EXTRACTS FROM HAWTHORN (CRATAEGUS ORIENTALIS PALL. EX. BIEB.) GROWN IN TURKEY FOR APPLICATION IN COSMETIC

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Abstract: It has been studied the influence of two main technological factors, temperature and duration, upon the composition of ethanol extracts from hawthorn fruits and leaves (Crataegus orientalis Pall. ex. Bieb.) growing in Turkey for cosmetics application. The equations of extraction with respect to tannins have been derived.
Keywords: fruits and leaves from hawthorn, ethanol extracts.

Introduction

Hawthorn (*Crataegus* spp.) from to the *Rosaceae* family is represented by 21 species in Turkey. *Crataegus orientalis*, which is called Anatolian hawthorn, is native to the Mediterranean region, Turkey, Crimea, and western Iran. The main constituents of hawthorn fruits and leaves are flavonoids, tannins, proanthocyanidins and organic acids [10]. The fruits are commonly used as food [8], and the ethanol extracts from fruits and leaves are used in traditional medicine in treatment of chronic heart failure, high blood pressure, arrhythmia, and various digestive ailments [1, 2, 10, 12].

From the leaves and fruits of *Crataegus monogyna* Jacq., growing in Bulgaria, extracts with ethanol for cosmetics application have been obtained [3, 5]. The diffusion coefficients of tannins in the extracts [7, 11] and their antimicrobial activity [4, 6] have been determined.

There is no scientific evidence for obtaining extracts for cosmetics application from fruits and leaves of anatolian hawthorn (*Crataegus orientalis* Pall. ex. Bieb), which is set as the aim of the current work.

Experimental

Plant material: Fruits and leaves from hawthorn (*C. orientalis*) from the Turkish market were used in the investigation. The raw material was characterized in terms of: moisture content by drying it up to constant weight, at 105 ºC [9] and content of tannins by titration of hot water extract with potassium permanganate solution using indigo carmine as indicator [9].

Obtaining of extracts: Extraction was carried out in laboratory conditions as a process in a batch static mode by maceration in the solvent at ratio of raw material to solvent = 1:10. Three solvents were used for the extraction: 96, 70 and 50 vol. % ethyl alcohol. The solvents, their concentration and the weight ratio of the raw material were chosen on the basis of authors' own unpublished data. The influence of the technological factors: temperature (20, 40 and 60 °C) and duration of extraction (1, 3 and 5 h), was examined by mathematical modeling of the experiment as a two-factor analysis on three levels (3^2). As a criterion for effectiveness of the process the quantity of tannins was determined. On the basis of the experimental data, the equations of extraction were worked

out for tannins, whose coefficients were estimated for significance by Student's test and for adequacy by Fisher's test. The extracts proving the highest levels of biologically active substances were further characterized with respect to their physical properties: appearance, color, odor, taste, relative density (d_{20}^{20}) and coefficient of refractive index (n_D^{20}).

Results and discussion

The analyzed hawthorn leaves and fruits were with 11,1 % and 12,4 % moisture level, and contained 6,4 % and 1,2 % tannins, respectively. Figures 1 - 6 present the schemes of the experiments that have been carried out and the obtained results.

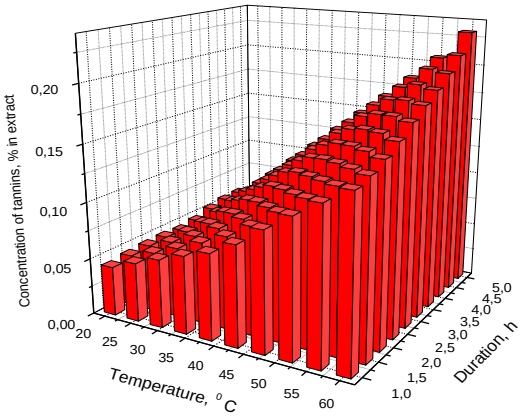

Fig. 1. Content of tannins in extracts with 96% ethyl alcohol from leaves.

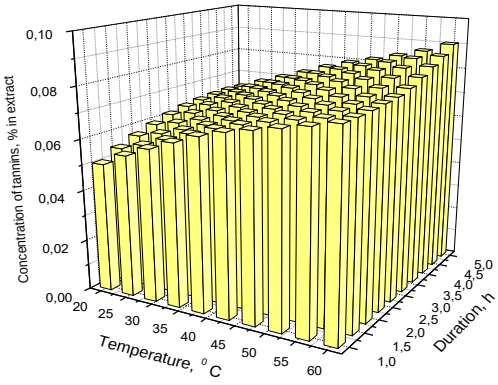

Fig. 2. Content of tannins in extracts with 96 % ethyl alcohol from fruits.

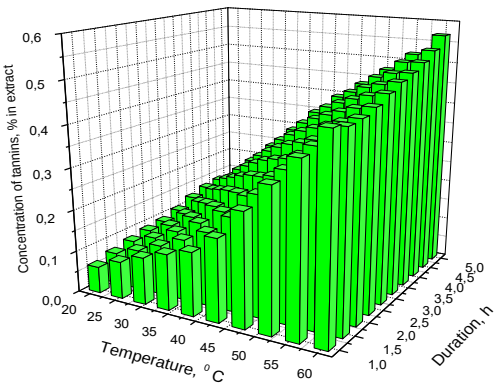

Fig. 3. Content of tannins in extracts with 70 % ethyl alcohol from leaves.

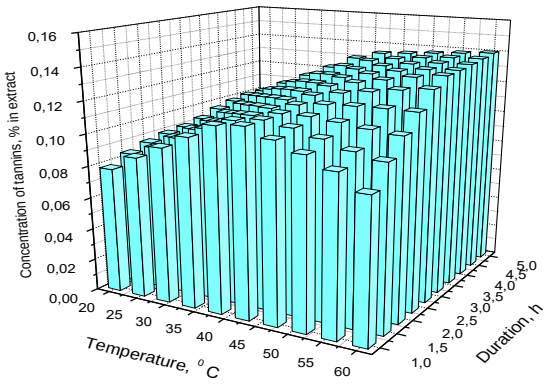

Fig. 4. Content of tannins in extracts with 70 % ethyl alcohol from fruits.

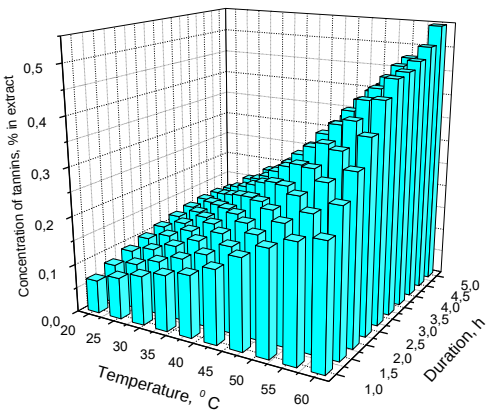

Fig. 5. Content of and tannins in extracts with 50 % ethyl alcohol from leaves.

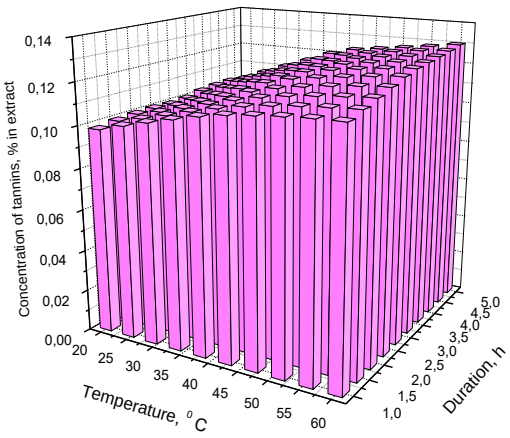

Fig. 6. Content of tannins in extracts with 50 % ethyl alcohol from fruits.

Data presented on the figures prove that the highest amounts of tannins are extracted with 70 % ethanol, regardless of the nature of the processed raw material (fruits or leaves). Parallel to the increase in the temperature and the duration of the process there is an increase in the content of the extracted tannins (the difference in the amount of tannins after 5 h and 7 h extraction was not statistically proven).

Compared to the extracts obtained from leaves [5] and fruits [3] from the species *C. monogyna*, the extracts from the current study were with lower tannin content.

The equations of extraction, which have been worked out, were proved adequate and with significant coefficients, as follows:

leaves - 50 % ethyl alcohol

$$y = 0,24 + 0,16x_1 + 0,08x_2 + 0,06x_1x_2 + 0,05x_1^2 - 0,05x_2^2 \quad (1)$$

leaves - 70 % ethyl alcohol

$$y = 0,28 + 0,21x_1 + 0,07x_2 + 0,01x_1x_2 + 0,03x_1^2 \quad (2)$$

leaves - 96 % ethyl alcohol

$$y = 0,11 + 0,07x_1 + 0,03x_2 + 0,02x_1x_2 \quad (3)$$

fruits - 50 % ethyl alcohol

$$y = 0,12 + 0,01x_1 + 0,01x_2 - 0,01\,x_1^2 \quad (4)$$

fruits - 70 % ethyl alcohol

$$y = 0,13 + 0,02x_1 + 0,02x_2 - 0,02\,x_1^2 - 0,01x_1^2 \quad (5)$$

fruits - 96 % ethyl alcohol

$$y = 0,07 + 0,01x_1 + 0,01x_2 \quad (6)$$

where: *y – content of tannins, %;*
x_1 – temperature, °C;
x_2 – duration of the process, h.

Equations reveal that in terms of tannin yields the impact of the temperature factor (x_1) was greater for three of the solvents, while the duration of the extraction process (x_2) had weaker influence. The extracts that were richest in tannins were further characterized with respect to some physical indexes, as shown in Table 1. The obtained extracts were liquid, yellow-green to brown in color (depending on the variant) and with specific odor and taste. The observed differences with respect to the other physical characteristics of the extracts were caused by the applied solvent.

Table 1. Physical indexes of hawthorn extracts

Index	***Extracts obtained with***		
	50% ethyl alcohol	***70% ethyl alcohol***	***96% ethyl alcohol***
Fruits			
Appearance	***Clear liquid***		
Color	***Yellow-brown***		
Odor	***Specific***		
Taste	***Specific***		
d_{20}^{20}	***0,9487***	***0,9107***	***0,8298***
n_D^{20}	***1,3694***	***1,3755***	***1,3782***
Leaves			
Appearance	***Clear liquid***		
Color	***Brown***	***Green-brown***	***Bark-green***
Odor	***Specific***		
Taste	***Specific***		
d_{20}^{20}	***0,9464***	***0,8975***	***0,8245***
n_D^{20}	***1,3680***	***1,3738***	***1,3764***

Conclusion

A technology for obtaining of ethanol extracts from hawthorn fruits and leaves has been developed. The equations of the extraction process have been worked out, that are adequate and with significant coefficients. Extracts from hawthorn fruits and leaves contain tannins and have the potential for application in various cosmetic products.

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