by 1.3 times compared to purified water. The proposed percolation method contributes to the production of medicinal products with a high yield of extractable substances at low energy costs. The search for an extractant and the choice of extraction conditions for herbal medicines largely depend on the chemical composition and pharmacological activity of the active substances. In addition to selectivity, the extractant should also have high diffusion capabilities, chemical, biochemical and pharmacological indifference, availability and cheapness. The dielectric constant of the extractant, its viscosity and surface tension are also of no small importance [9].

The choice of the extractant was carried out by varying various solvents, by infusing the plant composition at room temperature and obtaining a liquid extract using the above methods, followed by determining the amount of flavonoids in the liquid extract.

The results of the studies are presented in Table 1. As can be seen from the data provided, the optimal extractant is 70% ethyl alcohol. Also, analyzing the results, it can be concluded that when obtaining bioactive substances from the herb of Fireweed, with an increase in the concentration of alcohol, the amount of extractive substances and the amount of flavonoids decreases.

As can be seen from the data provided, the optimal extractant is 70% ethyl alcohol. However, analyzing the results, it can be concluded that when obtaining bioactive substances from the herb of the narrow-leaved fireweed (with the conventional name "Prostad") with an increase in the concentration of alcohol, the amount of extractive substances and the sum of flavonoids do not always increase.

Table 1
Yield of extractive substances and the amount of flavonoids when using different extractants

Extraction methods	Extractant				
	Purified water	30% ethanol	40% ethanol	70% ethanol	90-% ethanol
Yield of extractive substances, %					
Maceration	9,23	11,22	15,96	16,44	14,11
Percolation	11,21	15,43	16,87	20,54	10,09
Repercolation	10,98	14,09	14,73	16,96	9,91
Content of total flavonoids, %					
Maceration	0,028	0,034	0,039	0,043	0,029
Percolation	0,032	0,037	0,044	0,058	0,036
Repercolation	0,029	0,032	0,039	0,043	0,031

Further studies were devoted to determining the influence of the main factors on extraction.

Experiments were conducted in the following ratios: 1:10, 1:20, 1:30, 1:40 and 1:50. The optimal phase ratio corresponding to 1:10 (raw material - extractant) was established empirically. Some parameters influencing the speed and completeness of extraction were also determined. It is advisable to grind the raw material particles to 2 mm.

Upon subsequent study of the extraction conditions, it was established that with an increase in time and their quantity, the yield of extractive substances increases. The experimental data obtained are presented in Table 2.

Table 2
Yield of extractive substances and the amount of flavonoids depending on the time and method of extraction

Extraction methods	Extraction time, h				
	1	2	3	4	5
	Yield of extractive substances,%				
Maceration	0,95	1,27	1,26	1,25	1,23
Percolation	1,79	2,67	2,98	4,42	1,75
Repercolation	2,07	2,11	1,92	3,11	1,35
Content of total flavonoids, %					
Maceration	0,052	0,061	0,045	0,036	0,024
Percolation	0,067	0,089	0,055	0,045	0,055
Repercolation	0,074	0,091	0,069	0,066	0,087

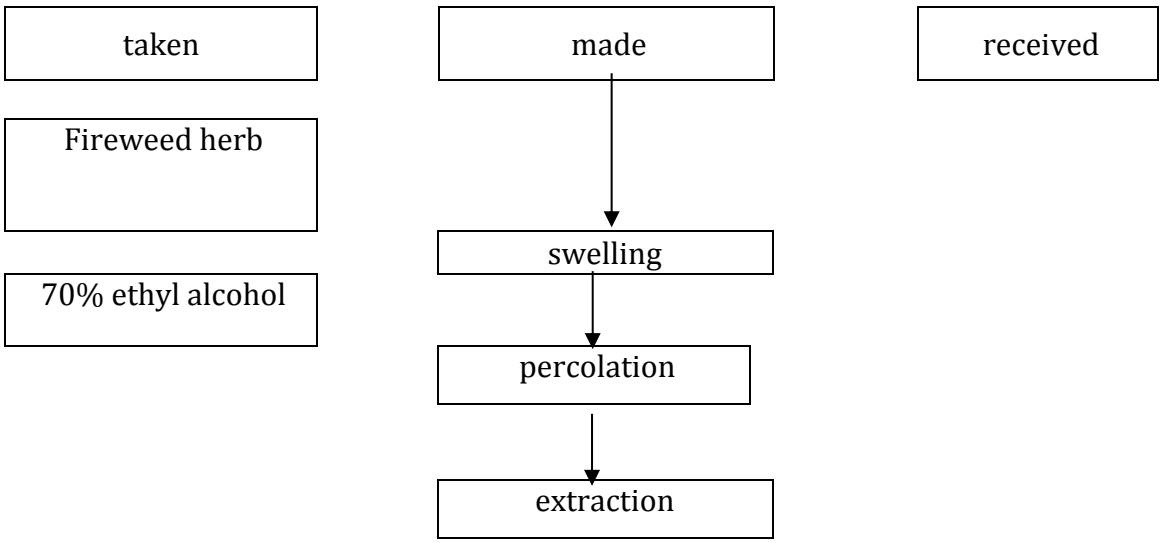
The optimal phase ratio corresponding to 1:10 (raw material - extractant) was established experimentally. It is advisable to grind the raw material particles to 2 mm. Threefold extraction ensures raw material depletion by an average of 85-90% of the initial content in the raw material. Losses of biologically active substances with meal amounted to 8 - 12%. Table 3 shows the generalized results of the studies conducted, i.e. the influence of the main factors on the extraction process. Thus, we studied the influence of the extractant, its ratio with the raw material, the degree of grinding of the raw material, the duration of extraction, which was carried out for extractive substances, as well as according to the previously developed method for quantitative determination of the amount of flavonoids.

The established optimal mode of extraction from the analyzed plant composition, conditions for purifying its extracts and drying made it possible to subsequently develop a method for obtaining a dry extract.

Table 3
Influence of the main factors on the extraction process

Extraction methods	Extraction conditions			
	Degree of raw material grinding, mm			
	more than 2 mm	1 – 2	less than 1	
	Yield of total flavonoids relative to their content in the raw material, %			
Maceration	38,17	69,76	57,42	
Percolation	44,28	92,65	74,11	
Repercolation	42,05	89,32	69,84	
Extraction temperature (°C)	30-40	50-60	70-80	90-100
Extraction methods	*Yield of the sum of flavonoids from their content in raw materials %*			
Maceration	32,98	38,89	54,43	92,15
Percolation	49,65	54,87	93,64	76,89
Repercolation	46,87	49,93	79,72	64,59
General hydromodule	1:10	1:20	1:30	1:40
Extraction methods	*The yield of the sum of flavonoids from their content in raw materials,%*			
Maceration	63,89	59,73	53,11	46,54
Percolation	93,52	88,15	79,66	64,45
Repercolation	81,98	77,91	69,95	60,22

The technological scheme for obtaining dry extracts includes the stages of solid-phase extraction, evaporation and drying of the concentrated extract (Fig. 1).



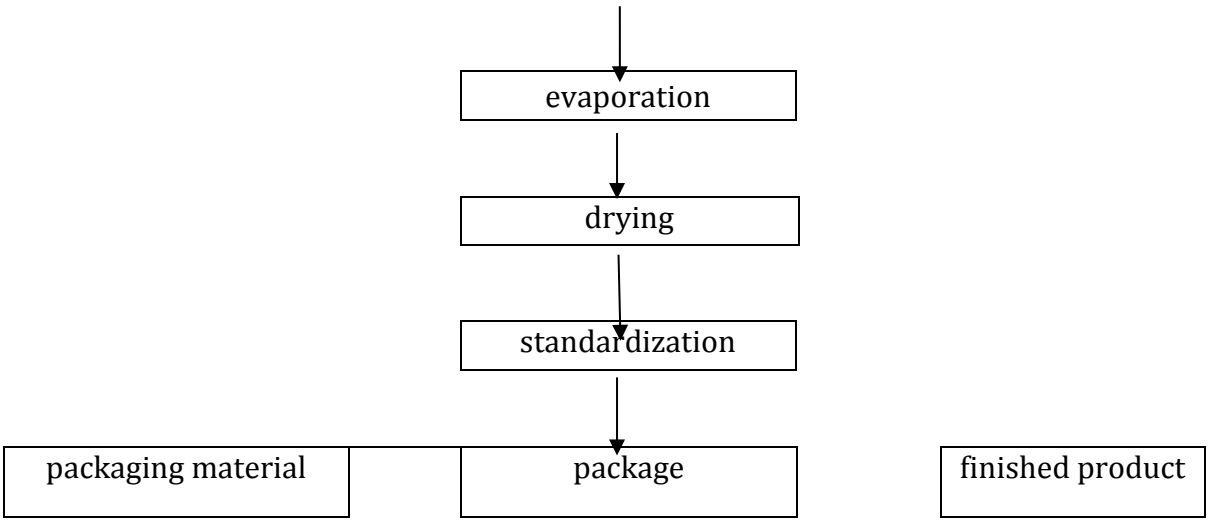


Fig. 1. Technological scheme for obtaining dry extract from the herb of Fireweed

The technology for obtaining dry extract includes the following stages: raw material extraction to obtain an aqueous extract, its evaporation, separation and drying. Evaporation of the obtained liquid extract was carried out at a temperature of 400C under a pressure of 0.69 MPa to approximately 1/10 of the initial volume. The aqueous still residue was drained into a collector and separated. The purified extract was dried at a pressure of 5.2 kgf/cm3 (0.52 MPa) and at an inlet temperature of 2000C, as well as at an outlet temperature of 800C. The liquid feed rate was maintained within 2.0-2.5 l/h. Drying of the obtained extract was carried out in a calorifer drying cabinet, spray drying and vacuum method. The resulting finished product is a polydisperse amorphous powder of dark brown color, hygroscopic. The residual moisture content of the obtained dry extract is 4.38 - 4.97%.

CONCLUSIONS

Thus, as a result of the conducted scientifically grounded experiment, a technology for obtaining dry extracts from Fireweed has been developed. The proposed percolation method facilitates the production of medicinal products with a high yield of extractable substances at low energy costs. At the same time, an individual mode has been selected for the extraction of plant raw materials: ethyl alcohol at a concentration of 70% has been selected as an extractant, the raw material size has been set at 2 mm, and the hydromodulus has been determined experimentally at 1:10.

REFERENCES

Medicinal plants and their use. Anikin Yu.Ya.; "Planet", 2010. - P.46.

The role of herbal medicine in modern medicine / Sh. K. Batyrkhanov, T. M. Imambaeva, Karimkhanova A. T., Abdullaeva G. M. – Text: electronic // Medicine of Kyrgyzstan. – 2015. – No. 4. – P. 30-32.

Yunusova Kh.M., Sunnatov Sh.Kh., Zhaloliddinova M.Sh., Anvarova F.Zh. On the development of Prostad capsule technology based on natural origin products. // Pharmaceutical journal. - Tashkent. - 2019.-№3. P83-87.

Ilkhamova N.B., Nazarova Z.A., Yunusova H.M. Study of import-substituting expectorant drugs based on medicinal plants//. XX international scientific and practical conference "Modern medicine: new approaches and current research".-Moscow. No. 11.-2019.-P.23-25.

Yunusova Kh.M., Abdijalilova Z.H. «Research on the Selection of Certain ontent of “Ambronat” Juice Syrup» // International journal of farmacy and Pharmaceutical Research, Vol.:20, Issue:4,2021.-P 62-71. (ISSN-2349-7203)

Yunusova Kh.M., Abdijalilova Z.H. «Research On The Choice Of “Ambronat” Syrup Technology» // The American Journal of Medical Sciences and Pharmaceutical Research,February 13, /Vol. 03, Issue 02-01, 2021.-P. 1-9.

Yunusova Kh.M., Sherkhadzhaeva N.N., Evaluation of the kinetics of moisture sorption of dry licorice extract depending on various factors // Pharmaceutical journal. - Tashkent. - 2019.-№3. P83-87.

Astafieva N.G., Geppe N.A., Kobzev D.Yu. The natural power of plants in the treatment of cough. Moscow: Media Sphere, 2017.- 68 p.

9. Vasiliev, A.N. Requirements for the safety and efficacy of herbal medicines: a comparison of domestic and European approaches / Vasiliev A.N., Syubaev R.D., Gavrishina E.V. [et al.] // Remedium. - 2014.- No. 5. - P. 6-15.

Yunusova Kh.M., Sherkhadjayeva N.N. Study of the hygroscopicity of the recommended granulated dosage

forms “Mukhas Forte.”

Yunusova Kh. M., Abdijalilova Z.Kh., Zaynutdinov K.S. The Peculiarities of Studies on the Stability of Ambronat // International Journal of Current Science Research and Review ISSN: 2581-8341 Volume 07 Issue 02 February 2024 DOI: 10.47191/ijcsrr/V7-i2-18, Impact Factor: 7.943. P.1043-1049.

Yunusova Kh.M., Sunnatov Sh.Kh., Jaloliddinova M.Sh., Anvarova F.Zh. On The Development Of The Technology For "Prostad" Capsules Based On Natural Origin Substances // Central Asian Journal of Medical and Natural Science 2024, 6(1),161-168

Alekseeva R.R. Phytotherapeutic sedative drug // International Journal of Applied and Fundamental Research. – 2016. – № 8-4. – P. 573-576.

Ravshanova S.E., Yunusova Kh.M. Evaluation of biopharmaceutical and pharmacological properties of combined ternary componential analgesic tablets // International Journal of Psychosocial Rehabilitation.-United Kingdom. 2020.-Vol. 24.-Issue 02.-P.6009-6017.

Yunusova Kh.M., Abdijalilova Z.H. "Research On The Choice Of 'Ambronat' Syrup Technology" // The American Journal of Medical Sciences and Pharmaceutical Research, February 13, Vol. 03, Issue 02-01, 2021.-P. 1-9.

Yunusova Kh.M., Abdijalilova Z.H. "Research on the Selection of a Certain Content of 'Ambronat' Juice Syrup" // International Journal of Pharmacy and Pharmaceutical Research, Vol.:20, Issue:4, 2021.-P.62-71