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Innovative beverage production technologies based on Amaranth biomass

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Abstract. The paper presents research results aimed at finding plant raw materials, food biologically active components and reviews the possibility of their organic interaction to a form nutrient phytocomplex to create functional beverages. Using the principles of food combinatorics, we formulate the criteria of safety and usefulness of extracts, the formulation of health drinks using edible red-violet dye enriched with antioxidants from leaves and seeds of the amaranth Valentina variety. The biochemical and mineral composition of the created drink is studied.

1. Introduction

Natural drinks show the most rapid growth in the market of functional foods. The development trend of the domestic consumer market of non-alcoholic beverages indicates the expansion of their range using natural ingredients in the composition of beverages, including those made from vegetable raw materials. Activation of the creation and production of domestic health drinks can be one of the factors of the state program *Basics of the State Policy in the Field of Healthy Nutrition of the Population of the Russian Federation for the Period up to 2020*.

Non-alcoholic beverages, as well as other products demanded by the consumer, should be tasty, healthy, and safe. Scientifically based composition of the plant mixture to obtain the extract and on its basis of the concentrated form, which is the main component of the product being created is determined in the process of their development [7, 9].

The purpose of this work was to develop a beverage with a preventive effect, with a manifested antioxidant effect, activating the metabolism and increasing the body's resistance to adverse factors. This is relevant as part of government programs aimed at improving quality and increasing life expectancy.

The main raw materials for the creation of natural drinks are herbal mixtures, usually including from three to six items [8, 9].

2. Material and Method

In the process of obtaining a concentrate for a drink, the herbal mixture was used, the main component of which is the leaf biomass of the introduced plant of the Valentina amaranth variety [3]. To harmonize the functional properties and taste-forming perception of the PDA, the vegetative part and black currant berries are included in the composition of the plant mixture. Scientifically based selection of plant mixture, containing a certain mass ratio of the above components, contributes to the



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formation of a targeted action of the phytocomplex of natural nutrients. Determination of free amino acids was carried out on a KNAUER liquid chromatograph (HPLC) ("KNAUER Wissenschaftliche Geräte GmbH", Germany), with a diode-matrix detector equipped with an automatic information collection and processing system [2]. Cations and anions were determined on an ion chromatograph of the Model 861 Advanced IC- "MCS" 853 Metrohm CO₂ Suppressor by Metrohm AG ("Metrohm" - Switzerland). The method is based on chromatographic separation of cations in a sample and their subsequent detection with a conductometric detector (Chromatography column for Metrosep C 4150 / 4.0 cations [10].

3. Results

Amaranth leaves contain the betacyanine-amarantine amaranth red pigment, protein (15-20%), balanced in composition of essential amino acids, a full set of vitamins B, E, C, carotenoids, flavonoids (rutin, quercetin, etc.), simple phenolic compounds, hydroxycinnamic acids, ascorbic acid [2, 10].

Vegetative part and black currant berries have functional properties. It is known that 100 g of berries of this culture contain up to 4000 mg of ascorbic acid, up to 17% sugar, organic acids (tartaric, succinic, citric, malic, nicotinic), pectic substances, tannins up to 0.62%, vitamins B₁, B₆, E, P, K, glycosides, essential oils, macro- and microelements.

Black currant leaves also contain a wide range of macro- and microelements, ascorbic acid, phytoncides, carotene, essential oil, as well as compounds with P-vitamin activity.

The complex of nutrients of berries and leaves of black currant in the human body is able to exhibit properties that improve the state of the cardiovascular system, tonic, enhance appetite, activate the functions of the gastrointestinal tract [4].

The extract was enriched with the products of hydrolysis of non-starch polysaccharides from amaranth seeds with easily digestible substances of carbohydrate and protein nature. Hydrolysis products formed in the process of biocatalysis contribute to the formation of functional and technological properties, positively affect the creation of a complex of nutrients that form organoleptic properties with the manifestation of a soft balanced taste.

4. Discussion

The results of scientific and experimental work to determine the criteria for the process of bioconversion made it possible to optimize the size of the plant particles, including fruit raw materials, in a ground mass. The particle size in the vegetable mixture is in the range of 3-5 mm. The duration of the extraction process is 12 hours at a temperature of 46 °C / 48 °C. A filtered clear extract is the main ingredient in the drink. The drink obtained in this way has a moderately pronounced taste and aroma perception characteristic of the used components of the herbal mixture.

In the complex of nutrients of the drink, amino acids are present, they are in the composition of all protein substances in the human body as the main component, and also are part of the vitamins and other compounds important for the body. 10 amino acids in the human body are not synthesized [5]. Amino acid composition was determined in the developed drink.

In total, 100 g of the drink include the following mass concentration of amino acids, mg: aspartic acid (122.8), glutamic acid (19.2), asparagine (38.0), histidine (58.8), serine (27.2), glutamine (3.2), arginine (16.0), glycine (8.8), threonine (6.4), alanine (127.2), tyrosine (62.4), valine (27.2), methionine (344.0), tryptophan (30.0), isoleucine (26.8), phenylalanine (4.8), leucine (62.0), and lysine (27.6).

Minerals in the form of organic and inorganic salts play an important role in the body. They are part of the cells and intercellular fluids, normalize metabolic processes, participate in the enzymatic and hormonal activities of the body, regulate the tension formed in the nervous system and muscle tissue, depending on the characteristics of salt metabolism. The constancy of the blood pH and other biological systems in the body is maintained by salts [1, 6].

Mass concentration in 100 g of the drink is represented by the following minerals, mg: Na (13.6), K

(1160.4), Mg (42.4), and F (30.4).

5. Conclusion

As a result of the research, the scientifically based criteria of the basic technology were developed. Namely, we focused on the extraction and technological process of obtaining a natural beverage based on the extract from the plant mixture, including leaves and berries of the “Valentina” amaranth variety.

In the complex of natural nutrients contained in the Debyut Amaranta non-alcoholic beverages, extractive (including biologically active substances of the main component of the PDA, which is Valentina's variety amaranth leaf (0.38 g per 100 cm³ of drink), prevail.

Scientifically-based decisions in the process of performing work on the possibility of using new types of plant raw materials in the technologies of creating new functional beverages contribute to the expansion of the raw material base, improving the process activation technology and qualitative development of organoleptic indicators and the biological value of the finished product.

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