Innovations in the production of syrups for healthy diet

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Abstract. Fruits and vegetables are the most popular raw ingredients that act as a source of dietary fiber and other biologically active substances that benefit the human body. The vast majority of nutrients enter the human body with food, so the daily ration of an average person should include those useful products that can provide the body with the necessary amount of biologically active substances. Vegetable-based raw materials containing vitamins, minerals, antioxidants, dietary fibers used in the production of food products are considered a source of functional properties. A priority area of product technologies is the search for technological methods for the production of functional food products with a given biological value (high BAS and antioxidant content). The paper presents recipes and innovative technology for the production of functional syrups based on Viburnum fruits, as well as the evaluation of consumer characteristics, nutritional value and functional orientation of the corresponding products.

1. Introduction

Ensuring health, performance, cheerfulness and longevity of people is one of the priority areas of the state activity.

In recent years, the deterioration of health is associated with poor nutrition and intensified environmental situation. According to the World Health Organization, the main determinant of our health is the quality of nutrition. Excluding hereditary diseases, 60-70% of health depends on the quality of nutrition, 10-12% – on medicine, 20-25% – on environmental conditions. In cities with developed industry, the adult population is 1.5 times more likely to suffer from circulatory diseases, 1.7 times – digestive diseases and environmental pollution causes an increase in the number of cardiovascular diseases – from 11 to 32% [1].

The current task of the food industry is to implement the decisions established by the Food Security Doctrine of the Russian Federation aimed at ensuring state interests in the field of quality control and safety of food production and circulation, as well as the creation of healthy and functional nutrition products [2].

In the last 2-3 decades the technology of food production has been increasingly influenced by the ideas of specialized and functional nutrition. The specialized and functional nutrition is also heterogeneous and has trends towards wide differentiation: from ideas of balanced mass nutrition to nutrigenomics, which takes into account the individual characteristics of an organism.

Summarizing the development of the ideas of specialized and functional nutrition, they may be divided into two main groups: technologies for the mechanical formation of a nutrition set necessary
for the functions of macro- and micronutrients, and technologies based on the study and accounting of consumers in the production of food [3].

Within the framework of the concept of optimal nutrition, a new direction of nutrition science has been formed – the concept of functional nutrition or the concept of functional food, which includes the development of theoretical foundations for the production, sale and consumption of functional products.

In developed countries, the sector of functional products and beverages is particularly important – it is the most convenient, natural form of application and enrichment of the human body with micronutrients (vitamins, minerals, microelements and other components).

In Russia, various types of non-traditional raw materials are used to obtain these products, in particular vegetable raw materials with high biological value [4].

A priority area in increasing the nutritional value of food is the use of non-traditional crops with high antioxidant activity. Such cultures include the Viburnum. The Viburnum fruits have always attracted the attention of people by its beautiful appearance and useful properties, but its use in processing was hindered by bitter taste and specific aroma [5-8].

Viburnum products, such as Viburnum with honey, Viburnum jelly, Viburnum strained with sugar, are very popular among people who care about healthy nutrition, but their mass production in the processing industry has not yet received proper distribution. It should be noted that food products based on or with the addition of Viburnum fruits have high antioxidant value and may be of interest not only among the adherents of healthy nutrition, but also among processing enterprises [9, 10].

The development of a new assortment and technologies for the production of functional food products from Viburnum fruits makes it possible to obtain products with given consumer properties and nutritional value, which is necessary in modern human living conditions.

The main task of the food industry is not only to expand the assortment of products due to the use of new, non-traditional crops in processing, but also to modernize the production technologies themselves [11, 12].

The purpose of the study is to develop recipes and technology for the production of functional syrups based on Viburnum fruits.

2. Materials and methods
The experimental studies of raw materials, ingredients, and obtained products were carried out on the basis of well-known and private (specialized) methods.

The organoleptic assessment of Viburnum syrups was carried out according to the developed point scales.

The set of physicochemical parameters was determined using the following:
- content of soluble dry matter – using a refractometer in accordance with GOST 28562-90;
- quantity of mono- and disaccharose – based on Bertrand method in accordance with GOST 8756.13-87;
- vitamin C content – titration in accordance with GOST 7047-66 and GOST 24556-89;
- antioxidant activity – using TsvetYauza-01-AA by amperometrical method according to GOST R 8.563-96, GOST R ISO 5725-2002;
- functional orientation – according to GOST R 52349-2005 “Food Functional Products”, 55577-2013 “Food Functional Products. Distinctive Features and Efficiency”.

3. Results and Discussion
Figure 1 shows the production of syrups from Viburnum fruits using innovative technology.

The existing techniques for the production of syrups are based on the use of juices and extracts, the preparation of which destroys fruits, and the juice has direct contact with air oxygen, which leads to an almost complete loss of BAS and antioxidant activity.

The proposed technology of syrups production involves the acceleration of juice extraction from fresh Viburnum fruits into hot sugar syrup due to the use of vacuum apparatus with residual pressure
of 23-23.7 kPa (500-600 mm Hg) and temperature of 70-75°C. Under such conditions, the contact with air oxygen is avoided, which minimizes losses of valuable biologically active substances of the source raw material.

**Figure 1.** Innovative technology for the production of syrups from Viburnum fruits

The obtained Viburnum syrups were evaluated by organoleptic, physicochemical parameters, nutritional value and antioxidant activity, in comparison with products of standard production.

Figure 2 shows the degustation results of syrups from Viburnum fruits.

**Figure 2.** Results of organoleptic evaluation of syrups from Viburnum fruits

According to the degustation results, Viburnum syrups (Figure 2) had a pleasant, pronounced flavor and taste typical for the Viburnum fruits. It is noted that the taste of the Kalinushka syrup (syrup concentration – 50%) with a degustation ranking of 10.0 points turned out to be the most harmonious due to the optimal ratio of components.

Table 1 shows nutritional and functional values of the syrups.
Table 1. Indicators of nutritional and functional value of syrups from Viburnum fruits

| Syrup, composition, % | Weight fraction of soluble dry matter, % | Weight fraction of sugar, % | BAS content in 100 g of syrup | Antioxidant value, mg/100 g |
|----------------------|----------------------------------------|-----------------------------|-------------------------------|---------------------------|
| “Kalinushka” syrup composition: Viburnum/syrup 35/65 | 50.0±0.02 | 46.0±0.05 | 40.4±0.02 | 0.35±0.01 | 119.0±0.02 |
| “Viburnum color” syrup composition: Viburnum/syrup 30/70 | 47.0±0.01 | 42.0±0.07 | 36.1±0.01 | 0.33±0.01 | 93.0±0.03 |
| “Viburnum aroma” syrup composition: Viburnum/syrup 25/75 | 45.0±0.03 | 40.0±0.07 | 30.4±0.03 | 0.3±0.01 | 79.0±0.02 |
| Viburnum syrup – control (from pharmacy) | 60.0±0.02 | 59.5±0.10 | 4.2±0.01 | 0.05±0.03 | 8.1±0.01 |

According to Table 1, Viburnum syrups contain from 30.4 to 40.4 mg/100g of vitamin C, which is 41-54% of its daily need. Antioxidant content was 79.0-119.0 mg/100g, compared to the control version it was 7-10 times higher. The weight fraction of soluble dry matter, carbohydrates and the calorie content of syrups (45-50% soluble dry matter) is lower than that of standard syrup (60% soluble dry matter).

The obtained results are an important characteristic of foods for a healthy diet and allow attributing new syrups from the Viburnum fruits to functional products.

The comparative BAS evaluation of syrups made from Viburnum fruits using standard and innovative technologies showed the advantages of innovative technology, and high consumer properties of the obtained samples – evidence of the feasibility of their production. Besides, variations in the composition of the recipe mixtures (amount of Viburnum fruits and sugar) make it possible to obtain certain marketing and cost variability.

4. Conclusion

The study made it possible to develop and obtain new food products from the Viburnum fruits of functional purpose: “Kalinushka”, “Viburnum color”, “Viburnum aroma” syrups with various weight fractions of Viburnum and sugar.

The developed formulations of syrups from Viburnum fruits allow obtaining products with the specified chemical composition and functional purpose.

The proposed innovative technology of syrups production based on Viburnum fruits with the use of effective technologies allows reducing losses of biologically active substances of the end product.

The advantage of the proposed formulations and innovative production technology is confirmed by assessing the chemical composition, nutritional value and functional orientation of syrups.

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