The use of Brassica napus L. in soft drink production

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Abstract. One of the forms of agribusiness development is the use of local raw materials. Swede is an unconventional raw material resource that has a number of valuable nutrients. The paper shows the possibility of using swede, growing in the Novosibirsk region, in the production of purees and soft drinks for the first time. In solving the tasks assigned, generally accepted research methods were used. As a basis, it is proposed to produce root vegetable purees, which consist of the following main stages: preparation of ingredients (washing, inspection, blanching, cleaning, washing, grinding), processing in an apparatus under the influence of an acoustic field, packing, cooling, storage. Based on organoleptic studies, a soft drink formulation has been developed, consisting of rutabaga, 20% sugar syrup, low esterified pectin and citric acid. Studies of the quality characteristics allowed us to establish the shelf life of the drink within 9 months from the date of production. Regulated requirements for organoleptic and physico-chemical parameters, food and energy values have been established for the developed products.

One of the objectives of the State program of the Novosibirsk region called “Development of agriculture and regulation of agricultural products, raw materials and food in the Novosibirsk region for 2015-2020” is to create conditions for the production growth of main types of agricultural products and food based on them, which can be achieved through the production of food, including beverages based on local raw materials.

Before the importation of potatoes into the territory of Russia, swede was the main diet of the population of the country (it was used to make broths, cabbage soup, etc.). Rutabaga (Brassica napus L.) is a biennial plant of the cruciferous family (cabbage), characterized by valuable characteristics, including organoleptic, because it contains carbohydrates, pectin substances, proteins, vitamins, etc. Due to the popularity of rutabaga in the diet scientists all over the world carried out numerous studies this culture. For example, in Norway, studies have been conducted to study the effect of storage conditions on the quality characteristics of swede, including the content of vitamin C, carbohydrates and other essential nutrients [1]. Polish scientists conducted studies on the effect of various cooking regimes on glucosinolate content in swede [2]. At present, with a growing interest of society in its own historical heritage, attention to undeservedly “forgotten,” in our opinion, food, including swede, is beginning to revive. For example, Russian scientists have already proposed ways of obtaining the following products from rutabaga: chips, caviar and juice (Patent Application RU 2010114796), concentrate for vegetarian and diet food (Pat. RU 2612776), ice cream (Pat. RU 2547309), snack food (Pat. RU 2459417), marmalade (Pat. RU 2468605), canned (Pat. RU 2522076), sauce (Pat. RU 2647511).

At present, innovations in the development of various kinds of food are generally perceived as antagonists of food traditions. In our opinion, it is necessary to change this situation by creating and...
promoting food products that are in high demand among consumers. It is worth noting the current lack of offers in the food market of swede-based beverages, as well as research in this direction. Drinks are a source not only of water, but also of physiologically active substances contained in the components of the raw materials necessary for the human body, in readily available forms of absorption [3]. Research in the field of production, storage and evaluation of the quality characteristics of vegetable drinks are conducted by many Russian and foreign experts [4-5]. It is proved that the main characteristics of vegetable drinks, important for consumers, as well as other food products, are organoleptic characteristics [6].

Based on the above, the goal of the work is to study the possibility of using local swede when creating a soft drink with high quality characteristics.

Objects of research are puree and drink made from swede. The subject of the research is the qualitative characteristics of puree and drink made from swede. For processing, fresh or quick-frozen root crops (variety mixture) were used. The quality of raw materials met the requirements of the current regulatory documentation [7-8]. When performing studies, conventional organoleptic and physicochemical methods were used:

- organoleptic indicators - visually and organoleptically on a 5-point scale;
- mass fraction of soluble solids - by the refractometric method;
- mass fraction of ethyl alcohol (puree) - by chemical method;
- active acidity - by measuring the potential difference between two electrodes immersed in the test sample;
- a mass fraction of mineral impurities - organic substances were separated by flotation, and heavy impurities - by precipitation; the precipitate was calcined at a temperature of about 525°C and the resulting residue was weighed;
- the presence of impurities of plant origin - impurities of plant origin were separated mechanically and their mass fraction was determined;
- the presence of impurities - visually;
- mass fraction of reducing sugars - by the permanganate method;
- mass fraction of pectin substances - titrimetric method;
- mass fraction of vitamin C - titrimetric method;
- energy value - by calculation method [9].

The studies presented in the work were carried out 3-7 times, processed statistically using standard methods.

Swede was used to prepare semi-finished product (vegetable puree), which was made from root vegetables without separating the juice.

Root was used to prepare purees in a mechanical acoustic apparatus. The production technology of purees included the following main stages:

- washing - until complete removal of dirt and impurities;
- inspection - removal of substandard root crops and impurities;
- blanching - to soften the skin and some softening of the pulp, as well as to inactivate enzymes and prevent darkening; within 5-7 minutes at a temperature of 80-100 °C (the temperature inside the root crop after treatment should not be lower than 98 °C);
- cleaning - from the skin;
- washing - under cold running water;
- grinding – to cubes with dimensions of faces of 20 mm x 20 mm;
- processing in the apparatus under the influence of an acoustic field with an intensity of 100-500 W/kg (the ratio of crushed roots and water - 1: 2; temperature 70 + 5 °C; for 25-35 minutes) - homogenization, deodorization and pasteurization;
packing - packing in glass jars of type III, with a nominal capacity of 500 cm³; capping with covers of type TO (metal screw cap with threaded protrusions), type RTO (standard cover);
cooling - to a temperature of 20 ± 2 °C;
storage - at a relative humidity of not more than 75% and temperature from 0 °C to 20 °C.

As a result of organoleptic, physicochemical and microbiological studies, regulated quality indicators have been established that meet the requirements of the current regulatory documentation for 12 months:

- appearance - uniform uniformly rubbed mass;
- consistency - puree, fluid mass;
- colour - uniform throughout the mass, light yellow (due to the carotene and lycopene contained in swede), with light brown shades;
- smell - natural, pronounced, peculiar to swede (due to the presence of essential oils), without foreign smell;
- taste - natural, pronounced, peculiar to swede (sweetish and spicy, due to the glycoside of sinigriona, consisting of residues of glucose molecules and cretan mustard oil), without foreign flavour;
- mass fraction of soluble solids - 8.7 ± 0.1%;
- mass fraction of ethyl alcohol in puree - 0.03 + 0.01%;
- mass fraction of mineral impurities - not identified;
- impurities - not identified;
- mass fraction of reducing sugars - 5.7 + 0.1%;
- mass fraction of pectin substances - 2.1 + 0.1%;
- mass fraction of vitamin C - 18.6 + 1.0 mg / 100 g.

Swede puree can be used in production of various food, including the manufacture of beverages. The main stages of beverage production are as follows:

- 20% sugar syrup, low esterified pectin (to stabilize the multiphase system, in the amount of 0.5-1.0 kg per 100 dal of the finished product) are added to the puree (to enhance the taste sensations of the finished product);
- blend is homogenized;
- the blend is heated to a temperature of 96-100 °C (to prevent the occurrence of secondary types of fermentation - alcohol, mucus formation, etc.);
- the blend is cooled to a temperature of 40-45 °C;
- citric acid is added to the blend (as an ingredient to reduce the active acidity to a pH of not more than 3.7, in the amount of 1.5-2.5 kg per 100 dal of the finished product);
- the drink is bottled in glass bottles, sealed, sterilized at a temperature of 120 °C in autoclaves.

For the production of 20% sugar syrup, sugar was passed through a sifter with a magnetic trap, then sugar was added to boiling water, boiled for 5-10 min and filtered.

By conducting an organoleptic evaluation of the drink, the amount of puree applied during its production was determined (table 1). It is established that, depending on the amount of puree added: the appearance and colour are improved; smell and taste are best recognized in the second version, which had a harmonious, refreshing smell and taste characteristic of swede; the first variant has a weak smell, and the taste is too sweet, and the third one has an excessive smell and taste of swede, while the latter is not sweet enough. Thus, in the production of the drink is recommended to use the following ratio of swede puree and 20% sugar syrup - 40:60.
Table 1. Evaluation of the organoleptic characteristics of the drink (n = 5), score.

| Variant | Puree ratio: 20% sugar syrup | Appearance | Colour | Odour | Taste |
|---------|-----------------------------|------------|--------|-------|-------|
| 1       | 30 : 70                     | 4.6±0.5    | 3.6±0.5 | 4.4±0.5 | 3.4±0.5 |
| 2       | 40 : 60                     | 4.8±0.4    | 4.4±0.5 | 4.8±0.4 | 4.6±0.5 |
| 3       | 50 : 50                     | 5.0±0.0    | 4.6±0.5 | 4.6±0.5 | 4.2±0.4 |

Table 2 presents the results of studies of the quality characteristics of the drink, confirming its shelf life, taking into account the reserve ratio of 1.15, for 9 months at a temperature not exceeding 25 °C. This period is established due to deterioration of organoleptic indicators during storage - sediment begins to appear, the colour becomes lighter, the smell is less pronounced, and in the aftertaste the swede tonality disappears.

Table 2. Qualitative characteristics of the drink during storage.

| Indicator                              | 0   | 7   | 8   | 9   | 10  | 11  |
|----------------------------------------|-----|-----|-----|-----|-----|-----|
| Appearance, score                      | 4.8±0.4 | 4.6±0.5 | 4.6±0.5 | 4.2±0.4 | 3.8±0.4 | 3.6±0.5 |
| Colour, score                          | 4.4±0.5 | 4.4±0.5 | 4.4±0.5 | 4.4±0.5 | 4.0±0.0 | 4.0±0.0 |
| Scent, score                           | 4.8±0.4 | 4.6±0.5 | 4.4±0.5 | 4.0±0.0 | 3.6±0.5 | 3.4±0.5 |
| Taste score                            | 4.6±0.5 | 4.2±0.4 | 4.2±0.4 | 4.0±0.0 | 3.8±0.4 | 3.8±0.4 |
| Mass fraction of soluble solids,%      | 15.2±0.2 | 15.2±0.2 | 15.2±0.2 | 15.2±0.2 | 15.1±0.2 | 15.0±0.2 |
| Active acidity, units pH               | 4.12 | 4.05 | 3.96 | 3.85 | 3.72 | 3.59 |

Note:
1. Impurities of mineral, vegetable origin and extraneous - not identified.
2. Safety indicators during the whole period of research, complied with the requirements of current regulatory documentation.

Thus, as a result of the research, the regulated organoleptic and physico-chemical indicators of the quality of the beverage from swede purees are defined:

- appearance - homogeneous opaque liquid with uniformly distributed pulp; slight compacted sediment is allowed at the bottom of the package, homogeneous after agitation;
- colour - uniform throughout the mass, from light yellow to deep yellow; dark shades are allowed;
- smell - harmonious, peculiar to swede, without foreign smell;
- taste - harmonious, refreshing, typical of swede, without any foreign taste;
- mass fraction of soluble solids - 15.2 ± 0.2%;
- active acidity, units pH - not more than 3.7;
- mass fraction of mineral impurities, % - not more than 0.005;
- impurities of plant origin are not allowed;
- impurities - are not allowed.

The nutritional value of 100 g of drink is due to the content of carbohydrates (14.4 g) mainly, which form the caloric content of products (57.6 kcal).

Thus, on the basis of the conducted research, it has been established that the use of swede, growing in the Novosibirsk region, makes it possible to obtain a variety of products from it, including non-alcoholic beverages, which have high quality characteristics. New products contribute to the revival of interest of ordinary consumers to the "forgotten" raw materials. At the same time, expanding the range of non-alcoholic beverages based on the recommended raw materials will attract potential new consumers, thereby increasing the production of beverages in the region, which in turn will contribute to the achievement of the indicator of the Novosibirsk Region's State Program "Agricultural
Development and Regulation of Agricultural Products, Raw Materials and food in the Novosibirsk region for 2015-2020 "- an increase in 2020 in comparable prices of food production, including drinks.

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