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Journal of the University of Chemical Technology and Metallurgy, 44, 4, 2009, 413-415

Short Communication

DETERMINATION OF TANNINS CONTENT BY TITRIMETRIC METHOD FOR COMPARISON OF DIFFERENT PLANT SPECIES

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Received 05 May 2009
Accepted 12 October 2009

ABSTRACT

Tannins represent a wide variety of compounds that can be found in fruits, vegetables, dry extract of red wine, dry extract of grape seeds, tea and dry not edible plants. Tannins are also known as proanthocyanidins possessing useful properties such as antioxidant, anti-apoptosis, anti-aging, anti-carcinogenic, anti-inflammatory as well as anti-atherosclerosis and cardiovascular protection. In the study 16 food products - 6 fruit and 2 vegetable dry species, 4 dry extracts of not edible and 4 dry not edible plants were analysed for their tannins content by titrimetric method.

Keywords: condensed tannins, fruits, vegetables, dry not edible and dry extract of not edible plants.

INTRODUCTION

The reactivity of condensed tannins with molecules of biological significance such as proteins, metal ions and polysaccharides has important nutritional and physiological consequences, and hence the determination of the content of condensed tannins in plant material is important [1]. Tannins exhibit many biologically significant functions, such as protection against oxidative stress, and degenerative diseases.

Oxidative stress results in oxidative alteration of biological macromolecules such as lipids, proteins and nucleic acids. It is considered to play a pivotal role in the pathogenesis of aging and degenerative diseases [2-4]. In order to cope with an excess of free radicals produced upon oxidative stress, human bodies have developed sophisticated mechanisms for maintaining redox homeostasis. These protective mechanisms include scavenging or detoxification of reactive oxygen species (ROS), blocking ROS production, sequestration of transition metals, as well as enzymatic and non-enzymatic antioxidant defenses produced in body, that is, endogenous [5, 6].

Tannins are the most abundant antioxidants in human diets. The main dietary sources of tannins include some common fruits, vegetables and not edible plans [7].

The aim of this study was focused on the determination of tannins in food products by titrimetric method.

EXPERIMENTAL

The study covered 16 food products. Randomized market sampling was applied. The average sample consisted of representative amounts of three individual samples from respectively different manufactures. All samples data are stated in the sampling protocol.

Sample preparation

3 g of the studied food product was extracted with distilled deionised water (dd H_2O) into 250 ml

Table 1. Content of tannins in dry fruit and vegetable species.

Tannins (%)	Dry fruits						Dry vegetables	
	Apple	Sweet cherry	Morello cherry	White cherry	Aronia	Quince	Red pepper	Red hot chillis pepper
	0.58	1.25	1.11	0.58	2.00	0.67	0.69	0.55

volumetric flask during 4 hours at room temperature and then the sample was filtered.

Tannins assay

The analyses of tannins content in fruits and vegetables were performed according to The International Pharmacopoeia [8] and AOAC method [9], after some modifications. 25 ml of the infusion are measured into 1 L conical flask, then 25 ml of indigo solution and 750 ml distilled deionised water (dd H_2O) are added. 0.1 N aqueous solution of $KMnO_4$ is used for titration until the blue coloured solution changes to green colour. Then few drops at time until solution becomes golden yellow are added. Standard solution of *Indigo carmine* is prepared as following: 6 g *Indigo carmine* is dissolved in 500 ml of distilled deionised water (dd H_2O) by heating, after cooling 50 ml of 95 – 97 % H_2SO_4 is added, the solution is diluted to 1 L and then filtered. The blank tests by titration of a mixture of 25 ml *Indigo carmine* solution and 750 ml dd H_2O are carried out. All samples were analyzed in duplicates.

CALCULATIONS

The tannins content (T, %) in the sample is calculated as follows:

$$T(\%) = \frac{(V - V_0)\ x\ 0.004157\ x\ 250\ x\ 100}{g\ x\ 25}$$

where V is the volume of 0.1 N aqueous solution of $KMnO_4$ for the titration of the sample, ml; V_o - volume of 0.1 N aqueous solution of $KMnO_4$ for the titration of the blank sample, ml; 0.004157 – tannins equivalent in 1 ml of 0.1 N aqueous solution of $KMnO_4$; g – mass of the sample taken for the analysis, g; 250 - volume of the volumetric flask, ml; 100 – percent, %.

RESULTS AND DISCUSSION

Tannins contents in Bulgarian dry products

The results for tannins content in Bulgarian dry fruits and vegetables are presented in Table1. Almost all analyzed products contain tannins in the range of 0.55 - 1.25 %. It was established that the larger quantity of tannins has been found into dark dry fruits - Aronia, Sweet cherry and Morrelo cherry, while the lower values have been found into white dry fruits – Apple, White cherry, Quince and into dry vegetables - Red hot chillis pepper and Red pepper. These results show a relationship between the fruit colour and tannin content in the case of the dry fruits. At the same time in the case of dry vegetables the tannins content has low values despite the dark colour.

Tannins contents in dry plants

The results for tannins content in dry not edible plants are presented in Table 2. The tannins content in these samples is several times higher than those given in Table 1 for the dry fruits and vegetables. The lowest values of tannins found in Hip (*Rosa cannia*) and *Geranium* are twice higher than those found in Aronia and Cherries. The highest values are found in the *Black tea* and *Rhus cotinus* leaves.

Tannins contents in the dry extracts of dry plants

The results for tannins contents in dry extracts in not edible plants are presented in Table 3. The values

Table 2. Content of tannins in dry not edible plants.

Tannins (%)	Dry not edible plants			
	Geranium	*Black tea*	*Rhus cotinus leaves*	Hip (*Rosa canina*)
	5.38	10.23	10.53	3.41

Table 3. Content of tannins in dry extracts of not edible plants.

Tannins (%)	Dry extracts of not edible plants			
	Betulae pendula leaves	Green tea	Grape seeds	Red win
	8.94	55.89	93.44	26.46

of the tannins in this samples varies in large scale – from 8.94 % in *Betulae pendula* leaves to 93.44 % in grape seeds. In red win dry extract it is 26.46 % and in green tea - 55.89 %, but it is important to notice that the comparison of the results for tannin contents in the dry fruits, vegetables and not edible plants and this for the dry extracts from plants will not be correct because of the different methods of analysis.

CONCLUSIONS

The present study presents original data for tannin contents in 6 dry fruits, 2 dry vegetables and 4 dry not edible pants as well as the data for 4 dry extract of not edible plants available in Bulgaria. It was found that in the case of the fruits the tannin contents is correlated with the fruit colour while for the dry vegetables the contents despite its dark colour corresponds to the lowest values for the fruits.

In the dry not edible plants the tannin contents are much higher than those in the dry fruits and vegetables. The analysis of tannin contents in dry extracts in not edible plants are also carried out but the comparison of these results with another tree groups is not possible because of the different approach for analysis.

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