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PRODUCTION OF BAKERY PRODUCTS FROM FROZEN DOUGH PIECES USING A CRYOPROTECTANT AS A YEAST CELL STABILIZER

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Abstract:
One of the most promising and young technologies in Russia in the baking industry is the production of baked goods from frozen convenience foods. The adoption of such a decision, due to the modern rhythm of life, in connection with which consumers of bakery products, the need for semi-finished products that can be prepared without a large investment in time. The paper presents the results of a study of the effect of pectin as a cryoprotectant. The options for defrosting and baking.

Keywords: *pectin, bakery technology, defrosting, baking, proofing.*

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INTRODUCTION:

An important component of the food pyramid, always remain bakery products. Consumers of bakery products prefer freshly baked products, at any time of the day, in a wide range, produced in the traditional way, with useful properties, hypoallergenic, and most importantly, tasty. But there are problems with the satisfaction of this demand - skilled personnel and expensive retail space. Modern food industry has found several solutions to this problem - “semi-finished technologies” (BakeOffTechnologies, BOT).
Semi-finished technology implies the implementation of the most labor-intensive and time-consuming operations at traditional bakeries, and the final baking and processing of products must be carried out in small businesses, shops or at home with minimal labor and equipment.

Most often, three semi-finished technologies are used - this is work with frozen non-yeast dough, with frozen partially baked semi-finished products and not frozen partially baked semi-finished products.

The use of production, frozen yeast-free dough, requires highly qualified specialists and is not inferior in quality to traditional bakery products. The production of this type of product requires a very large amount of time, but such products are very popular. The production of partially baked semi-finished product and the production of partially baked non-frozen semi-finished product does not require highly qualified specialists, the cooking time is usually less than an hour, but their production requires high energy costs.

Today, much attention is paid to the production of frozen frozen dough. The main problem is the death of a yeast cell as a result of the formation of ice crystals and changes in osmotic pressure, both in the cell itself and in the environment [1, 2].
The rate of freezing dough pieces, is a very important factor that directly affects the baking yeast. At a lower freezing rate, yeast cells are stored much better [3].

Most often, in practice, a method of rapid freezing of dough pieces is used. Studies conducted by the authors L. V. Kim, O. Neyrneuf [4], and others showed that rapid freezing adversely affects yeast cells. This is due to the formation of ice crystals, into which free moisture passes in the dough, an increase in osmotic pressure on both sides of the yeast cell membrane also occurs.

In the works of M. Havet, W. Lu [5, 6], the process of freezing is considered, it directly affects the rheological properties of the test, due to the ratio of free and bound moisture in the test. During storage, the amount of free moisture in the dough becomes larger, this leads to dehydration of the food matrix, because of this process changes occur in the rheological properties of the dough.

The effect of dough proofing on the quality of the finished product, before freezing, was studied by many scientists, and practice has shown that it is better to freeze after molding, in order to minimize the stage of fermentation and active growth of yeast. The dough temperature at the kneading should be 20 ° C, since the high temperature at the dough kneading deteriorates the quality of the finished product [7, 8].
To prevent the formation of ice crystals, cryoprotectants are used in frozen food technology. This is a substance that protects a product that is subject to freezing from hypothermia. Cryoprotectors are used in the practice of cryogenic technology because of their ability to stabilize the properties of food products or semi-finished products during storage [9-11].

In the role of cryoprotectant for bakery products sucrose, fructose, sorbitol can act, but their disadvantage is the sweet taste attached to the product when they are added [12].

In the preliminary results of the studies [13, 14], the rationale for selecting pectin as a cryoprotectant is given, the optimal dosage of pectin is determined by mathematical modeling, and studies of the functional, technological and rheological properties of the model test with the addition of pectin are given.

The purpose of this work is to develop scientific and practical recommendations on the use of frozen dough billet with a cryoprotector for the production of bakery products at home, to study the quality of the finished product.

MATERIAL AND METHODS:

Microbiological research methods for the evaluation of semi-finished products used generally accepted in Russia. The physical and rheological properties of the dough were determined in accordance with the methods of GOST R 51404-99 and GOST R 51415-99 [14, 15]. Organoleptic quality assessment of bread and bakery products is carried out in accordance with the requirements of GOST 5670-96, GOST R 52462-2005 [16, 17].

RESULTS AND DISCUSSION:

The effect of defrosting conditions on the quality of frozen test semi-finished products.

At the first stage of the study, model test preparations of 2 control, 2 with pectin added, 2 with sorbitol and 2 with fructose, in an amount of 1.5% of the flour weight, were prepared on the basis of previous studies to determine the optimal dosage of cryoprotectant [12, 13]. The dough was kneaded in a dough mixer with the addition of prescription ingredients and the required amount of water with a temperature of 20 ° C. After kneading and molding dough. To preserve the yeast in the inactivated state and increase their survival, there was no proofing of the model test. Freezing was performed by a slow method at a temperature of minus 24 ° C without air movement. The blanks were frozen until reaching the center of the product minus 18 ° C and stored for a month at a temperature of minus 18 °C.

To conduct research to determine the optimal method of defrosting at home, the defrosting of dough pieces was done in two ways. The first method: thawed under ambient conditions at an air temperature of 25 ° C. Defrosting duration is two hours. At the same time, the defrosting process was accompanied with an additional proofing process.

The second method: defrosting was performed under conditions of an electromagnetic field of ultra high frequencies (EMF microwave) with a radiation power of 100 watts for 10 minutes. After that, leave the dough for 20 minutes to redistribute moisture

Figure 1 shows the samples after proofing.

Figure 1: The effect of defrost on the quality of semi-finished products
(in the first variant defrosting in the microwave EMP, experiments were foreseen: 1 - adding pectin, 2 - adding sorbitol, 3 - adding fructose, 4 - control sample; in the second variant, defrosting in shop conditions: 5 - adding pectin, 6 - adding sorbitol, 7- addition of fructose, 8- control sample)

It should be noted that during defrosting in the microwave EMF in the dough with the addition of pectin, the fermentation process began faster and more intensively, compared to other samples, the proofing process accelerated, compared to defrosting at home. We assume that this is due to the active function of pectin as a cryoprotectant. At the same time, during defrosting in the EMF microwave, a strong drying of the surface of the dough piece was observed.

Testing modes of proofing and baking frozen semi-finished products.

The duration of proofing of frozen dough pieces after defrosting is significantly longer than that of a traditional dough, which is due to two factors: lower temperature of thawed blanks placed in a proofer and a certain decrease in the gas-holding capacity of the dough and activity of the yeast under the influence of the freezing process. To compensate for their influence, the proofing is carried out at elevated temperatures - 32 °C for bread and up to 42 °C - for products of small mass. The reason for the uneven fermentation and, consequently, the leeward outer layers of dough and the central part with poor proofing, may be a large temperature gradient in the dough for bakery products. The use of a higher relative humidity of 85–90%, compared with the traditional 75%, can lead to the appearance of blisters and light spots on the crust of the baked product.

The proofing of frozen semi-finished products thawed in microwave EMF was 35–40 min, compared to home proofing, which lasted 85–90 min, Figure 2.

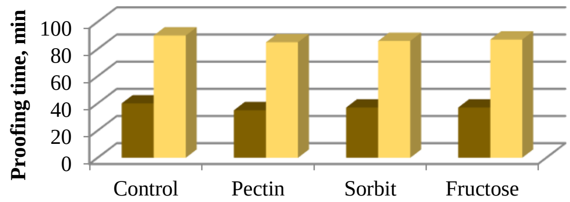

Figure 2: The effect of defrosting test semi-finished products on the duration of proofing

In the finished baked products was carried out a comparative description of the physico-chemical quality indicators presented in table 1.

Table 1: Physical and chemical indicators of bread quality

Name of the indicator	The value of the indicators during defrosting in							
	EMP microwave				Home conditions			
	Control	Cryoprotector			Control	Cryoprotector		
		pectin	sorbitol	fructose		pectin	sorbitol	fructose
The moisture content of the crumb,%	42,4	43,0	43,5	42,3	41,6	40,0	40,5	41,5
Crumb acidity, hail	1,4	1,6	1,4	1,6	1,4	1,6	1,4	1,4
The porosity of the crumb,%	77,1	81,4	78,6	77,0	77,4	78,2	73,8	74,8

A comparative characteristic of organoleptic quality indicators was also carried out, the data are presented in Table 2 and in Figure 3.

Table 2: Organoleptic characteristics of bread

Name of the indicator	The value of the indicators during defrosting in							
	EMP microwave				Home conditions			
	Control	With pectin	With sorbitol	With fructose	Control	With pectin	With sorbitol	With fructose
Appearance: Form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form	Corresponds to the bread form

Name of the indicator	The value of the indicators during defrosting in							
	EMP microwave				Home conditions			
	Control	With pectin	With sorbitol	With fructose	Control	With pectin	With sorbitol	With fructose
Surface	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions	Smooth without cracks and explosions
Colour	Yellow	Light yellow	Brown	Yellow	Light brown	Light brown	Light brown	Brown
Crumb condition:	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic	Baked, not wet elastic
Baked	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials	Without lumps and traces of unmixed raw materials
Intermix conditions	Developed, not thin-walled	Developed, thin-walled	Developed, thin-walled	Developed, not thin-walled	Developed, thin-walled	Developed, thin-walled	Developed, thin-walled	Developed, thin-walled
Porosity	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product
Taste	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product	Peculiar to this product

Figure 3: Finished products (defrosting in EMI microwave: 1 - with the addition of fructose, 2 - control sample, 3 - with the addition of pectin, 4 - with the addition of sorbitol; defrosting in the conditions of the workshop: 5 - with the addition of fructose, 6 - control sample, 7- with the addition of pectin, 8- with the addition of sorbitol)

From the data in Tables 1, 2, it can be seen that bread with the introduction of pectin into the dough, samples No. 3 and No. 7 are distinguished from all the experimental variants, as for organoleptic indicators - appearance, surface, color, crumb condition, porosity, appearance, smell , as well as by physicochemical parameters - humidity, acidity, porosity, which makes it possible to select a sample with pectin, as it most fully meets consumer properties.

The choice of a rational mode for baking bakery products from frozen convenience foods.

To select the optimum temperature for baking bread from frozen semi-finished products, two methods were tested: at temperatures from 180 to 220 ° C, and at temperatures of 250 ° C with pre-frying and a reduction to 220 ° C, Figure 4.

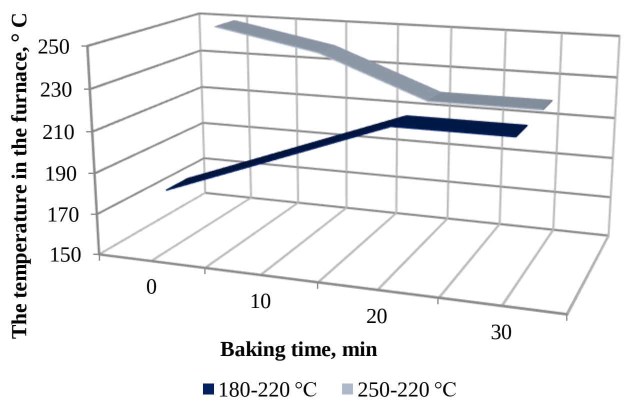

Figure 4: Temperature variation with various baking options.

With the baking mode from 250 to 220 ° C, organoleptic quality indicators were slightly higher than at temperatures from 180 to 220 ° C, Figure 5, 6.

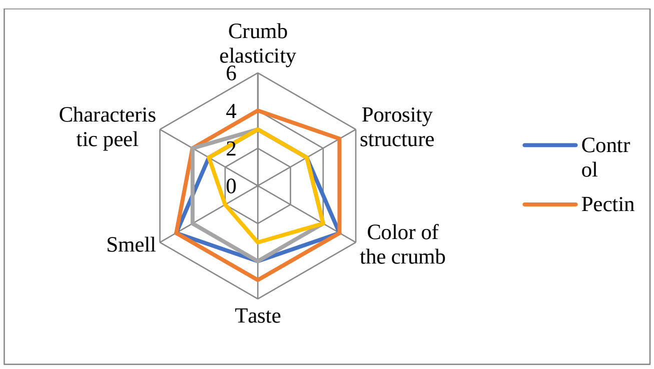

Figure 5: A nomogram of bread quality at a baking temperature of 180-220 ° C

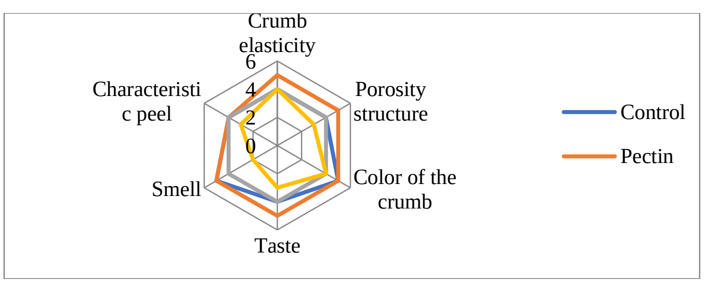

Figure 6: A nomogram of bread quality at a baking temperature of 250-220 ° C

Physical and chemical indicators of the quality of bread in both baking modes did not differ much, table 3.

Table 3: Physical and chemical indicators of bread quality

Name of the indicator	Baking at a temperature of 180-220 ° C				Baking at a temperature of 250-220 ºC			
	Control	With pectin	With sorbitol	With fructose	Control	With pectin	With sorbitol	With fructose
The moisture content of the crumb,%	45,7	43,5	42,6	41,6	45,8	44,9	43,3	42,7
Crumb acidity, hail	1,5	1,9	1,7	1,6	1,5	1,8	1,7	1,6
The porosity of the crumb,%	76,1	81,4	78,4	78,1	77,1	79,9	74,2	75,3

But since when choosing the mode, it is necessary to take into account energy costs, and in the case of baking temperatures from 250 to 220 ° C they are larger than at baking temperatures from 180 to 220 ° C, the option with a temperature of 180-220 ° C was chosen.

CONCLUSION:

The optimal method for defrosting the dough piece is substantiated. The use of EMI microwave allows you to reduce the process by 1.5 hours. The use of pectin as a cryoprotectant increases the survival of yeast cells by up to 98% compared with the control by 80%.

It was revealed that the best indicators of the quality of the finished bread are achieved using the EMF microwave method of defrosting test semi-finished products, taking into account the energy consumption, a rational baking method was chosen with an initial temperature of 180 ° C and baking at 220 ° C, the porosity of bread in this case was 78.2%.

REFERENCES:

1. Kenijz N.V., Sokol N.V. Pectic substances and their functional role in bread-making from frozen semi-finished products. European Online Journal of Natural and Social Sciences, 2013; 2(2): 253-256.
2. Kenijz N. V. The influence of pectin as a cryoprotectant on the water-absorbing ability of the dough and yeast cells. Bulletin of Kazan State Agrarian University, 2013; 3(29): 67-69.
3. Kitissu A. P. 2009. Development of the quick-frozen test semi-finished products technology after proofing. dis. ... cand. those. Sciences: 05.18.07, 05.18.04.KitissuAkoete Pol. St. Petersburg Russia.
4. Novikov V. M. 1971. Production of frozen finih. Handbook of Fishery Technology. Vol. 1.
5. Havet M., Mankai M., Le B. A. Influence of the freezing condition on the baking performances of French frozen dough. J. Of Food Engineering, 2000; # 45: 139-145.
6. Lu W., Grant L.A. Effects of prolonged storage at freezing temperatures on starch and baking quality of frozen doughs. Cereal Chemistry, 1999; 76 (5):656-662.
7. Judith A. Evans. 2010. Frozen Foods Production and Implementation: Translation from English. V.D. Shirokova. St. Petersburg, Russia: Profession.
8. Romanov A.S., Ilina O.A., Iunikhina V.S., Kraus S.V. 2016. Bread and bakery products. Raw materials, technology, range: studies. benefit. Moscow, Russia: DeLi plus.
9. Labutina N.V. 2004. Improving the Efficiency of Bakery Products from Frozen Semi-Finished Products Using Rye Flour: Dis. ... Dr. tech. Sciences: 05.18.01. Moscow, Russia.
10. Pushkar N.S., Shrago M.I., Belous A.M., Kalugin Yu. V. 1978. Cryoprotectors. Kiev, USSR: Naukova Dumka.
11. Deutscheback Deep Freezing Technology: Special Baking Concentrates Optimize the Quality of Bakery Products. Deutscheback. Bakery Products, 2011; # 9: 36-37.
12. Kenijz N.V., Sokol N.V. Technology of bread production from frozen semi-finished products using pectin as a cryoprotector. Bulletin of Michurinsky State Agrarian University, 2011; # 2-2: 92-94.
13. Kenijz N.V., Koshchaev A.G., Nesterenko A.A., Omarov R.S., Shlykov S.N. Study the effect of cryoprotectants on the activity of yeast cells and

the moisture state in dough. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 2018; 9(6): 1789-1796.

14. GOST R 51404-99. 1999. Physical characteristics of the test. Determination of water absorption and rheological properties using a farinograph. Moscow, Russia: Publishing house of standards.
15. GOST R 51415-99. 1999. Physical characteristics of the test. Determination of rheological properties using alveograph. Moscow, Russia: Publishing house of standards.
16. GOST 5670-96. 1991. Bakery products. Methods for the determination of acidity. Moscow, Russia: Publishing house of standards.
17. GOST R 52462-2005. 2005. Bakery products from wheat flour. General technical conditions. Moscow, Russia: Publishing house of standards.