



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating 2017: 5.03
TPI 2017; 6(8): 390-392
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www.thepharmajournal.com
Received: 11-06-2017
Accepted: 12-07-2017

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Definition of the Optimal Conditions for Wild Mallow (*Malva Sylvestris*) Extraction

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Abstract

the article presents results of the study of influence of extraction regimes and extracting medium types on the extraction content of the relevant spectrum of bioactive and extractive substances of wild Mallow flowers.

Keywords: flowers of wild Mallow (*Malva Sylvestris*), extracts of bioactive substances, extraction regimes, flavonoids, polysaccharides, extractives substances.

Introduction

The main biologically active substance of wild Mallow flowers is mucilage, mallow flowers are rich of. Mallow flowers contain up to 10 % mucus, consisting of polysaccharides, rhamnose, galactose, galacturonic and glucuronic acids; also, flowers contain flavonoids, phenolic acids, anthocyanosides, anthocyanidins, tannins. Flowers have purple-red coloring agents, consisting of glycosides and malvidin diglucoside^[1, 2].

Alternative and traditional medicines use extracts of Mallow flowers and leaves to treat inflammatory diseases of the oral cavity and respiratory tract, as a remedy for cough^[3, 4]. Mallow extracts inhibit the laryngeal reflex at the level of receptors stimulation. Mucilage mucins form a protective film on the respiratory tract mucosa, reducing inflammation and irritation, easing breath and reducing the nonproductive cough.

In the traditional medicine, Mallow flower extracts are also used to treat wounds, as they have a softening and anti scabious action, promote healing of wounds and ulcers, including on the oral mucosa. The presence of tannins in mallow flowers and leaves determine their astringent effect in gastroenteritis.

The Mallow extract has the proven antifungal and wound healing activity^[5, 6], and antibacterial activity against the staphylococcal infection. It was found by *in vitro* tests using 28 different strains of *S. aureus*. Tests have shown that the Mallow extract has an antioxidant activity and inhibited the growth of all studied Staphylococcus strains^[7, 8].

In another comparative study, using 11 pathogenic strains of human bacterial infections, the mallow extract inhibited the growth of five strains, while extracts of other medical plants had a narrower antibacterial spectrum, inhibiting the growth of 1-3 strains^[9].

Research objective

to determine the optimal conditions to obtain an extract of wild mallow flowers to develop a medicine to treat cough and cold-related diseases of the respiratory apparatus; to examine the degree of bioactive substances extraction depending on the type of an extraction content used and extraction conditions.

Materials and Methods

To study, we used samples of wild mallow flowers (*Malva Sylvestris*) collected in the western regions of Ukraine during the blossom time in June and July.

Raw material was crushed to a particle size 2-6 mm. Upon extraction of biologically active substances, the raw materials - finished product ratio was 1:10, using the calculated extractant volume required for getting a relevant quantity of the extract.

Today there are many extraction solvents; the most popular is purified water and aqueous solutions of ethyl alcohol of various concentrations. In general, none of the extractants, which are currently used in the pharmaceutical technology, satisfies all parameters at once. Therefore, in each case, they select an extraction solvent individually, taking into account the

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chemical composition of raw materials, the objective (extraction of an appropriate range of biologically active substances), economic feasibility and safety.

Taking the above into account, as an extractant they studied solutions of ethyl alcohol in concentrations of 10 to 90 % v / v (extraction was carried out at the room temperature) and purified water (extraction was carried out within the temperature range: 20-100 °C). To get extracts, they used the fractional maceration method, for a constant time for all series. The obtained extracts were combined and filtered through a paper filter.

Evaluation criteria were the yielded extractives (solids), the amount of flavonoids and amount of polysaccharides that make up the mucilage (as bioactive substances responsible for the pharmacological effect of a medicine in the treatment of cough and cold-related diseases).

The content of extractives (solids) was determined according to current SPU requirements, p. 2.8.16 [8]. The amount of flavonoids, in terms of hyperoside, was determined by absorption spectrophotometry in the visible spectrum (SPU p. 2.2.25), based on the photometric reaction of colored complex compounds of flavonoids with aluminum chloride in the alcohol medium [8]. Content of the polysaccharides amount was determined by the deposition method.

Results and discussions

On the first stage of the research, they studied the effect of concentration of the aqueous solution of ethyl alcohol on the degree of extraction of bioactive substances (extractants, flavonoids, polysaccharides) from wild mallow flowers.

Dependence of the extractives content (solids) in extracts on the ethyl alcohol concentration is shown in Fig. 1.

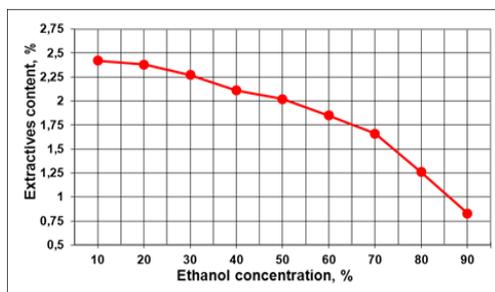


Fig 1: Diagram of dependence of the extractives content on ethyl alcohol concentrations

As shown in Fig.1, when ethyl alcohol concentrations rise from 10 to 90 %, content of extractives decreases. The maximum value of this indicator in the chart – 2,42 % when 10 % ethyl alcohol is used as an extractant.

The dependence of the flavonoids extraction on ethyl alcohol concentrations is shown in Fig. 2.

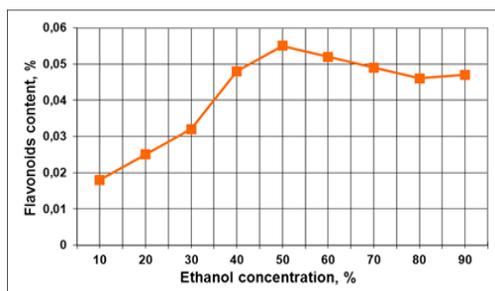


Fig 2: Diagram of dependence of flavonoids amount content on ethyl alcohol concentrations

It was established that the maximum content of flavonoids in extracts was 0,055 % when 50 % ethyl alcohol is used as an extractant.

The dependence of the polysaccharides amount extraction on ethyl alcohol concentrations is shown in Fig.3.

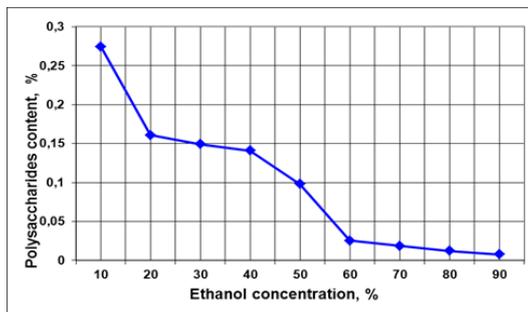


Fig 3: Diagram of dependence of polysaccharides content on ethyl alcohol concentrations

As shown in Fig. 3, when concentration of ethyl alcohol decreases, extraction of polysaccharides of wild mallow flowers significantly rises, as expected for these biologically active substances. Therefore, the maximum content of polysaccharides (0,274 %) was obtained when using 10% solution of ethyl alcohol.

The next stage of the research was to study the effect of purified water and extraction temperature on the degree of bioactive compounds extraction from wild mallow flowers.

Dependence of extractives content (solids) on the temperature of extraction with purified water is shown in Fig. 4.

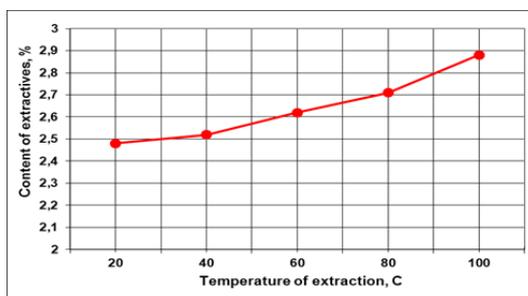


Fig 4: Diagram of dependence of extractives content on the temperature of extraction with purified water.

As shown in Fig. 4, the extraction with purified water, temperature increase improves the removal of extractives. The highest extractives content (2, 88 %) is obtained at 100 °C.

Dependence of flavonoids content (in terms of hyperoside) on the temperature of extraction with purified water is shown in Fig. 5.

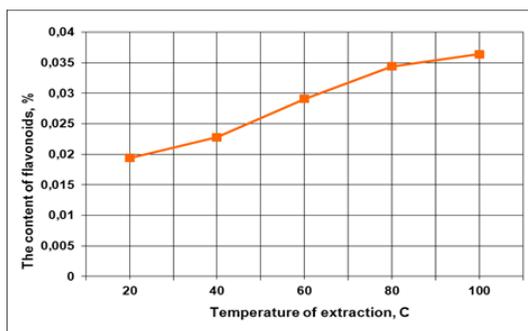


Fig 5: Diagram of dependence of flavonoids content on the temperature of extraction with purified water.

According to results, when wild mallow flowers are extracted with purified water, increased temperature also significantly increases the extraction degree of flavonoids. Like the previous experiment, the highest content of flavonoids (0,0364%) was obtained at the extraction at the extraction temperature 100 °C.

Dependence of polysaccharides content in extracts of wild mallow flowers on the temperature of extraction with purified water is shown in Fig. 6.

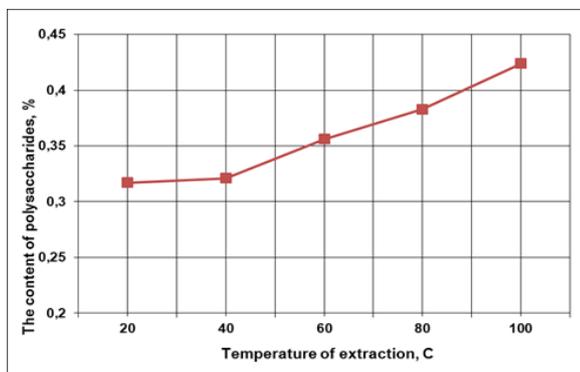


Fig 6: Diagram of dependence of polysaccharides content on the temperature of extraction with purified water

As shown in Fig. 6, when wild mallow flowers are extracted with purified water, increased temperature significantly increases the extraction degree of polysaccharides. The highest content of polysaccharides (0.424 %) in the extracts was obtained using purified water as an extractant and the extraction temperature 100 °C.

Conclusion

Based on research results, they defined the optimal concentration of an extractant and extraction conditions for extracting the relevant range of bioactive substances.

Therefore, to develop a medicine to treat cough and cold-related diseases of the respiratory system, to get better extraction of polysaccharides (being a component of mucilage of wild mallow flowers) and extractive substances, it is recommended to use purified water as an extractant, and the optimum extraction conditions shall be the temperature 100 °C.

For the maximum extraction of flavonoids (in terms of hyperoside), the optimal extractant is 50% ethyl alcohol solution, which fact may be of high relevance for development of antibacterial drugs to treat oral mucosa diseases.

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