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Technology of Sweet Vegetable Semi-Finished Products

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Abstract: Questions about the technological properties of vegetables, in particular, as stabilizers, emulsion and foam structure of food are considered. The data on the use of vegetables for the production of sweet dishes and the improvement of technology, as well as increasing the nutritional value of flour products are presented.

Keywords: vegetables, processing properties, stabilizer, emulsion, culinary products, form of moisture bond, cell walls, protopectin, hemicellulose, puree, paste, biscuit semi-finished product, dough.

INTRODUCTION

According to official data, Uzbekistan continues to increase the production of fruits and vegetables, becoming an increasingly important player in the world market for fruits and vegetables. About 2,950,900 tons of potatoes and 9,945,500 tons of vegetables are produced annually in Uzbekistan.100% natural vegetable products are the most beneficial for human health. They are most useful for human health, increase immunity, cleanse the body, provide the necessary vitamins and minerals, calm the nervous system and treat many human diseases, ensure longevity.

In the light of the task of improving the structure of nutrition of the population of the country, the issue of expanding the use of vegetables in public catering, which are sources of many important nutrients, and improving the technology of their processing, is becoming urgent.

The production of culinary products is based on the implementation of the basic principle of technology: from a detailed study of the properties of products to the choice of a rational method of processing and, on this basis, to the most effective technological design of the process.

As a result of scientific research in recent years in the field of culinary processing of plant products, a lot of new materials have been accumulated on the chemical composition, technological properties of vegetables and their changes during heat treatment.

Vegetables have found widespread use as stabilizers of the emulsion and foam structure of products, including sweet dishes, to improve technology and increase the nutritional value of flour products, meat and fish products.

Vegetables make it possible to intensify the technological process without reducing the taste of the product, improve its balance in the main food components and reduce the excess calorie content. Slow down staling during storage [1].

The weak link of the developed technology is the inadmissibility of the production of vegetable purees at specialized confectionery units for sanitary reasons and the short shelf life of centrally prepared vegetable purees, which seriously complicates their use.

The preservation of vegetable purees (pastes) in storage is to a decisive extent due to the nature of the relationship of moisture with the components of the tissue of products and its mobility. However, this issue has not been sufficiently developed in theoretical and practical terms to date, so scientific research in this area is relevant. They are the scientific basis for the creation of technology for moisture-containing products with an extended shelf life.

Taking into account the above, the goal is to develop a technology for sweet vegetable semi-

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finished products from beets and pumpkin (pastes) with a low sugar content, increased shelf life, suitable for the production of flour confectionery, using the example of biscuit semi-finished product [2].

The results obtained served as a scientific basis for the development of technology and recipes for sweet vegetable semi-finished products (sweet vegetable pastes).

The processing of vegetables into vegetable pastes and their use in the preparation of culinary products made it possible to expand the range, improve the quality of finished products, and reduce the amount of eggs and sugar in biscuit semi-finished products.

When studying the chemical composition of beets and pumpkins, it was considered expedient to include in the study plan the components that decisively determine the water-holding capacity of vegetables. Features of the composition of beets and pumpkin before and after hydrothermal treatment are presented in Table 1. The weight loss during hydrothermal treatment of beets and pumpkin was 8.28% and 17.5%, respectively.

Table 1 Features of the composition of beets and pumpkins before and after hydrothermal treatment

Componentname	Beet		Pumpkin	
	Raw	Boiled	Raw	Stewed
Solidscontent,%	16,96±0,12	14,40±0,14	12,23±0,08	10,82±0,07
Sugars	9,63±0,07	8,54±0,08	6,80±0,07	6,64±0,09
Pectinsubstancesincl.	2,72±0,13	2,26±0,12	1,79±0,18	1,71±0,09
Solublepectin	0,74±0,12	1,03±0,09	0,47±0,17	0,60±0,11
Protopectin	1,98±0,08	1,23±0,11	1,32±0,11	1,11±0,08
Cellwalls	3,84±0,06	2,69±0,09	2,61±0,04	2,41±0,04
Hemicellulose	1,09±0,09	0,73±0,08	0,46±0,10	0,44±0,12
Fiber	0,68±0,04	0,55±0,05	0,68±0,08	0,72±0,09
Nitrogenoussubstances	1,90±0,09	1,75±0,04	0,96±0,02	0,94±0,01
Cinder	0,95±0,01	0,92±0,01	0,85±0,01	0,82±0,01

Among the changes that vegetables undergo in the process of hydrothermal treatment, it is necessary to highlight the destruction of protopectin with the formation of soluble pectin, as well as a change in the mass of vegetables. We believe that we can talk about a certain relationship between the two processes.

In beets, as a result of the destruction of protopectin, highly methoxylated pectin with a degree of esterification of 66.52% is formed, which is in the boiled product in a swollen state, i.e. actively retaining moisture. In pumpkin, as a result of the destruction of protopectin, low methoxylated pectin with a degree of esterification of 39.36% is formed, which is in the boiled product in a dissolved state, i.e. poor moisture retention.

Differences in the properties of the resulting pectins and the structure of vegetables as a whole, to a certain extent, affect the amount of change in their mass as a result of hydrothermal treatment.

An important indicator of the quality of sweet vegetable pastes is the state of moisture in them, as it determines their technological properties in the production of culinary products from flour and stability in storage [3].

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The paper investigates the forms of moisture bond in beets and pumpkin before and after hydrothermal treatment, as well as their components according to the adsorption isotherms of moisture vapor at a temperature of 200 C. ...Egorov.

Analysis of linearized sorption isotherms of beets and pumpkin before and after hydrothermal treatment, and their components, made it possible to establish the boundaries of moisture bond forms at φ = 0 - 0.75, which are shown in Table 2.

Table 2 Forms of moisture bonding in beet, pumpkin tissue and their components(at φ = 0 - 0.75)

Name of objects	Moisture bond forms		
	Moisture of mono molecular ad sorption, %	Moisture of polymolecular adsorption,%	Moisturecapillary-osmotically bound,%
Beets: Raw Boiled	5,17±0,9 5,08±0,82	3,49±0,11 3,32±0,11	31,84±1,12 29,0±1,14
Pumpkin: Raw stewed	4,4±0,15 4,1±0,15	3,4±0,05 3,3±0,05	39,8±0,8 38,1±0,89
Cell walls Beets Pumpkin	7,5±0,7 6,8±0,7	1,36±0,18 1,0±0,18	15,14±0,53 16,2±0,53
Pectinsubstances Beetspumpkin	6,5±0,91 4,8±0,61	2,0±0,89 1,2±0,59	13,0±0,76 15,0±0,63
Hemicellulose BeetsPumpkin	5,8±0,35 5,10±0,35	4,0±0,99 6,0±0,99	22,6±2,4 28,0±2,4
Pulp: Beet Pumpkin	5,6±0,01 6,4±0,1	1,3±0,04 2,6±0,09	12,2±0,03 13,0±0,12

From the data obtained, it follows that the bulk of moisture (at φ = 0-0.75), providing microbial well-being in storage: 31.84% in the tissue of raw beets and 39.8% in the tissue of raw pumpkin is retained by capillary-osmotic forces. After hydrothermal treatment, the nature of the water-holding capacity of the vegetable tissue practically does not change. Capillary-osmotically bound moisture remains the dominant form of moisture bonding in vegetables.

Unlike whole vegetables, in the cell walls of beets and pumpkins, up to 40% of moisture falls on monomolecular and polymolecular bound moisture [4].

Isotherms of moisture sorption of celluloses and pectin substances of beet and pumpkin indicate a significant difference in the sorption activity of these components. The increased sorption activity of pumpkin cellulose reflects its greater looseness in comparison with beet cellulose, which simultaneously explains the lower mechanical strength of the pumpkin tissue.

The increased sorption activity of beet pectin substances is associated with a high degree of methoxylation and, therefore, a high swelling capacity in comparison with tissue pectin substances, which are more soluble.

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It can be assumed that in the case of the formation of jellies by pectin substances, their water-holding capacity can significantly increase due to capillary-bound moisture.

Table 3 presents data on the adsorption capacity of the structural components of beet and pumpkin at different relative humidity.

Table 3 Content and adsorption capacity of structural beet and pumpkin components

Component name	Beet		Pumpkin	
	Content,%	Adsorption capacity,%	Content,%	Adsorption capacity,%
$\varphi = 0,15$				
Drymatter	16,96±0,12	5,17±0,9	12,23±0,08	4,4±0,15
Cellwalls	3,84±0,06	7,5±0,7	2,5±0,04	6,8±0,7
Pectinsubstances	1,9±0,08	6,5±0,91	1,32±0,11	4,8±0,6
Hemicellulose	1,09±0,09	5,8±0,35	0,46±0,10	5,1±0,35
Cellulose	0,68±0,04	5,6±0,01	0,68±0,08	6,4±0,1
$\varphi = 0,4$				
Drymatter	16,96±0,12	8,66±0,7	12,23±0,08	7,5±0,69
Cellwalls	3,84±0,06	8,86±0,5	2,61±0,04	7,08±0,54
Pectinsubstances	1,9±0,08	8,5±0,72	1,32±0,11	6,0±0,69
Hemicellulose	1,09±0,09	9,8±0,28	0,46±0,10	11,0±0,31
Cellulose	0,68±0,04	6,9±0,04	0,68±0,08	9,0±0,06
$\varphi = 0,75$				
Drymatter	16,96±0,12	40,5±0,82	12,23±0,08	47,6±0,91
Cellwalls	3,86±0,06	23,,4±0,64	2,61±0,04	24,0±0,59
Pectinsubstances	1,9±0,08	22,2±0,68	1,32±0,11	22,0±0,64
Hemicellulose	1,09±0,09	32,4±0,31	0,46±0,10	34,0±0,32
Cellulose	0,68±0,04	19,1±0,06	0,68±0,08	22,0±0,08

Analysis of the data allows us to say that individual components of vegetable tissue, according to their share of their contribution to water-retention capacity, can be arranged in the following sequence: pectin substances - hemicelluloses - cellulose.

It was considered possible to increase the water-holding capacity of vegetable purees by boiling, adding sugar, and adjusting the pH of the medium. The last two factors, in addition to their own effects, change the solubility and aggregation capacity of pectin substances [5].

In the process of boiling vegetable purees, simultaneously with an increase in the content of dry substances due to their change, the content of soluble pectin and reducing sugars increased (Table 4).

The intended use of vegetable pastes provides, as a desirable requirement, sufficiently high viscous-plastic indicators, ensuring the ease of acceptance and preservation of the given forms.

Taking into account the requirements for the taste of products in the experiment, the puree was boiled down to a dry matter content of 30%.

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Table 4 Content of pectin and reducing sugars in pureefrom beets and pumpkin before and after boiling

Name of puree	Content, %	
	pectin	Reducing sugars
Beetroot puree		
Initial	1,03±0,09	0,64±0,17
After boiling	1,58±0,17	1,28±0,24
Pumpkin puree		
Initial	0,60±0,11	3,26±0,18
After boiling	0,90±0,18	7,49±0,22

In order to reduce the activity of water in sweet vegetable pastes, at the end of boiling, granulated sugar was introduced in an amount of 5.10.15.20% to the mass of boiled puree and citric acid to a pH value of 3.2 - 3.5.

It was taken into account that the pectin substances of vegetables in the obtained systems

can form a gelatinous framework and, accordingly, reduce the mobility of water in systems.

The given data reflect the specificity of the structure of pastes with different sugar content. When sugar is added to the puree in an amount of 5.10 and 15%, a gelatinous structure is formed in the system, characteristic of pectin-containing confectionery masses, which can be explained by a change in the properties of water with the introduction of sugar, a decrease in the solubility of pectin substances and their interaction [6].

The subsequent increase in sugar concentration is accompanied by salting out of pectin substances, as a result of a decrease in solubility below the optimum for the process of gelation and excessive interaction, and a corresponding drop in the viscosity of the systems.

The same nature of the change in viscosity and the formation of structure in beet and pumpkin puree pastes with the addition of sugar suggests that, under experimental conditions, pumpkin pectin substances with a low degree of esterification form a gelatinous framework, which they usually form when calcium salts are introduced into the system. In our opinion, the formation of a jelly carcass in pumpkin pastes in this case can be explained as follows. In an acidic medium, at the residues of galacturonic acid in the chains of rhamnogalacturonan, monovalent metal ions are replaced by hydrogen ions, followed by a decrease in the degree of dissociation of carboxyl groups. That is, as noted above, there is a decrease in the solubility of pectin substances and favorable conditions are created for the formation of a jelly carcass.

As a result of the formation of a jelly frame, the mobility of water sharply decreases and conditions are created for satisfactory preservation of pastes in storage.

The results of microbiological analysis make it possible to recommend in production conditions to store pastes at 4-6C for up to 30 days, at 18-20C for up to 5 days.

A recipe and technology for sweet vegetable pastes based on beets and pumpkin have been developed. Fig. 1 shows a technological scheme for the production of sweet vegetable pastes.

RESEARCH PARKS

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Technological scheme of sweet, vegetable semi-finished products (pastes)

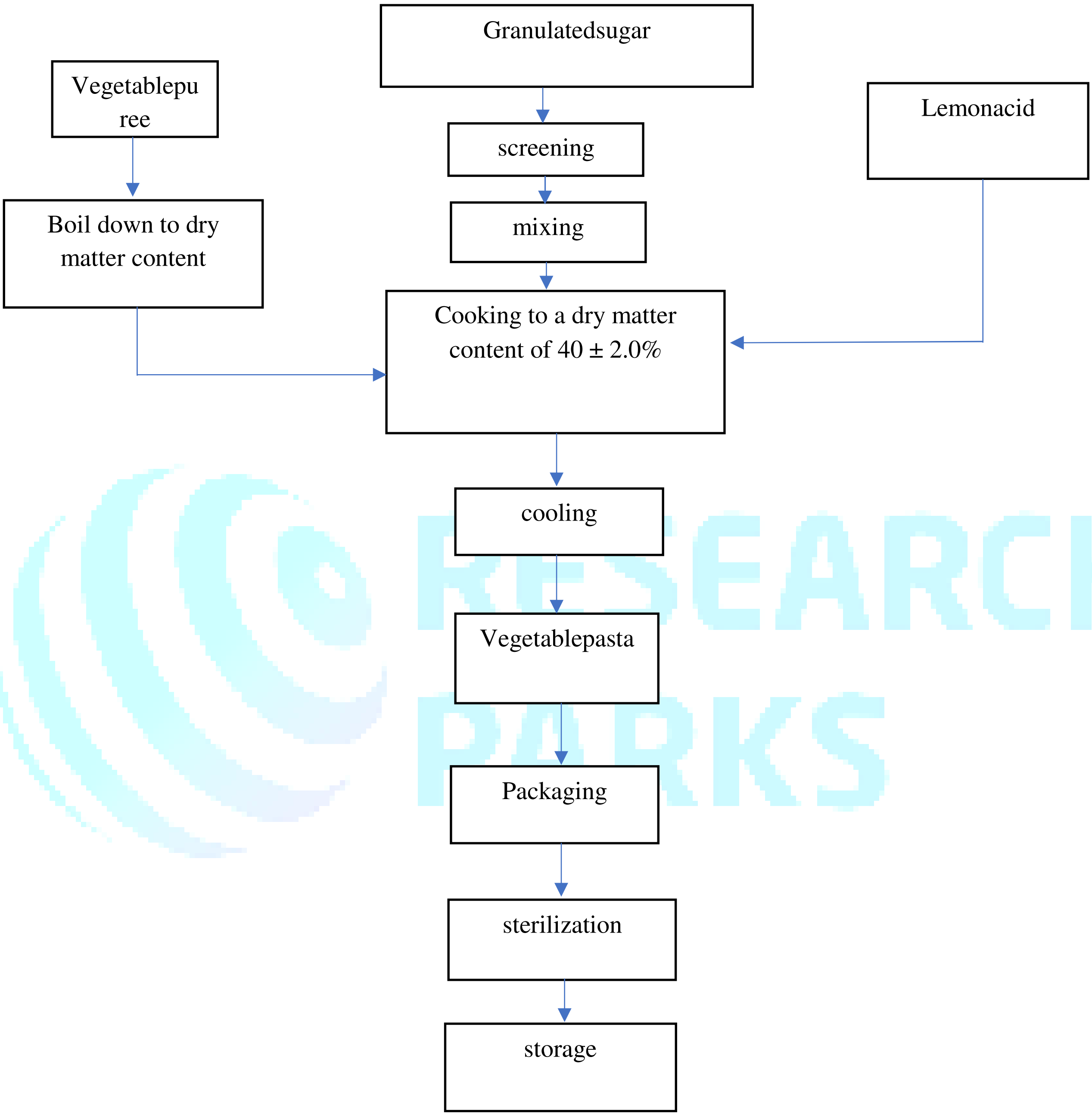

Fig. 1 Technological scheme of sweet, vegetable semi-finished products (pastes)

Table 5 shows data on the quality indicators of sweet vegetable pastes.

Sweet vegetable pastes make it possible to intensify the technological process of the production of flour products, without reducing the taste of flour products, improve their balance in the main food components, reduce excess calorie content, and slow down staling during storage.

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Table 5 Characteristics of sweet vegetable beetroot and pumpkin pastes.

Indicators	Beetpaste	Pumpkinpaste
Drymatter, notless,%	40,0±2,0	40,0±2,0
Sugar, notless,%	19,0±2,0	22,0±2,0
pH Wednesday, nomore	3,2±3,5	3,2±3,5

As a result of the studies performed, the relationship between the degree of esterification of pectin substances in beets and pumpkin and the amount of moisture lost by them during hydrothermal treatment was noted, the water-holding capacity of beets and pumpkin before and after hydrothermal treatment was studied by the analysis of sorption isotherms, the water-holding ability of the cell walls of beets and pumpkin was established. the degree of participation of pectin substances, hemicelluloses, beet and pumpkin cellulose in the binding of moisture in relation to the peculiarities of their structure and composition, optimal ratios have been established in sweet vegetable pastes of vegetable purees, sugar, pH of the medium, which provide the structure of products with reduced water mobility and stability in storage ...

The results obtained served as a scientific basis for the development of technology and recipes for sweet vegetable semi-finished products (sweet vegetable pastes).

The processing of vegetables into vegetable pastes and their use in the preparation of culinary products made it possible to expand the range, improve the quality of finished products, and reduce the amount of eggs and sugar in biscuit semi-finished products.

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