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DEVELOPMENT OF TECHNOLOGY FOR OBTAINING DRY EXTRACT FROM PLANT OF POLYGONUM AVICULARE

UBAYDULLAEYVA KHILOLA AKHRAROVNA
Tashkent Pharmaceutical Institute
Ubaydullaeva1982.@mail.ru
Deportment of Biotechnology aassociate Professor, PhD.

Abstract: In this article entitled technology for obtaining a dry extract of a poligonum aviculare, the process of obtaining a dry extract from the aerial parts of these plants is presented. In addition, the factors influencing the process of obtaining a dry extract are given, such as the wettability of the raw material, the degree of grinding of the raw material, the hydromodule of the process, the determination of the drying temperature, as well as the studies carried out and the results obtained to determine the qualitative and quantitative parameters of the dry extract.

Keywords: dry extract, hydromodule flavonoid, extractive substances, quantitative indicators, technological parameters, extractor, aerial parts.

INTRODUCTION

According to the World Health Organization, the incidence rate of the urinary system within 5 years increased by 7.6%, of which the inflammatory process was found in more than 2.2 million patients. Taking this into account, one of the important tasks of the pharmaceutical industry is the development of highly effective, high-quality medicines based on medicinal plants with a diuretic effect.

Today, scientific research is underway to develop technologies for obtaining phytopreparations, in particular dry extracts, from medicinal plant materials, their standardization, and the establishment of quality standards. In this regard, it is necessary to determine the influence of factors on the release of biologically active substances from medicinal raw materials, to obtain extracts using modern methods, and also to develop a tablet dosage form based on them, to ascertain expiration dates. Plant preparations have astringent properties, cause uterine contractions, increase the rate of blood clotting, have anti-inflammatory, antimicrobial, antiseptic and diuretic properties, reduce bleeding of mucous membranes, moderately lower blood pressure, accelerate wound healing, increase immunity, increase the excretion of sodium and chlorine from the body, reduce the crystallization of mineral salts in the urinary tract. In the treatment of knotweed in patients with pulmonary tuberculosis, appetite improves and body weight increases.

Materials and methods of research In studies to obtain a dry extract, the aerial part of the polygonum aviculare used as raw materials. One of the factors influencing the yield of biologically active substances in the extraction process is the degree of fineness of plant raw materials. To determine this indicator, a number of studies have been carried out. The data obtained are shown in Table 1.

Table 1

Results of studying the effect of the degree of fineness of the mixture of the aerial part of the polygonum aviculare on the extraction process

№	Size, mm	Number of extractive substances, g	Number of flavonoids relative to raw materials	
			g	%
1	6-7	6.05	0.28	56.5
2	5-6	6.65	0.38	67
3	4-5	7.53	0.36	73
4	3-4	8.07	0.40	81
5	1-3	8.75	0.426	86
6	less than 1	8.95	0.43	87

According to the research results, the best indicators were observed in the 6th experiment and similar values in the 5th. However, the filtration process of the extract obtained in the 6th experiment was difficult and required a lot of time. Thus, for the extraction, the degree of grinding of the raw material was 1-3 mm.

It is well known that regardless of the method of carrying out the process of extracting dried medicinal plant raw materials, the first stage is the entry of the extractant into the raw material and, as a consequence, its swelling. The dissolution and desorption of substances in the extractant supplied to the tissues can be considered as the second stage of the extraction process. The soakability of aerial parts of polygonum aviculare was studied in experiments. The results are shown in Table 2.

Table 2

Results of the study of the wettability of polygonum aviculare

№	Weight before soaking, g	Soaking time, hour	Weight after soaking, g	Wetness,%
1	2.25	0.5	2.95	131.0
2	2.31	1.0	3.40	147.0
3	2.05	1.5	3.41	166.0
4	2.20	2.0	3.94	179.0
5	2.28	2.5	4.47	196.0

6	2.30	3.0	5.01	218.0
7	2.10	3.5	5.02	239.0
8	2.15	4.0	5.74	267.0
9	2.20	5.0	7.28	331.0
10	2.30	6.0	7.82	340.0
11	2.20	10.0	7.46	339.0
12	2.15	16.0	7.31	340.0

According to the results obtained, the following conclusion can be made: to ascertain equilibrium during the soaking process, a time equal to 5-6 hours is required.

Based on the basic equation of the process of transition of substances between phases, the driving force of the process is the difference between the concentrations of a substance in the solid and liquid phases, i.e. the greater the difference between the concentrations of a substance in the extractant and the plant raw material, the greater the rate of transition of substances.

To increase this difference, it is necessary to increase the value of the hydromodule of the process (extractant : raw material). However, a sharp increase in the hydromodule can lead to a number of technological problems and excessive costs. The experiments were carried out using 50 g of raw materials, crushed to a size of 1-3 mm at the boiling point of the extractant (purified water) with the following values of the hydromodule 1: 4; 1: 6; 1: 8; 1:10; 1:12; 1:14; 1:16 and 1:20.

In the experiments, the amount of extractives and flavonoids was determined by appropriate methods (table 3).

Table 3

Results of studying the influence of the hydromodule on the extraction process

№	Hydromodule	Output, %	
		Extractive substances	flavonoids
1	1:4	53.8	49.7
2	1:6	63.5	61.8
3	1:8	75.0	71.3
4	1:10	86.1	79.9
5	1:12	89.7	83.4
6	1:14	92.8	88.7
7	1:16	93.9	89.9
8	1:20	95.1	90.2
9	1:24	95.7	91.1

According to the results of the experiments, the yield of extractive substances reached maximum values in 6-9 experiments, i.e. with hydromodule 1:14, 1:16, 1:20 and 1:24. However, to obtain a dry extract from the extraction, due to the large amount of evaporated moisture, a lot of energy is expended. Therefore, it is advisable to recommend hydromodule 1:10 or 1:12.

At high values of the hydromodule, for every 1% increase in the yield of extractive substances, an increase in thermal energy consumption is observed by at least 25-27%. Based on the above, it was recommended to use a hydromodule value of 1:10. However, it was also noted that during the experiments, in order to achieve the maximum value of the yield of extractives from plant raw materials, it is possible to extract the raw materials twice using a hydromodule 1:8 (1:16). The yield of extractives was 98%.

Subsequent studies were devoted to the determination of the extraction time. For this, the crushed plant material was placed in a series of flasks, the extractant was poured in a ratio of 1:17, and extraction was carried out in a water bath. After 20, 40, 60, 90, 120, 150 and 180 minutes of extraction, the yield of extractives was determined.

In the first extraction, the phase balance was reached in 150 minutes. Then the extract was poured off and a second extraction of the raw material was carried out, while the yield of extractives was also determined after 20, 40, 60, 90, 120 and 150 minutes. Experiments have shown that equilibrium is reached in 115 minutes for the second extraction and after 80 minutes for the third extraction. Figure 1 shows the results of studies to determine the extraction time.

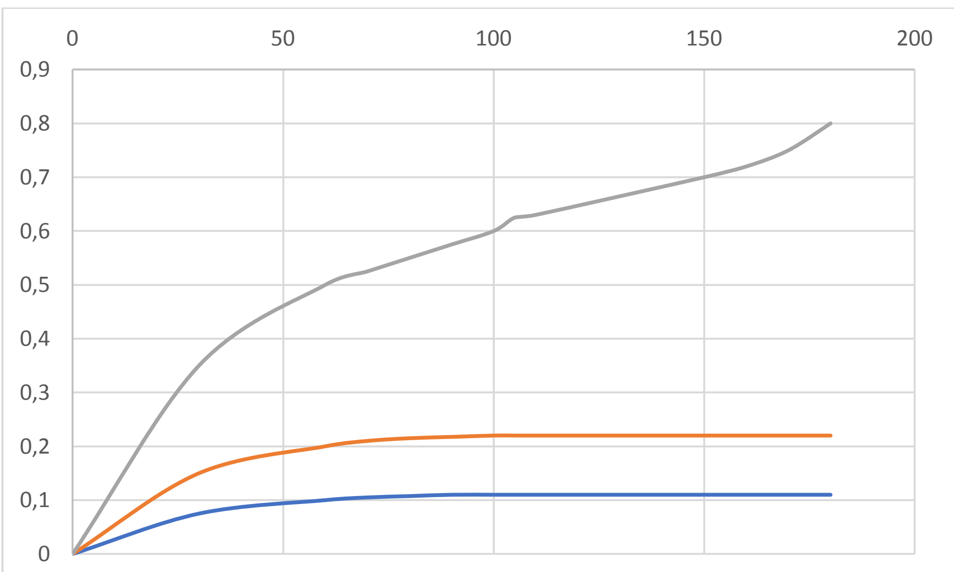

Fig. 1 Change in the concentration of the yield of substances (X) in the extraction process depending on time (τ)

When the total extraction time was 345-360 minutes, the extraction of at least 97% of the extractives from the content in the raw material was achieved.

Taking into account the above, the technology of obtaining a dry extract has been tested at the domestic pharmaceutical company PH "SO`QOQ-GILOSI". Grinding of medicinal plant materials was carried out in a special drum-type mill RSB-3.5 at a speed of 350-400 r/m. The degree of crushing of raw materials should not exceed 3 mm.

The grinded plant material was placed in a reactor with a heating jacket and a stirrer. The lower part of the extractor is conical and the base is represented by a grid. Before placing the raw material in the extractor, the grate was covered with belting cloth for further filtration of the extract. After planting the plant material, 120 liters of pre-measured extractant, purified water, were poured in, and the reactor was hermetically sealed, and live steam was fed into its shell. When the temperature of the extraction mass reached the boiling point in 15-20 minutes, the extraction of the soaked mass began. For this, an extractor stirrer was connected and the stirring speed was maintained for 40 minutes. After this time, the mixer was stopped and the steam supply to the reactor was also stopped. After the end of the extraction after 60 minutes, it was filtered hot. Checked the absence of mechanical impurities in the resulting extract. The pure dark brown extract, free of inclusions, was sent to the thickening stage. The resulting extract was concentrated in a rotary film condenser. Steam with a temperature of 135ºC was used for the evaporation process. The extract was fed at a rate of 11-12 liters per hour while the rotor was rotating at the top of the evaporator, and the condensed extract was collected in a special container at the bottom of the device. The thickened extract was dried in a spray dryer at a rate of 9.0 liters per hour. From 10.0 kg of medicinal plant material, 1.78 kg of dry extract with a residual moisture content of 4.7%, dark brown, hygroscopic, and having a peculiar odor were obtained.

Qualitative and quantitative indicators of the obtained dry extract were determined on the basis of ND. The results are shown in Table 4.

Table 4

Results of determining the qualitative and quantitative indicators of the obtained dry extract

s/n	Determined indicators	Norm for ND	Results	Method of determination
1.	Appearance	Amorphous powder, brown with a peculiar odor, hygroscopic	Meets the requirements of ND	Organoleptically
2.	Authenticity: flavonoids	0.05 g of dry extract is dissolved in 0.5 ml of purified	Satisfactorily	Specific reaction to flavonoids

		water, iron (III) chloride is added to the solution		
3.	Moisture, %	Should not exceed 5%	4.8	SP XI, volume 2
4.	Heavy metals	Should not exceed 0.01%	Less than 0.01%	SP XI, volume 2
5.	Microbiological purity	In 1 g of the drug, the presence of a total number of aerobic microorganisms is allowed - no more than 104 CFU, yeast and mold fungi - no more than 102 CFU, enterobacteriaceae resistant to bile, no more than 102 CFU, in the absence *Pseudomonasaeruginosa*, *Staphylococcusaureus*, *Escherichia coli*.	Meets the requirements of ND	SP XI, volume 2 category 3.2
6.	Quantitative content of flavonoids%	Must be at least 0.5%	1.35%	Spectrophotometric method

In the development of tablet technology, it is of great practical importance to determine the physicochemical and technological properties of the substance, which is the basis not only for choosing a method for preparing tablets (direct compression or wet granulation), but also plays an important role in determining the amount and type of excipients introduced in the composition of the tablet.

Based on the foregoing, the physicochemical and technological properties of the dry extract obtained from the aerial parts of the medicinal plant of the polygonum aviculare was determined, according to the methods given in the literature (table 5).

Table 5

Results of studying the physicochemical and technological parameters of dry extract obtained from a mixture of polygonum aviculare

п/п	Indicators	Unit measurements	Results
1.	Fractional composition +1000 +500-1000 -500+250 -250+150 -150	µm,%	 27.5 38.0 22.4 9.0 3.1

2.	Flowability	10-3 kg / sec.	0.13
3.	Bulk density	kg/m^3	387
4.	Angle of repose	degree	59
5.	Compressibility	H	43
6.	Compaction factor	К	3.9
7.	Residual moisture	%	4.8

According to the research results given in the table, a large part of the fractional composition is represented by relatively large particles (more than 65%), which is caused by the aggregation property due to the high hygroscopic properties of the amorphous powder, which will negatively affect the tablet preparation process. This also explains the relatively large slope angle and the very low flowability of the powder. If you look at the results obtained, you can see that the indicators of compressibility and bulk density of the dry extract are also unsatisfactory. That is, it is impossible to obtain a tablet from such a mass by direct compression. Therefore, to improve the technological parameters of the substance, it is necessary to prepare the mass by the method of wet granulation.

CONCLUSION

1. The results of the conducted research showed that the aquifer was used as a purified water separator to obtain a dry extract.
2. The optimal values of the technological parameters of the extraction process of plant raw materials were determined.
3. Factors affecting the extraction process were studied. From these, the raw material's level of grinding and pulverization was studied. Taking into account that very fine raw materials cause a number of technological difficulties in the next stages of the process, it was considered appropriate that the particle size should not be smaller than 2-3 mm. The results of the experiment showed that it takes 5-6 hours for the boiling process to reach equilibrium.
4. When the total extraction time is 345-360 minutes, it was found that extractive substances in raw materials will not be less than 97%.
5. The quality and quantity indicators of the obtained dry extract were determined. The technological properties of the dry extract were studied. The resulting dry extract was studied for its wet absorption kinetics due to its high hygroscopicity.

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