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Georgian Delicacy – Improved Technology of Preparation

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ABSTRACT

The history of the original analogue of this product dates back many centuries. Grape juice (Badagi), wheat or corn flour, dried fruits (walnuts, hazelnuts, almonds, semi-dried grape seeds -raisins, etc.) were used to make it. The technology included: thickening grape juice at high (> 80°C) temperature (final concentration - 40-50% by weight), adding wheat flour to it and boiling, threading dried fruits onto a string, dipping it into a grape juice and flour concentrate, hanging the resulting product on a horizontally positioned wooden stick and placing the latter in a sunny place to dry. The duration of the last process is up to 10 days, depending on the weather. The disadvantages of the delicacy (Georgian name - Churchkhela) prepared using this technology include: the formation of 5-hydroxymethylfurfural (5-HMF) in grape juice at high temperatures, the oxidation of flavonoids, the preservation of starch in flour unchanged, which leads to undesirable solidification of the finished product, excessively delaying the entire technological process.

Among the changes made by the author to this technology, the following should be noted:

a) Thickening of grape juice at a relatively low (55-65°C) temperature to prevent the formation of 5-HMF and oxidation of flavonoids;

b) Thickening according to the method developed by the author – in a double-walled stainless steel boiler multiplying the evaporation surface area (Copyright No. 5870, Sakpatenti [1]);

c) Dilution of flour starch in a suspension of wheat flour and water in a mass ratio of 3:7 by an amylolytic enzyme preparation (Madzgarashvili, et al. [2,3]) and its final thickening, the introduction of crushed dried fruits at a temperature of 80-85°C (up to 2 hours), lowering the temperature to 60-65°C and the introduction of concentrate of grape juice.

Keywords: Delicacy; Flavonoids; 5-Hydroxymethilfurfural; Churchkhela; Grape Juice Concentrate; Dried Fruits

Introduction

The Achievements of the Above-Mentioned Technological Changes Include:

1. Obtaining an environmentally safe product without the formation of substances harmful to human health;
2. Reduction of the total duration of the process from 240 hours to 26-28 hours;
3. Improvement of organoleptic properties (plasticity, color);
4. Optimization of economic indicators of delicacy production: cost, use of more acceptable packaging material (sterilized glassware) to prevent contamination of finished products.

Equipment Used:

1. Grape press
2. Cylindrical vessel for decanting grape juice
3. Double-walled boiler (inner -stainless steel) with heater and air pump - for condensation of Badagi
4. Double-walled open-type boiler for processing flour slurry

5. Drying cabinet with stainless steel shelves, temperature control and improved internal ventilation
6. Glassware of any shape and size
7. Vacuum chamber with pump and containers
8. Pressure-resistant cylinder with gearbox
9. Refractometer.

Materials:

1. Grapes, well-ripened, with a sugar content of 20-22% using refractometer, without signs of acidity and rot.
2. Antioxidant: sulfuric anhydride or potassium pyrosulfite.
3. Wheat or corn flour, Grade 1, with a residual moisture content of 12-13%
4. Dried fruits (raisins, walnuts, hazelnuts, almonds, peanuts, etc.)
5. Grape juice, condensed to >80% by weight
6. Enzyme α-amylase, commercial preparation
7. Carbon dioxide gas.

The purpose is to obtain an environmentally friendly product with more attractive organoleptic properties, as well as a radical reduction in labor costs, instead of producing Churchkhela in the traditional way.

Research Objectives:

- Protection of grape juice during concentration: a) from oxidation of flavonoids with or without antioxidant; b) Inhibition of formation of 5-hydroxymethylfurfural (5-HMF);
- Using a new concentration method to speed up the process at low temperatures;
- Treatment of an aqueous suspension of wheat or corn flour with the enzyme α-amylase (production of oligosaccharides containing 5-7 glucose molecules in radicals);
- Achieving optimal specific gravity and residual moisture in the finished product (dense dough), as well as determining the effectiveness of known methods for their determination.

Description and Review of the Research Results. Purification of Grape Juice from Sediments and Obtaining its Concentrate

After crushing the grapes using a traditional device and pouring the juice into an open cylindrical vessel, the sediments removal rate was determined using the recommended dose of antioxidant (0.3g/1L of grape juice; Shatirishvili, et al. [4-6]), as well as the filling level of the vessel using the same indicators. The most optimal time turned out to be filling the vessel with grape juice by 4/5 of its volume and completely cleaning it from sediment — 36 hours, after which grape juice no longer required filtration. The minimum thickening temperature of grape juice poured into an open double-walled boiler was 48-50°C at the beginning of the process, and then, as the concentration increased, it increased to 58°C (concentration - up to 81-82% by weight). At a concentration of 23-65 wt.%, the intensity of thickening (increase in dry matter) per hour was 15-17%. Later (66-80% by weight) this indicator gradually decreased (to 7-8%). The temperature of the heater in the jacket was on average 10-12°C higher than the same temperature of grape juice. The photos below show the discoloration of grape juice, both with and without the antioxidant (Figures 1 & 2). Grape juice processed by.

Figure 1: New technology.

Figure 2: Traditional technology.

Comparative Characteristics of Churchkhela Samples Made by Different Methods

The material taken from the outer shell of Churchkhela samples produced using both traditional and new technologies was tested for the presence of 5-HMF using a qualitative analysis method (Fiehe, 1967, p.10) based on the effect of hydrochloric acid resorcinol on the extract obtained by processing the material with ethyl ether. The appearance of 5-HMF in Churchkhela made using traditional technology should be explained by the interaction of simple sugars and organic acids present in grape juice. As a result of the reaction, a reddish precipitate is formed (the presence of 5- HMF) (Figures 3 & 4). Churchkhela analyzed by Fiehe's test and prepared by the effect of temperature is also evident when comparing finished products by color. When using the traditional method, this phenomenon should be explained by both the oxidation of flavonoids and the formation of 5-HMF.

Figure 3: New technology.

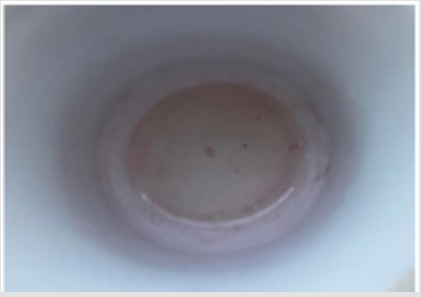

Figure 4: Traditional technology.

Enzymatic Hydrolysis of an Aqueous Flour Suspension and Preparation of a Delicacy

At the next stage of the process, we prepared an aqueous flour suspension in a double-walled open boiler with the addition of a commercial α-amylase preparation (depending on the amount and activity). With constant stirring, the temperature was raised to 80-85°C, kept at this temperature for 10-15 minutes to dilute the starch, then the temperature was raised to 90-92°C and the mixture was concentrated and boiled for 1 hour. After that, we lowered the temperature to 82-85°C and flour from dried fruits was added to the hydrolysate to further concentrate the mixture and sterilize the molds (1.5 hours). At the next stage, the mixture in the form of thick porridge was transferred with a sterile spoon to the sterile shelves of the drying cabinet (T = 60-65°C), concentrated grape juice was added in an amount of 10% of the total mass of flour and intensive drying of the mixture began with increased air consumption, while to increase the drying intensity, the mixture layer was rotated by 180°once an hour, bringing it to a constant mass, at the end of which: 1) specific gravity (at least 1.35 g /cm^3), or 2) residual moisture after treatment at a temperature of 100-105°C (until a constant mass was obtained) was determined.

Packaging and Storage of Finished Products

The finished product was transferred under sterile conditions into glass jars, the lids were not fully closed, and the containers were placed in a vacuum chamber. The air pressure was reduced to a minimum using a pump, and then a weak jet of carbon dioxide was injected into the chamber. After removing the filled jars from the chamber, we quickly closed them with lids and left them to store at room temperature in the dark. Violation of the conditions of preparation (sterilization) of the delicacy is manifested primarily by the appearance of molds (Fungi), which can only be sterilized above 80°C. Using carbon dioxide to store finished products only slows down the oxidation-reduction process. As for the use of dried fruits, if they are covered with colored peel, it is advisable to peel them before chopping (if possible). For example, almond skin is relatively easy to remove after soaking. It is impossible to peel the walnut fruits prepared in this way, so the finished walnut delicacy has a darker color compared to almond and peanut analogues (Figures 5 & 6). Georgian delicacy with.

Figure 5: Walnuts.

Figure 6: Almonds.

Conclusion

1. Churchkhela, traditionally prepared from wheat or corn flour, partially condensed grape juice, and dried fruits (walnuts, hazelnuts, almonds, raisins, etc.), contains undesirable substances in the finished product obtained as a result of processing: oxidized flavonoids, carcinogenic 5-hydroxymethylfurfural and unprocessed starch. It is characterized by a long production process (>220 hours) and, consequently, a high market price.

2. To correct these negative indicators of the specified product, the author has developed a modern biotechnological method, which mainly corrects the following undesirable properties: due to the short processing time (26-28 hours) and low temperature (60-65°C for simple sugars), as well as the action of an antioxidant, the appearance of the above substances in the finished product is prevented, manual labor is significantly reduced and the overall ecological purity is preserved.
3. By reducing the total duration of the process and labor costs, a significant economic effect has been achieved, as well as the technological scheme of the process has been simplified, which will facilitate the release of finished products to foreign markets. Accordingly, this fact will become a significant incentive for entrepreneurial activity in Georgia.

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