Quantitative assessment of pectin content in the pulp of mountain ash fruits (fructus sorbia)

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Abstract

In the course of the analysis of mountain ash fruit pulp of fruits collected from wild and cultivated plants the content of pectin substances was established. It ranged from 2.1 to 2.7%, depending on the sample under study. Given the wide distribution of mountain ash in the Russian Federation, it seems appropriate to use mountain ash fruits (Fructus Sorbia) as an additional source of pectin substances.

Keywords: fruits, mountain ash, pectin, gravimetric analytical method.

Pectin is one of the most common polysaccharides accumulated in various plant raw materials. Pectin is widely used in many industries. For example, in Russia the food industry needs up to 10,000 tons of pectin per year [1]. A slightly smaller amount of pectin is required for therapeutic and prophylactic purposes.

In medical practice pectin is used as an enterosorbent, as well as an excipient and corrigent in different medical prescriptions [2]. It was also found that pectin substances have a marked antimicrobial effect on test-strains of microorganisms. E. coli and S. Aureus colonies seem to be the most sensitive to pectin substances [3]. Despite its considerable presence in many plant-based products, the cost of food pectin is 25-35 US dollars per 1 kg, whereas 1 kg of medical pectin costs 60-120 US dollars, depending on the purity of the finished product.

Nowadays up to 80% of pectin in Russia is imported, so the search for cheap domestic sources is thought to be a relevant and promising direction. In Russia pectin is produced by processing apple or citrus pomace in compliance with the requirements of GOST 29186-91 pectin (technical specifications).

Previous studies [4, 5] analysed pectin content in fruits of the following plants: viburnum, blackberry, dogwood, blackthorn, rosehip, hawthorn**,** oriental wild apple and blueberry. In the course of this research the content of pectin substances in the studied samples was established. Also, the prospects of using them as an additional source of pectin were highlighted [6, 7]. As one of the sources of pectin is an apple fruit pulp, we considered it appropriate to make a

quantitative assessment of pectin content of the pulp of fruits of mountain ash, that belongs to the same family Rosaceae.

The aim.

An analysis of the quantitative content of pectin in mountain ash fruit pulp for estimating the prospects of this raw material use as a source of pectin for medical purposes.

Materials and methods.

The objects of the study were wild mountain ash fruits collected in the underbrush of broad-leaved forests in Moscow Oblast (Istra District and Chekhov District) and Tver Oblast, cultivated mountain ash fruits (Michurinskaya Desertnaya variety) and the fruits of cultivated plants of hybrid mountain ash (Burka variety, a hybrid obtained by crossing alpine sorbaronia and mountain ash, and Granatnaya variety, a hybrid obtained as a result of crossing mountain ash and large-fruited hawthorn).

For a preliminary assessment of the presence of natural polysaccharides Pharmacopoeia method was used. It included the following procedures: grinding the plant raw material to a particles enabling to pass through sieves with a hole diameter of 2mm, extraction of hydrophilic substances with water purified by heating for 30 minutes, filtration of the extracts, and adding 30 ml of alcohol 96% to 10 ml of the filtrate that was accompanied by flocculent sedimentation.

For quantitative assessment of the content of pectin substances we used sample preparation, including mechanical squeezing of juice, followed by drying and grinding the pulp to particles enabling to pass through sieves with a hole diameter of 2mm. Pectins were quantified by the gravimetric analytical method. The pH value of the solutions of obtained pectins was found after dissolving samples of 0.1 gram mass (accurately weighed) in water distilled with a help of an automatic high-precision potentiometric titrator ATP-02 with Aquilon software. The analysis of pectin samples was performed in accordance with the requirements of GOST. Organoleptic and physicochemical properties of pectin such as moisture content, etherification degree, gel strength, weight ratio of nitrates and particles of the fibrous fraction larger than 0.5 mm in size were determined and assessed.

Discussion and results.

To assess the quantitative content of pectin substances prepared according to the method described above, mountain ash fruits pulp was treated with 0.5% oxalic acid solution at 65° C and a weight ratio of 1:5 for 4 hours, followed by coagulation with 95% ethyl alcohol, separation of the finished product by centrifugation, isothermal drying, and gravimetric determination of pectin.

The results of the quantitative assessment of pectin content in the samples of fruits collected from wild and cultivated mountain ash plants, as well as hybrid varietal mountain ash plants, are presented in *Table 1.* Also, the table shows the pH value of aqueous pectin solutions of obtained samples.

Table 1. Assessment of pectin content in the plant raw materials

Plant raw material	**Collecting area**	**Quantitative content of pectin, %**	**pH of aqueous pectin solutions**
Pulp of mountain ash fruits (wild plants)	Underbrush of broad-leaved forests in Moscow Oblast (Chekhov District)	2.7±0,05	2,4
Pulp of mountain ash fruits (wild plants)	Underbrush of broad-leaved forests in Tver Oblast	2,6±0,01	2,3
Pulp of mountain ash fruits (wild plants)	Underbrush of broad-leaved forests in Moscow Oblast (Istra District)	2,4±0,03	2,1
Pulp of hybrid mountain ash fruits (Burka variety)	Garden Community □Sunrise□	2,2±0,03	3,0
Pulp of hybrid mountain ash fruits (Granatnaya variety)	Nursery garden □Ecoplant□	2.3±0,03	3,2
Pulp of cultivated mountain ash fruits (Michurinskaya Desertnaya variety)	Botanical Garden of Moscow State University	2,1±0,01	2,5

Table 1 shows that all the analysed samples have similar content of pectin substances, from 2.1 in the cultivated mountain ash fruits pulp of Michurinskaya Desertnaya variety to 2.7 in wild mountain ash fruits pulp. The analysis of the pH values of the aqueous pectin solutions suggests its highest content in wild mountain ash fruits pulp (Istra District). An increase in the pH value in the varietal fruits samples may be explained by a larger amount of monosaccharides, which predetermine better taste characteristics.

The obtained pectin samples were examined in accordance with the requirements of GOST 29186-91 Pectin. The organoleptic parameters of the studied samples are presented in *Table 2.*

Table 2. Organoleptic parameters of pectin obtained from the pulp of wild and varietal fruits of mountain ash

Sources of pectin	Aggregate state	Taste	Odor	Color
Pulp of mountain ash fruits (wild plants)	Fine grinding powder without foreign impurities	Slightly sour, tasty	No	Yellowish
Pulp of mountain ash fruits (wild plants)	Fine grinding powder without foreign impurities	Slightly sour, tasty	No	Yellowish
Pulp of mountain ash fruits (wild plants)	Fine grinding powder without foreign impurities	Sour	No	Yellowish
Pulp of hybrid mountain ash fruits (Burka variety)	Fine grinding powder without foreign impurities. Pectin flakes fractions can be found.	Slightly sour with pronounced berry flavor	No	Reddish
Pulp of hybrid mountain ash fruits (Granatnaya variety)	Fine grinding powder with separate fibre fractions	Slightly sour, tasty	No	Cream-colored
Pulp of cultivated mountain ash fruits (Michurinskaya Desertnaya variety)	Fine grinding powder without foreign impurities	Slightly sour, tasty	No	Cream-colored

Physicochemical parameters of the pectin samples are presented in *Table 3.*

Table 3. Physicochemical parameters of pectin

Sources of pectin	Moisture content,	Degree of etherification,	Gel strength, Farr-Baker	Weight ratio of nitrates,	Weight ratio of particles of the

	%	%	degrees	%	fibrous fraction larger than 0.5 mm in size, %
Pulp of mountain ash fruits (wild plants)	3,4	69	185	0,04	4,5
Pulp of mountain ash fruits (wild plants)	3,1	71	180	0,12	5,0
Pulp of mountain ash fruits (wild plants)	3,6	70	179	0,06	5,5
Pulp of hybrid mountain ash fruits (Burka variety)	2.4	82	190	0,14	12,5
Pulp of hybrid mountain ash fruits (Granatnaya variety)	5,6	76	186	0,08	16,0
Pulp of cultivated mountain ash fruits (Michurinskaya Desertnaya variety)	3,7	68	182	0,06	6,0

As can be seen from *Tables 2* and *3*, all the pectin samples are in line with the requirements of GOST for industrial pectin. Physicochemical parameters of pectin obtained from wild mountain ash plants and cultivated mountain ash plants of Michurinskaya Desertnaya variety are close to each other, while physicochemical parameters of hybrid varieties differ. All samples have a fairly high degree of etherification (>65%). Considering all the information

above, we suggest using mountain ash fruit pulp as a promising source of pectin, particularly for medical purposes [10, 13, 15, 16].

Conclusion.

The study carried out the quantitative assessment of the content of pectin substances in the fruits of mountain ash pulp collected in different areas, as well as of hybrid varieties. The results show that pectin content ranges from 2.1% (pulp of cultivated mountain ash fruits of Michurinskaya Desertnaya variety) to 2.7% (pulp of wild mountain ash fruits). Given the significant reserves of mountain ash in the Russian Federation, this type of raw material can be used as an additional source of pectin for medical purposes.

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