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IMPROVEMENT OF ZEFIR PRODUCTION BY ADDITION OF THE DEVELOPED BLENDED FRUIT AND VEGETABLE PASTEINTO ITS RECIPE

An. Zahorulko
PhD, Senior Lecturer*
E-mail: zagorulkoAN@hduht.edu.ua
Al. Zagorulko
PhD, Associate Professor*
E-mail: zagorulko@hduht.edu.ua
K. Kasabova
PhD, Associate Professor**
E-mail: Kasabova_kateryna@hduht.edu.ua
N. Shmatchenko
PhD, Senior Lecturer**
E-mail: shmatchenko_nat@hduht.edu.ua
*Department of Processes, Devices and Automation of Food Production***
Department of Technology of Bakery, Confectionary, Pasta and Food Concentrates*
***Kharkiv State University of Food Technology and Trade
Klochkivska str., 333, Kharkiv, Ukraine, 61051

Розроблено спосіб виробництва плодоовочевого пастоподібного напівфабрикату на основі яблука сорту Антонівка, гарбуза сорту мускатна Перлина та буряку сорту Бона. Спосіб відрізняється проведенням концентрування в щадних температурних режимах (50…55 °С) у роторному плівковому апараті до вмісту 45 % сухих речовин протягом 1,25…2,0 хв. Встановлено структурно-механічні характеристики пюре компонентів сировини і купажованих концентрованих паст за розробленим способом. Підтверджено зміцнення структури розробленої плодоовочевої пасти, оскільки її максимальна динамічна в'язкість складає 283 Па·с, що в 1,9 рази більше в порівнянні з контролем (яблучною пастою). Це дозволило виділити раціональну композицію для проведення подальших досліджень з вмістом компонентів у пасті: яблука – 60 %; гарбуз – 20 %; буряк – 20 % (композиція 1). Вона в порівнянні з контролем має підвищений вміст фізіологічно-функціональних інгредієнтів та володіє гарними органолептичними властивостями.

Підтверджено доцільність використання у рецептурному складі зефіру розробленої плодоовочевої пасти (композиція 1) у кількості 75 % заміни яблучного пюре. Обраний зразок зефіру відрізняється оригінальними органолептичними властивостями. При цьому забезпечується зростання ефективної в'язкості ($\eta_{еф}$, Па·с) зефіру з заміною 75 % яблучного пюре купажованою пастою в порівнянні контролем (зефір без домішок) з 391 до 782. Також спостерігається зміцнення пластичної міцності (P_k) в залежності від тривалості: 75 % – 54,2 кПа (контрольний зразок – 47 кПа), що в цілому є позитивним явищем з технологічної точки зору. Це дозволить забезпечити споживачів продуктами харчування з фізіологічно-функціональними інгредієнтами природного походження за умов частковоїабо повної заміни окремої сировини на купажовану плодоовочеву композицію, що забезпечить підвищення їх функціональної дії

Ключові слова: плодоовочева паста, купажування,-структурно-механічні властивості,фізіологічно-функціональні інгредієнти, піноподібна маса, структуроутворення

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1. Introduction

Today in the markets of many countries there is a shortage of functional products with therapeutic and prophylactic properties. Therefore, the primary task of the food industry is to resolve this issue by expanding the range of products of this group. The low consumption of physiologically functional ingredients (PFI) can lead to an increase in a number of diseases, especially in children. The natural source of these substances is fruit and vegetable raw materials, capable of providing the consumer with the necessary physiological and nutrients to the maximum. Even a partial introduction of fruit and vegetable raw materials into food products can provide an increase in their functional action, for example, an increase in the content of pectin to promote the removal of heavy metals from the human body [1]. The growing demand for healthy nutrition is driving the development of the food industry through the introduction of innovative technologies. One of the mechanisms for obtaining a balanced diet is the production of functional products, in particular confectionery with health-improving properties. Ensuring the expansion of the assortment of "healthy foods" is possible by partially or completely replacing individual raw materials with a low content of physiologically functional components with blended fruit and vegetable composition, which will provide an increase in their nutritional value [2]. Confirming the relevance of scientific and practical work on the production of functional products by improving methods for the production of semi-finished fruit and vegetable products, as well as combined foods based on them.

2. Literaturereviewandproblemstatement

In [3], studies are presented to evaluate the component content of a portion of a person's daily needs to determine the amount of health food in it in order to establish the necessary standards for ensuring a daily diet. But the question of what percentage should occupy plant raw materials in the diet has not been fully determined. This is due to the diversity of the range of these raw materials, the difficulty of creating generalized characteristics of its use in various proportions and the advisability of research in this direction. An important role is also played by an increase in demand for quality food products of plant origin at an affordable cost. This necessitates the preservation of the initial properties of natural raw materials, the determination of its structure, nutrient content and energy value, as well as the improvement of technological and hardware solutions for the production of health food products have natural raw materials in their composition [4]. Modern fruit-and-vegetable pasty semi-finished products can fully meet the demand of consumer cooperation in all respects by maximizing the preservation of their quality during technological operations [5]. The use of fruit and vegetable pasty semi-finished foods in the diet will eliminate the seasonality of the population's use of natural functional products.

Now, in most cases, the processing of fruit and vegetable raw materials into paste-like semi-finished products is carried out on domestic lines, in comparison with foreign counterparts they have significant specific resource costs. At the same time, the conduct of heat exchange processes does not correspond to the basic laws on stabilization of thermodynamic parameters, which leads to a decrease in the quality of the products obtained. Obtaining high-quality pasty semi-finished products of a high degree of readiness is provided by using modern resource-efficient heat and mass transfer equipment with rational parameters during preliminary and main heat treatment [6].

Today, the consciousness of a healthy diet at the consumer is focused on the use of functional products [7], which have a highPFI content and high quality. This necessitates the improvement of methods and apparatus solutions for the production of functional products with the introduction of vegetable semi-finished products in its recipe. The work [8] emphasizes the need for an active search for raw materials with natural functional ingredients necessary for the consumer in a difficult environmental situation. The complexity of the production of the original natural composition is due to the initial properties, blended by the ratio of the components and further studies of their influence on the resulting structure. One of such solutions is the introduction of pollen granules and honey into the recipe for the Chak-Chak confectionery, which makes it possible to obtain a product with a high nutrient content [8]. The obtained results confirm the feasibility of introducing plant impurities in the formulation of food products for the production of natural products, but require further research in the manufacture of other products.

In [9], the need to determine the structural and mechanical properties of the resulting fruit and vegetable paste-like semi-finished products, as well as confectionery based on them, is noted. Since their accounting allows to determine the effect of plant materials on the structure of the products. The question of consistency of products while calculating pipeline transport and working units of technological equipment remains unclear. Since the technological and hardware solution as a whole is decisive, they determine the expediency of studying the rheological properties at all stages of production.

The authors of [10] established the rheological properties of children's vegetable purees at various temperatures (5...65 °C). The range of shear rates (5...200 s^{-1}) depending on the duration is established. The influence of pH, temperature, and glucose addition on the rheological behavior of vegetable purees (peach, papaya, and mango) was also established in [11], focusing on the need to determine the structural and mechanical properties to obtain high-quality functional products.

Most of the zefirs on the market have a small nutritional value, namely vitamins, dietary fiber and other nutrients necessary for nutrition. This indicates the feasibility of enriching confectionery with herbal supplements, bringing pleasure to consumer cooperation, in particular to children [13]. In [14], a method for the production of zefirs with partial application of mashed potatoes from wild raw materials (physalis, viburnum and thorns) was proposed. The proposed replacement of apple puree with 5 % puree of viburnum, 15 % puree of physalis and 10 % puree of thorns has been found to have a healing effect compared to traditional (on apple puree). The content of pectin and fiber, flavonols increases 3 times, flavonoids by 36 % and anthocyanins by 57 %. A comparison of the vitamin-mineral composition of traditional zefirs and mashed potatoes with wild berries confirms in the latter an increase in the content of iron, potassium, phosphorus and ß-carotene.

The manufactured confectionery products most often contain synthetic dyes and flavorings, the use of which leads only to negative consequences, therefore the development of new types of natural herbal supplements with fruit and berry, vegetable and spicy aromatic raw materials (mashed potatoes, pastes, concentrated juices, powders) with a high PFI content, the use of which will increase the biological value of zefirs and give products high organoleptic quality indicators without the use of additional dyes and flavorings [15]. Unresolved issues remain in the rational improvement of existing methods for the production of functional products, blended is the ratio of natural raw materials in the compositions and the proportion of their introduction into the formulation of the main product to obtain original natural organoleptic properties. The foregoing determines the feasibility of scientific research in these areas.

The increase in demand for functional products necessitates the search for modern technological solutions to meet the needs of consumers. The production of functional products is a complex technological task, requires maximum analysis of all stages of manufacturing with tight control. This is especially true for products with partial or full introduction of natural components in their formulations, in particular confectionery. Particular attention should be paid to heat and mass transfer operations in the manufacture of multi-component pasty products. In most cases, they are obtained by blending a variety of natural raw materials into single compositions, which in turn need to determine the resulting structural-mechanical and organoleptic properties. Taking into account the percentage of introducing blended natural semi-finished products into confectionery products will ensure their original taste and structural-mechanical properties. It will increase their competitiveness, ensure the expansion of the range of functional products and increase the PFI content. The above confirms the advisability of scientific research in this direction to provide consumers with high-quality natural functional products, in particular zefirs.

3. The aim and objectives of research

The aim of research is improvement of the technology for the production of functional zefirswith the introduction of the developed fruit and vegetable paste. This will expand the range of high-quality competitive products of high nutritional value, both in the domestic and foreign markets.

To achieve the aim, the following objectives are set:

– suggest ways to improve the production method of fruit and vegetable paste-like semi-finished product and establish its structural and mechanical properties with quality indicators;

– determine the rational amount of introduction of the developed fruit and vegetable paste in the technology of zefirs, to study its structural and mechanical properties and organoleptic quality indicators.

4. Materials and research methods of fruit and vegetable purees and pastes

The implementation of these tasks for research was carried out on the basis of the Scientific Research Center "New Biotechnologies and Equipment for the Production of Food Products with High Health-Improving Properties" at Kharkiv State University of FOOD Technology and Trade (Ukraine).

During the study of the fruit and vegetable semi-finished product, the main raw materials used were apple (Antonovka varieties), pumpkin (Muscat pearl varieties), beets (Bona varieties) with a high content of biologically active substances and therapeutic and prophylactic properties. The resulting structure-mechanical properties of one-component mashed potatoes, blended pastes with different formulation ratios of the main raw materials and, respectively, zefir products with the addition of the developed paste are determined. The rheological properties of the test samples were determined on a Reotest-2 rotational viscometer (Germany).

The study of the organoleptic properties of the prototypes was carried out by an expert commission consisting of 5 members of the Kharkiv State University of FOOD Technology and Trade (Kharkiv, Ukraine) on a 5-point scale.

5. Improvement of the zefir production technology by introducing developed blended fruit and vegetable paste into its recipe

5. 1. Establishment of ways to improve the production method of fruit and vegetable paste-like semi-finished product and determine its structural and mechanical properties with quality indicators

During studies of ways to improve the method of manufacturing a paste-like semi-finished product, it is proposed that the recipe composition of blended compositions of fruit and vegetable pastes is considered taking into account the BAS, the organoleptic and structural-mechanical properties of each component to the consistency of the resulting product. Structuring agents are all selected components with significant pectin content. Selected raw materials with a high content of dietary fiber (DF) and have therapeutic and prophylactic properties on the human body [16].

The production of blended multicomponent fruit and vegetable pastes is carried out according to the recipe ratio of the components (Table 1) as follows: apple puree, pumpkin and beetroot puree are prepared according to the current technology for the production of fruit and vegetable purees. The resulting purees are mixed according to the recipe ratio. After it is preheated (45...50 °C), followed by concentration at a temperature of 50...55 °C in a rotary film apparatus (RFA) to a dry matter content (DM) of 45 % for 1.25...2, 0 min [17].

Table 1

Prescription ratio of fruit and vegetable components in the compositions

Components	Composition		
	1	2	3
Apple	60	65	60
Pumpkin	20	20	30
Beet	20	15	10
Control, %	100	100	100

In the production of blended compositions, a necessary component is the determination of rheological properties in order to establish their structure. The sliding characteristics of the mashed potatoes of each component are determined (Fig. 1), and apple puree is used as a control. All dependences are satisfactorily described by equation (1)

$$\theta-\theta_0=K_1\cdot\gamma^n, \quad (1)$$

where θ_0 – the ultimate shear stress, Pa; K_1– a coefficient proportional to the viscosity of the velocity gradient equal to unity, Pa·cn; γ – shear rate, s^{-1}; n – the flow index.

The threshold shear stress θ_0 is determined: apple – 9 Pa, pumpkin – 36 Pa, beet – 54 Pa (Fig. 1), which confirms that the raw materials belong to imperfectly plastic hard bodies. The increase in the ultimate shear stress for all fruit and vegetable raw materials in comparison with the control is explained primarily by the high content of DM and pectin substances.

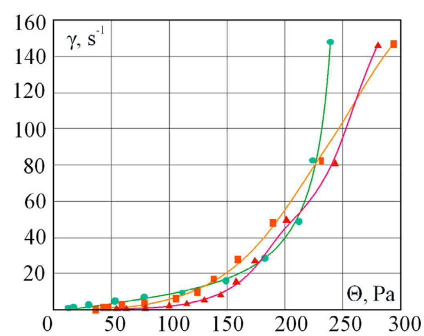

Fig. 1. Shear characteristic of mashed potatoes (t=20 °C): ● – apple, Antonovka varieties; ■ – pumpkin, Muscat Pearl varieties; ▲ – beets, Bona varieties

The complete rheological curves of blended pasty semi-finished products according to the recipe (Table 1) from fruit and vegetable raw materials are presented in Fig. 2. These dependences are described by equation 2 (Fig. 3):

$$\eta_{ef}=B\cdot\gamma^{-m}, \quad (2)$$

where B – the effective viscosity at a single value of the velocity gradient, Pa·s; γ –shear rate, s^{-1}; m – destruction rate of the structure.

The maximum value of the effective viscosity η_{ef} (Pa·s) of the studied pastes is for samples of compositions: 1 – 283;

2 – 252; 3 – 195 and controls – 147, respectively. So the recipe ratio is proposed and the raw material selected in the developed blended paste leads to an increase in the effective viscosity index in comparison with the control (apple paste), which positively affects the strengthening of the resulting structure.

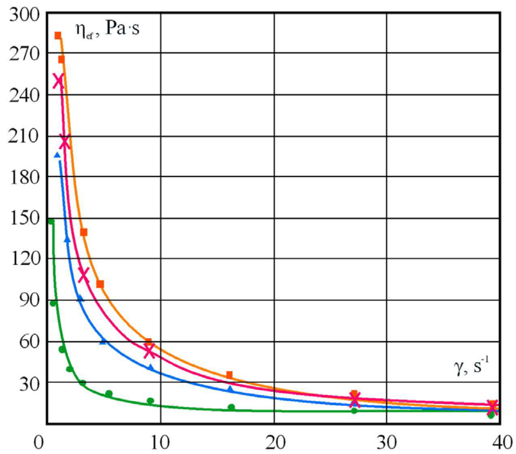

Fig. 2. Complete rheological curve of pastes at t=20 °C: ● – control (apple paste); ■ – composition 1; ✕ – composition 2; ▲ – composition 3

To establish the optimal prescription ratio of the presented samples, their organoleptic evaluation is carried out (Table 2).

Table 2

The results of the organoleptic evaluation of the compositions of fruit and vegetable pastes

Indicator	Characteristics		
	Composition 1	Composition 2	Composition 3
appearance	Homogeneous mashed puree mass without seeds and mashed particles of the skin		
Taste and smell	Pleasant harmonious taste of pumpkin and beetroot	Strong taste and smell of beets, pumpkin is almost not felt	The beet smell and taste are almost absent; pronounced pumpkin
Colour	Hot pink	Pink	light pink
Consistency	Homogeneous spreading mass		

According to organoleptic characteristics, composition 1 has a pleasant harmonious taste of pumpkins and beets, composition 2 has a pronounced taste and smell of beets, and composition 3 has pumpkins. The color of the third composition is not as bright as in the first and second. The introduction of pumpkins and beets in large quantities – provides an unpleasant specific taste, and a small amount leads to deterioration in the color scheme of the paste. Thus, the best indicators are composition 1 with a prescription ratio of components: apple – 60 %; pumpkin – 20 %; beets – 20 % compared with 2 and 3 compositions. Assessment of the chemical composition recommended for further studies of fruit and vegetable paste (composition 1) in comparison with the control (apple paste), Table 3 [16], confirms the enrichment of the PFI composition.

The resulting paste (composition 1), made by an improved method in comparison with apple paste (control), is characterized by an increased content of pectin substances by 1.6 times, and ascorbic acid by 2.7 times (Table 3).

Table 3

Comparison of the chemical composition of pastes

Chemical composition	Unit	Apple paste (control)	Composition 1	Composition 2	Composition 3
Dry matter	%	45,0±2,3	45,0±2,3	45,0±2,3	45,0±2,3
Amount of sugars		11,0±0,6	11,75±0,6	11,54±0,6	11,93±0,6
Pectin substances		3,47±0,2	5,71±0,3	5,44±0,3	5,82±0,3
Ascorbic acid	mg in 100 g	21,05±1,1	57,25±2,9	57,03±2,8	57,38±2,8
Carotene		–	2,12±0,01	2,06±0,01	2,25±0,01
Anthocyanins		107±5,4	66±3,3	64,3±3,2	61±3,0
Catechins		105±5,3	63±3,1	62,4±3,1	63,6±3,2
Betanin		–	40±2,0	38,7±1,9	40,2±2,0
Active acidity	pH	3,03±0,15	3,2±0,16	3,13±0,15	3,23±0,16

5. 2. The rational amount of making fruit and vegetable paste in zefir technology

The general technology for the production of zefirs includes the following technological stages:

– preparation of raw materials;

– preparation of agar-sugar-syrup syrup and zefir mass of its formation, structure formation and drying of zefirs, dusting with powdered sugar.

By changing the introduced proportion of the content of fruit and vegetable paste in the formulation of zefir masses, it is possible to adjust and predict the resulting nutritional value and consistency.

The paper proposes the introduction of 25 %, 50 %, 75 % and 100 % of the developed blended paste (composition 1) into the zefir technology with the replacement of apple puree with the subsequent determination of the structural and mechanical properties (Fig. 3). The control sample is zefirwithout additives.

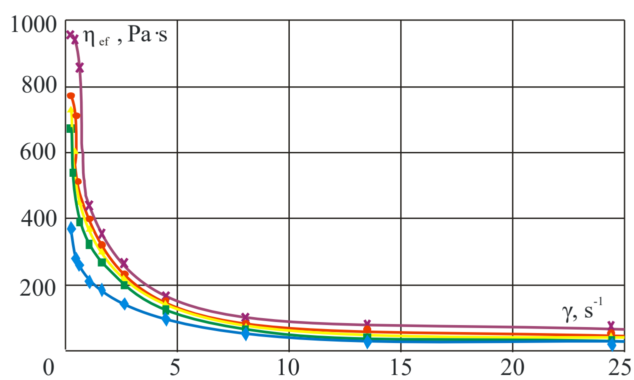

Fig. 3. The complete rheological curve of the zefir mass for t=20 °C: ♦ –control (zefir without additives); and with the replacement of apple puree with fruit and vegetable paste, % replacement: ■ – 25; ▲ – 50; ● – 75; ✕ – 100

Fig. 3 shows the change in dynamic viscosity and shear rate depending on the amount of replacement of apple puree with blended paste. The maximum value of the dynamic viscosity η_{ef}, Pa·s for zefirs is: control – 391; with the replacement of apple puree in the amount of: 25 % – 695, 50 % – 743, 75 % – 782 and 100 % – 967, respectively. Let's also study the process of structure formation depending on the duration (Fig. 4) by determining the plastic strength of the zefirmass on the structure measurer (C-1) using equation (3):

$$P_k = K \cdot F / h^2, \quad (3)$$

where P_k – the plastic strength, kPa; F – the maximum force when moving the surface up, N; h – surface displacement, m; K=0.658.

The minimum plastic strength P_k has a control sample of 47 kPa. For samples with apple puree replacement in the amount of: 25 % – 48.3 kPa, 50 % – 50.7 kPa, 75 % – 54.2 kPa and 100 % – 56.9 kPa, respectively. The analysis of the obtained curves confirms the previous statement that the partial or complete replacement of apple puree with fruit and vegetable paste in the zefir formulation provides an increase in the structure formation indices during the formation of zefir masses reducing its duration, which is a positive phenomenon from a technological point of view. The inherent plastic strength of the samples is sufficient for the structure-forming abilities of the products.

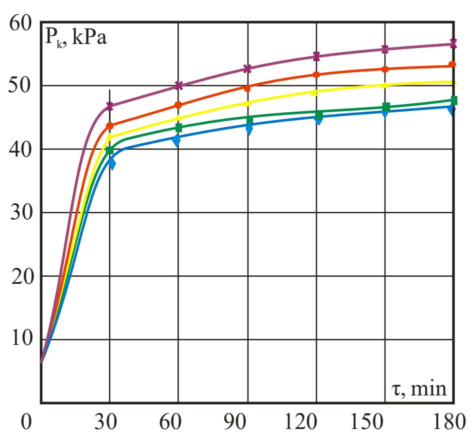

Fig. 4. The dependence of the plastic strength of zefirs on the duration of maturation at a temperature of 20 °C: ♦ – control; with the replacement of apple puree with fruit and vegetable paste, % of replacement: ■ – 25; ▲ – 50; ● – 75; ✕ – 100

To determine the rational content of fruit and vegetable paste in zefir samples, their organoleptic and physicochemical parameters are compared (Table 4).

It is established that the addition of blended fruit and vegetable paste leads to a change, first of all: the taste, aroma and color of the zefir. So, when replacing apple puree with blended paste in an amount of 25 % by weight of the puree, the organoleptic characteristics of the zefir are close to the control sample, only the color acquires a light pink hue. When replaced at 50 % and 75 %, the color of the product becomes light pink and pink, respectively. At 50 % replacement, a light pleasant taste of the paste appears, and at 75 % replacement, the taste becomes more pronounced. In a sample with a complete replacement of apple puree, the taste and smell become not characteristic of zefirs, the color is close to beetroot hue, which negatively affects the appearance, texture, structure of the zefir and its consumer properties in general.

6. Discussion of the results of the production of zefirs with the introduction of fruit and vegetable paste

On the basis of an improved method for the production of fruit and vegetable paste-like semi-finished products, the proposed experimental compositions are based on: apples, Antonovka varieties, pumpkin, nutmeg varieties Pearl, beets, Bona varieties. Blending with a different ratio of raw materials will allow to obtain functional semi-finished products with the necessary structural, mechanical and organoleptic properties, which necessitates research in this direction. To ensure maximum preservation of the initial properties of natural raw materials in the compositions of its concentration, gentle temperatures (50...55 °C) are carried out in RFA to the content of 45 %DM for 1.25...2.0 minutes. The limiting bias stresses q_0 of the mashed potatoes of each individual raw material are determined: apple – 9 Pa, pumpkin – 36 Pa, beet – 54 Pa (Fig. 1) and the effective viscosity η_{ef}(Pa·s) of the investigated blended pastes, for sample compositions 1 – 283; 2 – 252; 3 – 195 and control – 147, respectively (Fig. 2). A comparison of the rheological and organoleptic characteristics of all the experimental samples confirms the effectiveness of the further use of blended composition 1 from the prescription ratio: apple – 60 %; pumpkin – 20 %; beets – 20 % (Table 1, 2). It also has an advantage when comparing its chemical composition with the control (apple paste), due to the enrichment of the composition of the PFI (Table 3).

Table 4

Organoleptic and physico-chemical characteristics of zefir samples

Indicator	Characteristics (when replacing apple puree, %)				
	«Control»zefir	25 %	50 %	75 %	100 %
Taste and smell	Specific to this product	Peculiar to this product, the paste is not felt	Light smell and taste of paste	Pronounced smell and taste of paste	Excessive taste and pungent paste
Colour	white	white with a touch of pink	light pink	pink	beetroot
consistency	Soft, easy to break				Soft, middle fluid
structure	Inherent in this product, foamy, uniform				spreadable
surface	Inherent to this product, without rough hardening on the side faces and the allocation of syrup				
Mass fraction of dry matters, %	80,0	81,5	82,0	83,0	85,0
Mass fraction of reducing substances, %	7,5	7,9	8,2	8,5	8,7
Density, kg/m^3	490,0	509,0	518,0	525,0	528,0
Total acidity, degrees	6,8	7,4	7,8	8,2	9,2

The influence of the content of fruit and vegetable paste (composition 1, Table 1) in the formulation of zefir masses is determined to identify the regulatory and predictive component relative to the resulting nutritional value and consistency. Subject to making it within 25 %, 50 %, 75 % and 100 % with the replacement of apple puree. It is confirmed that dynamic viscosity η_{ef} is strengthened with zefir samples with apple puree replacement in the amount of: 25 % – 695 Pa·s, 50 % – 743 Pa·s, 75 % – 782 Pa·s and 100 % – 967 Pa·s, respectively, compared to the control (391 Pa·s) (Fig. 3). The obtained results of structure formation, depending on the duration, are characterized by an increase in the minimum plastic strength $P_k$compared to the control (47 kPa): with replacement: 25 % –48.3 kPa, 50 % – 50.7 kPa, 75 % – 54.2 kPa and 100 % – 56.9 kPa, respectively (Fig. 4). This confirms the preliminary conclusion on ensuring an increase in the indicators of structure formation during the formation of zefir masses and a reduction in their duration due to the partial or complete replacement of apple puree with fruit and vegetable paste in the zefir recipe. It has been established that a rational amount of blending paste is 75 %. Such a percentage of paste application in zefir technology provides an increase in the effective viscosity and structure formation parameters in the control mixture, which have the best original taste properties (Table 4).

The introduction of an improved technology for the production of zefirs with the introduction of the developed fruit and vegetable paste in accordance with the research results confirms the relevance of the research area. Ensuring the expansion of the range of high-quality competitive products of functional purpose with original natural organoleptic properties and a high content of PFI.

The main advantage of a technologically engineering solution is the use of modern methods for the production of functional products based on fruitful raw materials. A significant role is played by the qualitative approach when blending pastes to ensure original compositions in conditions of taking into account physicochemical and structural-mechanical properties. Not only in the obtained blended compositions, but in the finished product as a whole. Non-compliance with generally sparing temperature conditions, the formulation ratio of the components in the compositions and taking into account the influence of the fraction of its introduction can lead to a change in the output properties of the raw material. Reducing the content of PFI and reducing the consumer properties of the resulting products.

To date, many works have implemented methods for optimizing the formulation of zefirs to ensure its functionality by introducing diverse natural filler [18]. But the influence of the natural filler on the resulting organoleptic and functional physiological properties of the finished product remains fully defined. This determines the feasibility of this area of research to ensure the expansion of the range of functional products.

In the future, it is planned to conduct more detailed studies using a variety of natural raw materials obtained in gentle production conditions and establishing the shelf life of the obtained zefir with the addition of concentrates. To achieve maximum competitiveness of the products obtained by providing them with original organoleptic and structural-mechanical properties with a natural content of PFI. Studies are also planned to determine the change in the quality of prototypes at all stages of production by determining their color formation.

7. Conclusions

1. A method is developed for concentrating blended mashed potatoes with the content of components (60 % apple, 20 % pumpkin, 20 % beet). Further concentration is carried out in a rotary film apparatus to a DM content of 45 % at gentle temperatures (50...55 °C) for 1.25...2.0 min, compared with traditional vacuum-evaporators. The structural and mechanical characteristics of puree components and blended compositions are established. The strengthening of the obtained structure of the developed paste is confirmed, since its maximum dynamic viscosity is 283 Pa·s, 1.9 times more than apple paste (control). A paste composition has been developed in comparison with the control, has a high content of PFI and has good organoleptic properties.

2. The feasibility of using the developed fruit and vegetable paste (composition 1) in the amount of 75 % when replacing apple puree in the recipe is confirmed. The selected zefir sample differs in its original organoleptic properties. This ensures an increase in the dynamic viscosity (η_{ef}, Pa·s) of zefirs with the replacement of 75 % of apple puree blended with paste compared to the control (zefirs without impurities) from 391 to 782. The plastic strength (P_k) also increases depending on the duration: 75 % – 54.2 kPa (control sample – 47 kPa), which is generally a positive phenomenon from a technological point of view.

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