

DEVELOPMENT OF A FUNCTIONAL BREAD PRODUCT BASED ON ROSE HIP
POWDER AS A NATURAL ANTIOXIDANT SOURCE

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Annotation: *This chapter presents a comprehensive study on the influence of rose hip powder on the quality indicators of national bakery products. The research combines experimental findings with theoretical analysis to substantiate the effect of different dosages of rose hip powder on the technological process. The impact of the additive on dough rheological properties, fermentation dynamics, and gas formation intensity has been thoroughly investigated. Particular attention is given to how varying concentrations affect dough structure, stability, and the overall baking performance. Furthermore, the study evaluates changes in organoleptic characteristics, physicochemical parameters, and the nutritional value of the finished products. Based on the obtained results, optimal dosages of rose hip powder have been established for both simple and enriched bakery formulations, ensuring improved functional properties without compromising product quality. In addition, an assessment of the projected economic efficiency of implementing enriched flatbread production under industrial conditions has been carried out, demonstrating the practical feasibility and commercial potential of the proposed technology.*

Key words: *bread products, cooking technology, test indicators, quality physico-chemical characteristics of the finished product, rose hip powder, flour, uzbek breads, Proteins, Fats, Carbohydrates, Fiber, Organic acids, Carotenoids.*

Purpose and objectives of the research. A preliminary analysis of the chemical composition of rose hip powder (RH) revealed that it is a rich source of vitamin C, polyphenolic compounds, organic acids, carotenoids, and dietary fiber. The presence of these biologically active components indicates that RH has significant potential as a functional ingredient capable of enhancing both the technological properties of flour-based semi-finished products and the nutritional and biological value of finished bakery goods. In addition, the antioxidant nature of rose hip powder suggests its possible role in improving product stability and slowing staling processes. The primary purpose of this research was to scientifically substantiate the feasibility of using rose hip powder in the production of simple Uzbek flatbreads and to determine its optimal dosage within the formulation.

- ✓ To achieve this goal, the following objectives were established:
- ✓ To study the effect of different dosages of rose hip powder introduced by partially replacing an equivalent amount of grade I wheat flour.

- ✓ To evaluate the influence of RH on dough rheological properties, including elasticity, extensibility, water absorption capacity, and structural-mechanical behavior.
- ✓ To analyze changes in fermentation dynamics and gas formation intensity during dough development.
- ✓ To assess the impact of RH addition on organoleptic characteristics such as appearance, crust and crumb color, taste, aroma, and texture.
- ✓ To determine variations in physicochemical parameters, including moisture content, acidity, porosity, and specific volume.
- ✓ To evaluate the improvement of nutritional value, particularly antioxidant activity and dietary fiber enrichment.
- ✓ To establish the optimal dosage ensuring improved functional properties without negatively affecting product quality.

The study was aimed not only at enhancing the nutritional profile of traditional Uzbek flatbread but also at developing a scientifically grounded approach for producing functional bakery products with increased biological value and industrial applicability.

The results obtained and their analysis. The recipe for Obi-non flatbreads was used as a prototype. The dough was prepared from 1st grade wheat flour in a straight method according to the presented recipe (control) and with the addition of 3.0, 5.0 and 7.0% PS with the replacement of a similar amount of flour (experiment).

The flour used for a series of laboratory baking was characterized as “medium” in strength (68 units IDK-1) with normal gas-forming ability (1354 cm³ CO₂) and, in accordance with the requirements of O'zDSt 1313:2009, belonged to the I quality group.

It was established that the studied additives had a certain effect on the properties of the dough and the quality of the finished products. The results of the study are shown in tables 1.-4 and figures 1-2.

The experimental data obtained on the effect of PS dosage on quantity and quality are shown in Table 1.

Table 1.

The influence of food additives on the amount of gluten washed from dough and its structural and mechanical properties

Indicators	Value of indicators of washed gluten from dough prepared with the addition of PSH, % by weight of flour			
	without additives	3,0	5,0	
Gluten yield,%:				
raw	30,6	29,7	29,0	28,4
dry	12,2	12,0	11,8	11,6
Hydration capacity, %	151,0	147,5	145,8	144,8

Resistance to deforming load, , units, $H_{\text{деф}}^{\text{ИДК}}$	68	64	61	60
Extensibility, cm	13,7	12,8	12,0	11,7

It was established (Table 1.1) that increasing the dosage of the studied additives led to a natural decrease in the mass fraction of gluten in the dough. In the test samples, with an increase in the PS dosage, the yield of wet gluten naturally decreased from 3.0 to 7.2% and dry gluten from 1.6 to 5.0% relative to the control sample. This pattern is due to the absence of the main components of gluten in the studied additive, namely the gliadin and glutenin fractions of the protein, as well as the increased water absorption capacity relative to flour, which led to a decrease in the amount of free water necessary for the formation of gluten. The strengthening of wheat flour gluten is also associated with the content of ascorbic acid in the powder, which causes the oxidation of sulfhydryl groups and the formation of disulfide bridge bonds. At the same time, which is quite natural, a strengthening of gluten was noted, including due to organic acids introduced from PG.

Strengthening the gluten also led to a decrease in the degree of spreadability of the dough ball (Fig. 1). It was established (Table 1.) that increasing the dosage of the studied additives led to a natural decrease in the mass fraction of gluten in the dough. In the test samples, with an increase in the PS dosage, the yield of wet gluten naturally decreased from 3.0 to 7.2% and dry gluten from 1.6 to 5.0% relative to the control sample. This pattern is due to the absence of the main components of gluten in the studied additive, namely the gliadin and glutenin fractions of the protein, as well as the increased water absorption capacity relative to flour, which led to a decrease in the amount of free water necessary for the formation of gluten. The strengthening of wheat flour gluten is also associated with the content of ascorbic acid in the powder, which causes the oxidation of sulfhydryl groups and the formation of disulfide bridge bonds. At the same time, which is quite natural, a strengthening of gluten was noted, including due to organic acids introduced from PG.

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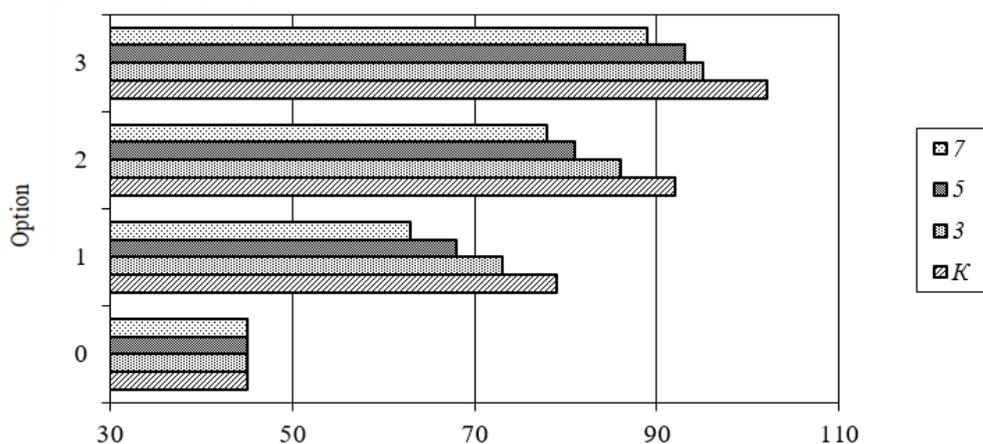


Figure 1.- Effect of PS dosage on the spreadability of the dough ball

A study of the dynamics of acid accumulation in the dough showed that an increase in the dosage of PS leads to a natural increase in the titratable acidity of the dough during the fermentation process, which helps to shorten this process by an average of 0.5 hours (Fig. 2).

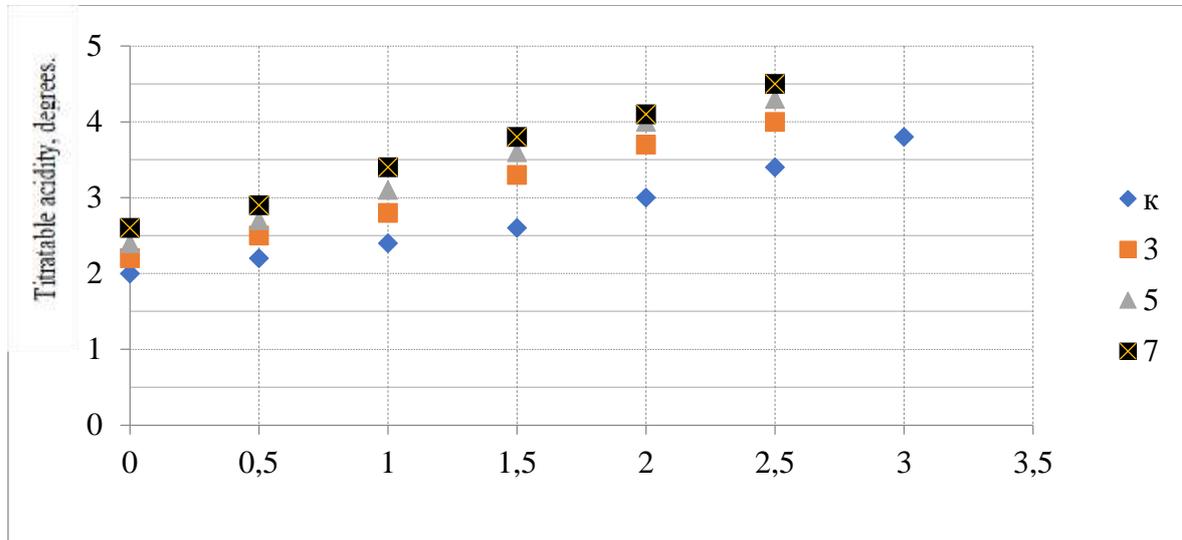


Figure 2 – Effect of PS dosage on acid accumulation during dough fermentation

The influence of the studied additive on the dynamics of gas formation in the dough was established (Fig. 1.2).

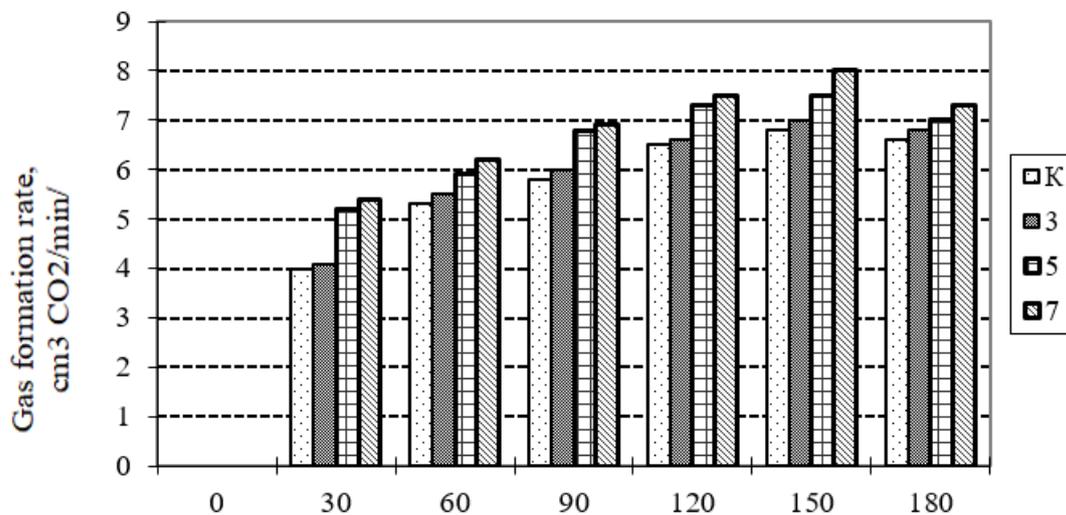


Figure 3 - Dynamics of gas formation in the dough depending on the dosage of PS

Research has shown that with an increase in the powder dosage, the rate of CO₂ accumulation during fermentation increased by almost 1.5 times compared to the control (Fig. 4.3.). This is due to the high content of mono- and disaccharides, vitamins and minerals in the additive under study, which stimulate the activity of yeast microflora in the dough. However, adding more than 5.0% of the flour weight to flour leads to a loss of CO₂ due to the limited elasticity of the gluten framework. Therefore, in further studies, namely during a series of laboratory baking of flat cakes, the amount of added powder was limited to 5.0%.

Quality indicators of finished products are given in Table 2.

Table 2

Effect of PS on the quality of plain flatbreads

Indicators	Meaning of indicators	
	Control (without additives)	
Appearance: Form surface Color	Correct, round, without pressing Smooth, glossy, without tears, cracks or dark blisters From light yellow to brown	Brown
Characteristic aroma	Выраженный, свойственный	Слабо выраженный аромат добавки
Characteristic taste	Свойственный данному виду изделий	
Crumb condition: bakedness porosity Traffic	Baked, not sticky, not wet to the touch, elastic Developed, small No lumps or traces of unmixing	
Crumb moisture, %	42,0	42,5
Crumb acidity, grad	3,2	3,5
Exit, %	120	122

Analysis of the results of the organoleptic evaluation of flatbreads showed that the addition of PS to the recipe has a beneficial effect on all indicators of the finished products, especially taste and aroma. The humidity and acidity of the products meet the requirements for this type of product.

Based on the results of the research, production recipes for this type of product (Table 3) and technological regulations (see appendix) were developed and approved.

Table 3

Recipe for preparing Obi-non flatbreads

name of raw materials	Raw material consumption, % (kg)
Wheat baking flour, 1-st grade	95,00
Rose hip powder	5,00
Pressed baker's yeast	1,50
Table salt	1,50
Cottonseed oil for lubrication	0,15
Total	103,15

It should be noted that when using PF, it is recommended to increase the humidity of the dough by an average of 1.0 - 2.0% due to the difference in humidity with wheat flour and increased water absorption capacity. As a result, product yield can be increased to 2.0%.

Next, the effect of PS on the nutritional value and calorie content of finished products was determined. A comparative analysis of the nutritional value of the control and experimental samples, as well as the results of calculating the degree of satisfaction of the need for basic nutrients, are given in Table 1.4.

These indicators were calculated according to the methodology developed by the All-Russian Research Institute of Chemical Chemistry, the degree of satisfaction of the need for nutrients - through a comparative analysis with WHO standard indicators.

Table 4

Nutritional value and degree of satisfaction of daily needs for basic nutrients of Obi-non flatbreads with 5.0% PS

Nutrients	Contents of 0.3 kg of flatbreads prepared with the addition		Daily allowance need	Degree of satisfaction of daily needs for food nutrients (%) due to flatbreads prepared with the addition of	
	without additives	5,0% ПIII		without additives	c 5,0% ПIII
Proteins, g	26,50	25,22	80-90 (85)	31,18	29,67
Fats, g	3,75	3,70	80-100 (90)	4,17	4,11
Carbohydrates, g	169,50	164,72	382	44,37	43,12
Fiber, g	0,50	3,50	25	2,00	14,00
Organic acids, g	-	0,64	2	-	32,00
Carotenoids, mg	-	0,74	3,0-5,0 (4,0)	-	18,50
Minerals, mg:					
iron (Fe)	5,25	5,27	15	35,00	35,13
calcium (Ca)	60,00	63,84	900	6,70	7,10
magnesium Mg)	110,00	105,07	400	27,50	26,26
phosphorus (P)	287,50	271,00	1250	23,00	21,68
Calorie content, kcal	775	752	2850	27,20	26,38

Analysis of the data in Table 4 showed that in the test samples with 5.0% PS the content of proteins, fats and carbohydrates decreased. At the same time, the degree of satisfaction of an adult's daily need for dietary fiber (fiber) increased by 7.0 times, organic acids by 32.0 times, carotenoids by 18.5 times and Ca by 1.1 times compared to products without additives. The calorie content of prototype flat cakes weighing 0.3 kg decreased by 23 kcal.

Thus, the feasibility of using the studied PS in the production of simple Uzbek flatbreads has been proven, which leads to a reduction in the duration of the technological process of their preparation by 0.5 hours and a reduction in the calorie content of the products.

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