



ESTIMATION THE QUALITY OF WILD PLANT RAW FOR PRODUCTION OF HEALTHY FOOD

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Abstract

The article presents the results of experimental researches of biologically active components in aronia berry (one of the most wide-spread representative of wild plant raw) and the estimation of the influence of separate biologically active substances contained in it on the normal functioning of a live organism. There was affirmed that the researched raw material is rich of natural poly-component system whose parts make the many-trended positive influence on human life activity. The obtained results have shown the perspectives of production of poly-functional food enriching compounds on the base of wild-grown berries, which will be helpful for creating the new competitive foodstuffs with determined composition, color, taste, odor, texture, and shelf life terms.

Introduction

The specificity of modern food science (particularly the branch concerning the production of healthy foodstuffs) can be formulated that the object of its activity is the state of human health, the means to increase the quality of human life, and the active and creative longevity.

This is why the food industry nowadays is being transformed into greatly important component of health protection and therefore occupying the outstanding position in the field of intellectual and physical activity of a man.

The scientists of National University of Food Technologies that will celebrate its 130th anniversary this year are the first in Ukraine who have designed the strategy of formation and development of healthy food industry. Thereinafter, they have trained a great number of high-qualified specialists for this principally new branch, proposed the new technologies of healthy foodstuffs and the ways of their practical realization in industrial conditions.

On the current stage the scientists of NUFT have achieved the significant success in creating the wide array of natural ingredients, complex technological enriching compounds, nutraceuticals etc. to enlarge the range of healthy foodstuffs.

The researches which were conducted by both our scientists and specialists from other institutions have confirmed that it is necessary to include some inexpensive, biologically valuable, and wide-spread in Ukraine plant raw materials into the field of healthy food production for the newer successful scientific approaches and efficient decisions (Kaprelyantz, Yorgachova, 2003). These are wild-grown plants that can serve such a new kind of non-tradition raw (Khomych, 2012).

The wild-growing fruit and berries are the rich source of vitamins, carbohydrates, lipids, proteins, organic acids, aromatics, minerals, and others. As the curative raw and foodstuff component, they are valuable due to the complex of biologically active substances that have the capillary-strengthening, anti-sclerotic, hypotensive, anti-inflammation, and hormonal action.

Many species of wild-growing berries have the high nutritional value, so that they would become the important reserve to create the new poly-functional compounds for enriching the traditional food products. However, the range of such a raw to use in food industry is significantly limited by now. The studies over the biological value of wild plant raw materials are one of the main ways to introduce them into the sphere of food technologies; henceforth, it would allow widening the range of wild-grown plant resources.

The **purpose** of this work is to define the main biocomponents in the samples of aronia berries grown in Vinnytsia and Kyiv regions, and to estimate their polyfunctional properties from the viewpoint of its influence on the live organism.

Method

The authors of this article used the standard physical and chemical methods of estimating the plant raw (Yermakov et al., 1987).

- The sugars' sum was determined by *the Bertrand half-micro method modified by Bierry*,
- The pectin substances were determined by *calcium-pectate method*,
- The general content of organic acids was defined by *titration of the samples by 0.1 n. solution of sodium hydroxide*,
- The ascorbic acid content was defined by *method based on the ascorbic acid's ability to restore the 2,6-dichlorophenolindophenol cyan solution into colorless compound*,
- The polyphenol substances were determined by *using the Fauline-Dennis reagent*.

Results and Discussions

The analysis of the data published recently evidence that the main biological value of wild berries (including aronia) is represented by the following components: pectin substances, organic acids, sugars, ascorbic acid, polyphenol compounds, and mineral substances.

Just those were the indices which we determined experimentally with additional orientation on literary data for several of them. The obtained results are shown in Tables 1 and 2.

Table 1

Biologically active substances in aronia berries, per cent (by raw product mass)

Samples	Dry substances content, per cent	General sugar content, per cent	Pectin substances		Organic acids, per cent
			Protopectin	Soluble pectin	
Sample No.1	19.6 ± 0.01	7.8 ± 0.005	0.448 ± 0.001	0.264 ± 0.003	0.98 ± 0.03
Sample No.2	20.4 ± 0.01	8.0 ± 0.003	0.425 ± 0.001	0.248 ± 0.003	0.76 ± 0.01
Sample No.3	22.2 ± 0.01	8.6 ± 0.005	0.488 ± 0.001	0.265 ± 0.002	1.44 ± 0.04
Sample No.4	20.8 ± 0.01	8.2 ± 0.004	0.470 ± 0.001	0.258 ± 0.002	1.12 ± 0.04

Four samples of aronia berries (samples No. 1 and 2 were harvested in Vinnytsia region and samples No. 3 and 4 were harvested in Kyiv region) were researched in our paper.

The analysis of the obtained data shows the following facts.

First, all of the samples contain the efficient sum of dry substances. The content of general sugars vacillates between 7.8 and 8.6 per cent. Moreover, according to the literary data, this range is significantly wider – from 4.6 to 14.6 per cent. The profound researches also showed that inverted sugar is prevalent in aronia berries, but sucrose content is very low or nil.

This is the important characteristic of aronia berries, because such carbohydrate content allows implementing the products made of it into diets for sick, disabled persons, old age people and children. Subsequently, the organism would not need to spend energy for dissolving sucrose to simple sugars that would come into blood directly.

Second, all of the studied samples contain circa 1 per cent of pectin substances (0.673 to 0.753 per cent). Besides, their significant part falls on soluble pectin (35.2 to 37.0 per cent).

According to literary data, aronia can contain 0.52...1.2 per cent of pectin substances (Shatniuk, 2000). There was confirmed that protopectin is dominant on all the phases of aronia berries' development. As we can see, the mature berries have twofold more protopectin than soluble pectin.

This convinces once more to recognize expedient the usage of wild-growing plants in producing foodstuff with both common and special destination, considering the outstanding role of pectin substances in

normalizing different processes in human organism (particularly, prophylactic and healing intestine diseases, regulation and removal of heavy metals, radionuclides, cholesterol residua, and so on).

Third, the aronia berries contain the significant amounts of organic acids, according to our data – from 0.76 to 1.44 per cent (the literary data show that the acidity of different aronia species may vacillate within 0.94...2.01 per cent).

The samples of aronia harvested in Vinnytsia region contain a little less organic acid than the Kyiv region samples do. These indices correlate with the general sugar content (7.8...8.0 in Samples No. 1 and 2; 8.2...8.6 in Samples 3 and 4).

The researchers who investigated the changes in aronia berries' general acidity dependently on the growing place came to conclusion that acidity, along with saccharine index, is increasing in north area. Consequently, these indices are higher for berries grown in Kyiv region.

It is well-known that organic acids like apple, lemon, and oxalic, are prevalent in fruit. Amber, fumaric, vinous, cinchona, chlorogenous and other similar acids are present in smaller amounts. Aronia berries are not an exception – lemon acid is dominant in them, less are present apple, cinchona, and amber acids. All of these acids are extremely important for human organism normal functioning, as they support the acid and alkaline balance, oppress the harmful bacteria's activity, and protect the organism from nuclear damages.

Yet, the amber acid is attracting more and more scientists today. This is not a wonder, as the range of its influences is very wide – it stimulates the activity of kidneys and bowels, shows anti-stress, anti-inflammation, anti-toxic and other actions. Amber acid is used to heal the anemia of different etiology, lumbago, and heart diseases.

Table 2 represents the vitamin compound of aronia berries.

Table 2

Vitamin content in aronia berries, mg per cent (by raw product mass)

Samples	Ascorbic acid	Polyphenol compositions	Carotenoids
Sample No.1	67.8 ± 0.08	2447.0 ± 0.9	10.2 ± 0.04
Sample No.2	54.6 ± 0.09	2143.0 ± 0.8	8.4 ± 0.06
Sample No.3	129.4 ± 0.07	2646.0 ± 1.0	14.9 ± 0.03
Sample No.4	88.5 ± 0.04	2097.0 ± 0.9	10.7 ± 0.07

The obtained results evidence the rich vitamin content of aronia berries. As the biologically active substances of this culture are not yet studied properly, all the experimental results are a contribution into knowledge about still unidentified possibilities of aronia.

The index of ascorbic acid content in aronia is quite high, especially in Samples No. 3 and 4. Of course, these indices are significantly more humble than those for eglantine berries (that contain 1 531...3 094 mg per cent of ascorbic acid). However, they are almost equal for such ascorbic acid rich cultures as haw (14.2...110 mg per cent), wild cherry (26.6...75.5 mg per cent), black currant (49.4...123.0 mg per cent). Along with that, aronia berries overcome sea-buckthorn (that contains 12...45 mg per cent of vitamin C), Cornelian cherries (28.6...36.8 mg per cent), guelder berries (7.0...39.7 mg per cent), raspberries (26.7...49.4 mg per cent), and barberry (20.2...28.4 mg per cent) by the ascorbic acid content.

The aronia berries' attractiveness to use in food technologies and production of poly-functional enriching substances is based on their ability to accumulate not only the significant amounts of ascorbic acid, but also the polyphenol compounds, because the mentioned combination is the most efficient for human organism functioning.

The mechanism of flavonoids activity is defined as blocking the metals' catalytic influence by constraining them into stable complexes that are resistant to any chemical reactions. The flavonoids help the organism to spend ascorbic acid more economically. The flavonoids' ability to strengthen the vessel membranes and regulate their penetrability is universally recognized. There was also proved that the effect of flavonoids' influence on capillaries gets maximally intensive with simultaneous introduction of ascorbic acid.

The obtained results showed that the high level of polyphenol compounds coincides with sufficient C-vitamin activity in all of the examined samples of aronia berries. Generally, a lot of researchers noticed that aronia exceeds the majority of other wild berries and fruit by the polyphenol substances content.

According to all of the listed criteria, aronia berries should take the priority place among high-vitamin plants and therefore be used widely in food and pharmaceutical industries.

High carotenoid content is also the important characteristic of aronia berries (8.4...14.9 mg per cent; See Table 2). The comparison of obtained results showed that the carotenoids (vitamin A precursors) synthesize in plants less intensively than ascorbic acid and polyphenols do.

Carotenoids are represented by β -carotene and its isomers. Vitamin A plays the polyfunctional role in human organism. As the daily dose of this vitamin is only 1...2 mg (or 2...4 mg of β -carotene), the small amount of wild fruit and berries would be sufficient to provide the human organism with noticed substance.

Therefore, the experimental data obtained during our research show that wild growing berries (including aronia) are very rich source of a complex of biologically active substances, which would allow obtaining the new foodstuff with increased biological value. Taking aronia for a base to create the biologically active additives and polyfunctional ingredients is grounded scientifically, expedient technologically, and profitable economically; henceforth, the expected products from aronia would have a great demand on both domestic and foreign markets.

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