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Received 30.03.2026
Revised 15.05.2026
Accepted 19.05.2026

https://doi.org/10.53360/2788-7995-2026-2(22)-48

IRSTI: 65.33.39

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THE EFFECT OF ROSE HIP LEAF EXTRACT ON THE QUALITATIVE AND MICROBIOLOGICAL INDICATORS OF WHOLE GRAIN BREAD

Annotation: *An analysis was conducted of the organoleptic, physicochemical, and microbiological parameters of the finished product to determine the effect of rosehip leaf extract on the quality parameters of whole-grain bread and its shelf life.*

Rosehip leaf extract was used as a plant raw material. The effective amount of rosehip leaf extract has been established. Rosehip leaf extract contains biologically active substances belonging to different

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classes of compounds: flavonoids, tannins, glycosides, alkaloids, organic acids, which increase the microbiological safety of grain and products. Whole grain bread was stored at room temperature (t= 20 ÷ 25 0C) at a high humidity of 40-50%.

The number of mesophilic aerobic and facultatively anaerobic microorganisms was not detected after 96 hours in the bread sample containing 4% rosehip leaf extract. In the control sample, an increase in the number of mesophilic aerobic and facultatively anaerobic microorganisms was observed after 24 hours of storage. On the second day, mold growth appeared in the control sample, whereas no mold was detected in the bread sample supplemented with 4% rosehip leaf extract. The results of the study demonstrated that rosehip leaf extract improves the microbiological safety and stability of the product by inhibiting the growth of microorganisms and mold. The results obtained indicate that rosehip leaf extract increases the nutritional value of the finished product and extends its shelf life. Thus, bakery products with rosehip leaf extract can be stored for 72 to 96 hours.

Key words: *bread, microbiological indicators, plant raw materials, extract, quality.*

Introduction

In recent years, flour and baked goods have increasingly been affected by various microorganisms. Relatively heterogeneous microbial populations of bacteria belonging to the genus Bacillus, such as Bacillus subtilis and Bacillus mesentericus, pose a serious challenge for manufacturers. The potential solution to this problem lies in the direct correlation between the content of biologically active compounds in certain unique natural food additives/ingredients and their antibacterial potential [1, 2].

One of the core principles of the concept of healthy eating is that these foods must not only meet the human body's needs for nutrients and energy, but also ensure food safety [3]. More attention is being paid to the development of functional foods. Research in this area is ongoing, so the list of functional ingredients is constantly expanding. To enhance the microbiological and toxicological safety, nutritional value, and organoleptic properties of baked goods, rosehip leaf extract was used in their composition [4].

Rosehip extract contains plant phenols, ascorbates, tocopherols and carotenoids, biologically active to antioxidants. In addition, they are one of the main sources of biologically active substances with even minimal bactericidal effect [5-7]. The problem of bakery products is associated with high microbiological contamination of grain and low-quality flour. Increased safety can be achieved by adjusting the chemical composition of products using simple raw materials and introducing various food additives that allow you to obtain products with functional properties [8]. Therefore, in order to improve and preserve its quality, it is very important to use rosehip leaf extract, which prevents the microbiological destruction of whole-grain bread [9].

Materials

The main objects of the study are a whole grain bread product, an extract from rosehip leaves.

Whole grains are the main source of energy and carbohydrates for human nutrition worldwide (Tab. 1).

Table 1 – Recipe and technological mode of whole grain bread

Whole grain bread recipe	
Raw material name:	Added amount of product
Whole wheat flour	70 g
Wheat flour	30 g
Table salt	3 g
Pressed Baker's Yeast Rosehip Extract	4 g
Water	Calculated at 46.5% humidity
Technological mode of whole grain bread	
Name of indicators	Value
Duration of Kneading Dough, min	7-8 min
Duration of opening of the dough, min	170-180 min
Duration of dough arc, min	5-10 min
Weight of the dough blank, G	200 g
Duration of maturation of the dough blank, min	35 min
Temperature in the improvement cabinet, °C	35-40 °C
Relative air humidity, %	70-80 %
Duration of bread baking, °C	60 min

Products with all morphological and anatomical parts of the grain, in particular grain bread, make it possible to replenish the necessary amount of these nutrients, are rich in dietary fibers, which are effective sorbents. It is known that eating whole grain products lowers blood cholesterol levels, increases intestinal motility, and improves metabolic processes.

Rosehip extract contains some of the main active ingredients such as flavonoids, tannins, anthocyanins, phenolic compounds, organic acids and inorganic compounds, as well as dietary fiber. In this regard, rosehip extract can be used to enrich bakery products with dietary fiber and increase shelf life.

Methods

To obtain an extract from vegetable beer, water, ethyl alcohol with various concentrations and other extractants are used, sometimes with the addition of acid, alkali, glycerin, chloroform, etc.

And in this work, rosehip leaves were collected in the fall of 2019 in the mountainous regions of the Almaty region. The leaf and stems are strictly washed in distilled water and dried at room temperature under sterile conditions. The higher leaves and stems were crushed and extracted with 50% ethanol at room temperature (25 ±2 °C) for 20 hours. The supernatants are sucked out in a vacuum at 50 °C using a rotary evaporator and the remaining dry extract is scraped off the bottom.

Based on data from scientific studies, an optimal rosehip leaf extract concentration of 4% was selected to determine its effect on the quality and microbiological indicators of whole-grain bread.

During the study of the effect of rosehip leaf extract on the quality and microbiological indicators of whole-grain bread, classical microbiological analysis methods were used: the count of mesophilic aerobic and facultative-anaerobic microorganisms (MAFAM) was determined in accordance with GOST 10444.15-94 [10].

The enumeration of molds and yeasts was carried out in accordance with GOST 10444.12-88 [11].

Determination of the quality of bread by organoleptic indicators is made by paying attention to its correctness of shape, appearance, color of the crust, color and elasticity of the soft medium, condition of porosity, taste and aroma. The organoleptic indicator of bread is determined according to GOST 5667-2022

Methods for assessing physico-chemical indicators of bread

Determination of Physico-Chemical indicators is carried out at least 3 hours after receiving bakery products made from whole wheat flour weighing more than 200 g from the oven.

Determination of moisture content of sawdust-according to GOST 21094-75.

Determination of the acidity of sawdust-according to GOST 5670-96.

Determination of porosity-according to GOST 5669-96.

The experiments were carried out in triplicate and the results were given as mean values of the ± standard deviation. Statistical analysis was carried out using standard methods of variational statistics.

Results

To determine the effect of rosehip leaf extract on the quality parameters and shelf life of bread made from whole-grain flour, the finished product was analyzed for organoleptic, physicochemical, and microbiological characteristics. The control was a sample baked without the plant extract [12].

At the Almaty Technological University, members of the tasting committee conducted a tasting of a new type of bread with rosehip leaf extract. Bread with rosehip leaf extract is made in the laboratory conditions of the Department "Food Safety and quality" of Almaty Technological University.

The following bread samples were presented for sensory evaluation:

Sample № 1 – control sample

Sample № 2 – bread with 2.0% rosehip leaf extract addition

Sample № 3 – bread with 3.0% rosehip leaf extract addition

Sample № 4 – bread with 4.0% rosehip leaf extract addition

Sample № 5 – bread with 5.0% rosehip leaf extract addition

Sample № 6 – bread with 6.0% rosehip leaf extract addition

The tasting assessment of the studied bread samples was carried out on a 5-point scale of organoleptic quality indicators (Tab. 2)

Table 2 – Tasting results

Name of indicators	Samples					
	bread with 2.0% rosehip leaf extract addition	bread with 3.0% rosehip leaf extract addition	bread with 4.0% rosehip leaf extract addition	bread with 5.0% rosehip leaf extract addition	bread with 6.0% rosehip leaf extract addition	Control sample
	Evaluation of indicators taking into account coefficients X_i K_i					
form of bread	4,2±0,02	4,2±0,02	4,2±0,02	4,0±0,02	4,0±0,02	4,2±0,02
the outer surface of the bread	4,2±0,04	4,2±0,02	4,3±0,02	4,0±0,02	3,9±0,02	4,3±0,02
color	4,8±0,03	4,8±0,03	4,8±0,03	4,0±0,02	3,8±0,02	4,8±0,03
Ripe middle of bread	4,8±0,01	4,8±0,01	4,8±0,01	4,3±0,01	4,0±0,01	4,8±0,01
Porosity	4,0±0,04	4,0±0,04	4,0±0,04	3,5±0,05	3,5±0,05	4,0±0,04
Smell	5,0±0,01	5,0±0,01	5,0±0,01	4,3±0,18	4,0±0,18	5,0±0,01
taste	4,9±0,25	4,9±0,1	4,9±0,1	4,2±0,25	3,5±0,25	4,9±0,1
Evaluation of sum indicators $\sum_{i=1}^{n}$ XiKi						
Common score	4,40	4,78	4,86	4,20	4,10	4,86
Quality category	«жақсы»	«өте жақсы»	«өте жақсы»	«жақсы»	«жақсы»	«өте жақсы»

During the tasting, experts said that bread with 2.0% rosehip leaf extract does not have enough taste and smell. Bread with 4.0% rosehip leaf extract has the appropriate shape, the surface is without large scratches and breaks, the outer color is from light yellow to slightly brown, the middle of the bread is not wet, elastic, well-developed and uniform, the taste is slightly sweet, the smell is characteristic. The appearance of bread with the addition of 6.0% rosehip leaf extract is bubbly, rough, with large scratches, the surface is matte, the color is dark brown, the taste is sour, unpleasant, with a slight foreign smell. As a result of the tasting, experts rated the organoleptic indicators of bread with 4% rosehip leaf extract very good.

The results of the study on the freshness indicators of the samples over time are presented in a diagram (Figure 1). Evaluation was conducted on a 5-point scale based on the following parameters: taste, aroma, crumb softness, elasticity, and fineness [13].

The freshness of whole grain bread is one of the main indicators of its quality. The freshness of bread with rosehip leaf extract was higher compared to the control. This is due to the fact that tannins and organic acids, which are part of the rosehip leaf extract, affect the moisture content of bread and prolong the shelf life of bread [14].

The bread sample baked with rosehip leaf extract after 16 hours had a smooth, light brown surface with no cracks, a light rosehip flavor and aroma, and a uniform, thin-walled crumb structure.

During storage, the bread's organoleptic properties changed: the crust became hard and brittle, then soft; the intensity of its flavor and aroma decreased; the crumb's elasticity and the bread's masticatory properties declined; and the crumb size increased.

During storage, the freshness of bread containing 4% rosehip leaf extract decreased by 49.9% after 96 hours compared to the control sample, and the sample containing rosehip leaf extract decreased by 30.1%.

To improve the technology of bread products with rosehip leaf extract, laboratory trials were conducted. The rosehip leaf extract was introduced into the dough at levels of 2-6%. The control samples were prepared without the plant extract. The quality of the finished bread products was evaluated by determining their organoleptic and physicochemical characteristics (Tab. 3).

The organoleptic and physical characteristics of the finished product containing a 4% rosehip leaf extract were observed to have improved. The appearance remained essentially unchanged compared with the control and the bread containing 2%. A slight change in the appearance of the bread containing 6% extract was observed.

Bread with the addition of 4% rosehip leaf extract had a pleasant aroma due to the softness of the bread.

According to the physicochemical parameters of the finished product, moisture content decreased, while acidity remained unchanged. Volumetric capacity increased. Biologically active substances and acids contained in rosehip extract affect the texture of the flour dough. For this reason, rosehip leaf extract affects the protein structure of the dough, the rate of fermentation and the ability to retain gas, increasing the porosity of the bread compared to the control. Bread with high porosity is soft and light.

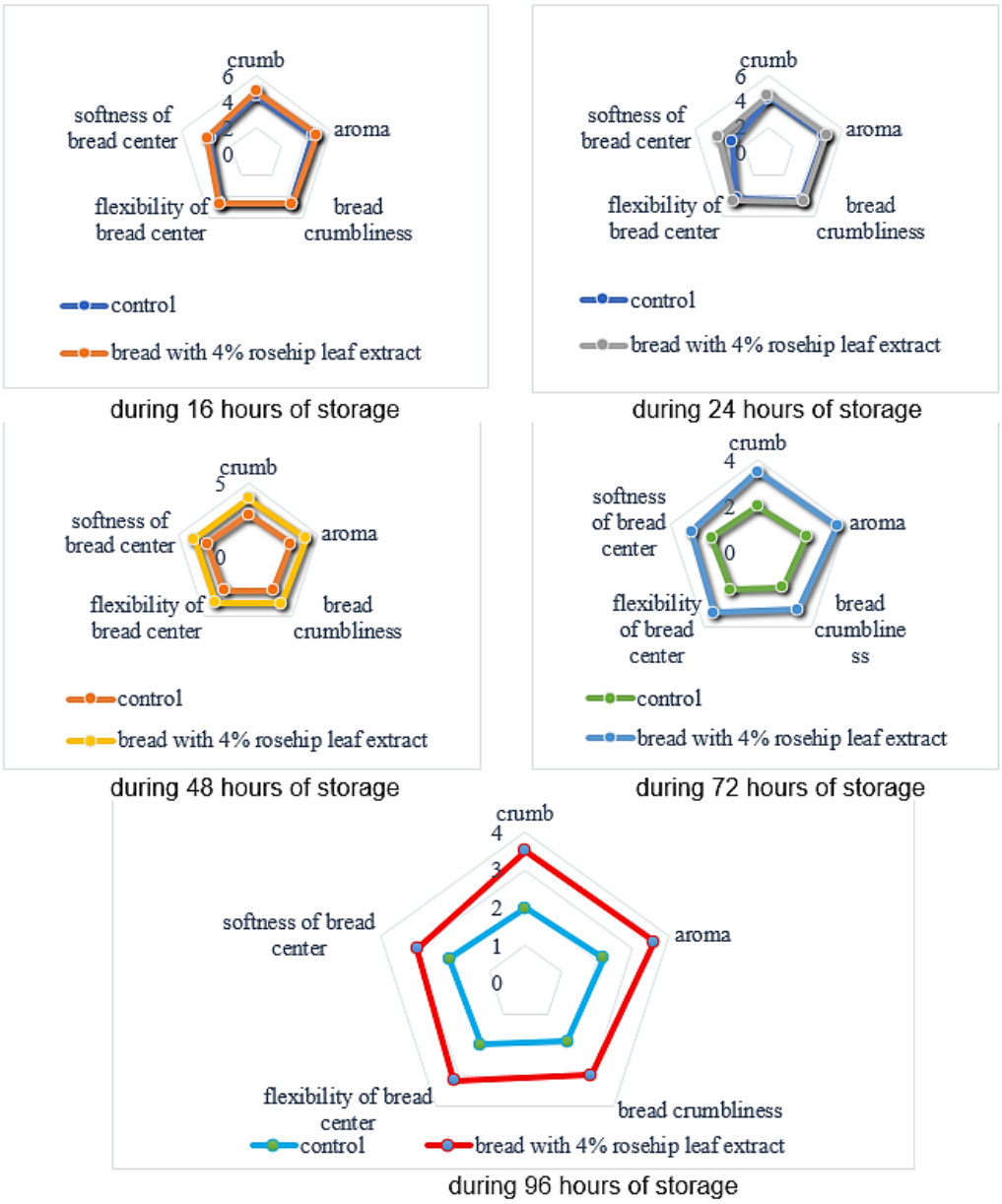

Figure 1 – Freshness assessment diagram for whole-grain bread

Based on the analysis results, a profiler gram of the organoleptic quality assessment of the test samples was created (Figure 2).

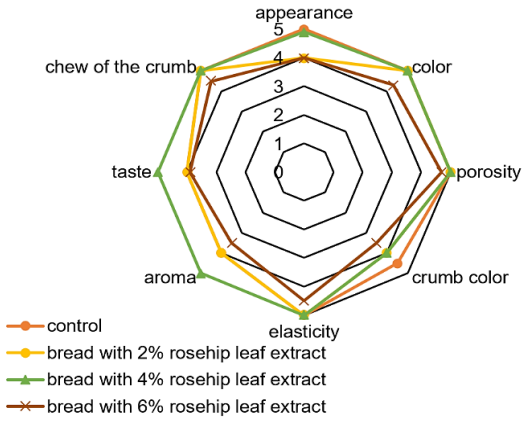

Figure 2 – Profiler gram of the organoleptic quality parameters of bread containing 2%, 4%, and 6% rosehip leaf extract

Table 3 – Effect of rosehip leaf extract on the quality of whole wheat bread

Names of the indicators	control	bread with 2% rosehip leaf extract	bread with 4% rosehip leaf extract	bread with 6% rosehip leaf extract
Appearance				
-Shape:	Proper shape	Shape is irregular, slightly domed, with an outer crust	Proper shape	Correct shape
-Surface:	Smooth, not cracked, no dents	Surface is rough; uncracked, without indentations	Surface is rough; not cracked, no dents	Surface is rough, with slight scratches visible
-Color:	Brown	Brown-black in color	Light brown color	Brown – black color
The condition of the bread dough:				
Consistency	No lumps			
Evaluation of porosity	Uniform, thin-walled			
Taste	No foreign taste characteristic of the product type.	No foreign taste characteristic of the product type.	Pleasant, characteristic of the product type.	Salty, slightly sour.
Smell	No foreign odor characteristic of the product type.	No foreign odor characteristic of the product type.	Fragrant, characteristic of the product type.	A faint aroma characteristic of this type of product is noticeable.
Physicochemical parameters				
Moisture content of bread dough, %	46	48	47,0	47,1
Acidity, °	6,3	6,4	6,4	6,5
Porosity, %	54	55	67	69

Analysis of the nutritional value of the developed samples revealed that the 4% rose hip leaf extract is characterized by a higher content of vitamin C, retinol, and tocopherol compared to the bread control sample. Among the macronutrients, phosphorus, chlorine, and sulfur were notable [15].

The experimental samples were stored for 4 days at room temperature (t = 20-25 °C) and a relative air humidity of 40-50%.

The result of the study was the determination of microbiological indicators of the studied bakery products by the number of mesophilic aerobic and facultative anaerobic microorganisms, mold fungi. As a result, it was found (Tab. 4) that after 48 and 72 hours of storage in a bread sample supplemented with 2% rosehip leaf extract, the number of mesophilic aerobic and facultative anaerobic microorganisms did not differ much from the control samples.

Table 4 – Research results indicating the microbiological indicators of the finished product

Bread sample	Number of mesophilic aerobic and facultative anaerobic microorganisms, CFU/g, not exceeding				Fungus, CFU/g, not exceeding			
	In accordance with the requirements of TR CU 021/2011							
	$5,0\times10^3$				50			
	24 h	48 h	72 h	96 h	24 h	48 h	72 h	96 c
control	Not detected	$4,5*10^3$	$4,8*10^3$	$5*10^3$	Not detected	< 10	(65±6)	(70±6)
bread with 2% rosehip leaf extract	Not detected	$2*10^3$	$2,8*10^3$	$3*10^3$	Not detected	< 10	(55±5)	(60±5)
bread with 4% rosehip leaf extract	Not detected				Not detected			
bread with 6% rosehip leaf extract	Not detected				Not detected			

In addition, mesophilic aerobic and facultative anaerobic microorganisms were not found in bread samples containing 4% and 6% rosehip leaf extract. The number of yeasts in bakery products containing 4% rosehip leaf extract was lower than in the control sample after 72 hours of storage. 4% and 6% rosehip leaf extract-there is no mold in the added bread samples. No fungi were found in the studied samples. The addition of rosehip leaf extract improves the quality of the product and extends its shelf life.

Conclusion

It should be noted that plant raw materials are of considerable interest to the medical and food industries. It exhibits antimicrobial activity because it contains key active components such as flavonoids, tannins, anthocyanins, phenolic compounds, organic acids, and inorganic compounds. Therefore, the use of extracts from plant raw materials and conducting research on bread quality is relevant.

The antimicrobial activity of rosehip leaf extract is explained by the complex action of phenolic compounds, flavonoids and tannins contained in it. These compounds destroy the membrane of the microbial cell, inhibit enzyme systems, increase oxidative stress, and disrupt the synthesis of nucleic acids. In this regard, rosehip Leaf is considered a promising plant raw material as a natural antimicrobial agent.

Due to biologically active compounds with bactericidal properties (phytoncides, polyphenols, organic acids), rosehip leaf extract also has an antiseptic effect, which improved the microbiological purity of bread. It has been established that rosehip leaf extract contains biologically active substances belonging to the class of various compounds that inhibit the destruction of raw materials and finished products under the action of microorganisms: flavonoids, tannins, glycosides, alkaloids, organic acids. The shelf life of whole grain bread with the addition of 4% rosehip leaf extract has been increased from 72 to 96 hours.

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ИТМҰРЫН ЖАПЫРАҒЫ СЫҒЫНДЫСЫНЫҢ ТҰТАС ДӘНДІ НАННЫҢ САПАЛЫҚ ЖӘНЕ МИКРОБИОЛОГИЯЛЫҚ КӨРСЕТКІШТЕРІНЕ ӘСЕРІ

Мақалада қазіргі уақытта тамақ өнімдерінің жоғары сапасы мен қауіпсіздігін қамтамасыз ету ұтымды тамақтанудың, денсаулықты сақтаудың, ақыл-ой мен физикалық өнімділіктің және дененің қорғаныс жүйелерін қолдаудың маңызды шарты болып табылады. Қазіргі экологиялық жағдай халықтың тамақтану жағдайын анықтайтын факторлардың бірі болып табылады.

Өсімдік шикізаты ретінде итмұрын жапырағының сығындысы қолданылды. Итмұрын жапырағы сығындысының тиімді мөлшері анықталды. Итмұрын жапырағы сығындысы құрамында әртүрлі қосылыстар класына жататын биологиялық белсенді заттар флавоноидтар, таниндер, гликозидтер, алкалоидтар, оганикалық қышқылдар астықтың және өнімнің микробиологиялық көрсеткіштерін төмендетуге көмектеседі. Тұтас дәнді нан өнімі бөлме температурасында (t= 20 ÷ 25 ^{0}C) жоғары ылғалдылықта 40-50 % сақталды.

4% итмұрын жапырағы сығындысы қосылған нан үлгісінде 96 сағаттан кейін МАжФАМС табылған жоқ. Бақылау үлгісінде 24 сағаттық сақтаудан кейін МАжФАМС көбеюі байқалады. Бақылау үлгісіне 2-тәулікте зең пайда бола бастады, ал 4 % итмұрын жапырағы сығындысы қосылған нан үлгісінде зең табылған жоқ. Зерттеу нәтижелері итмұрын жапырағы сығындысы өнімнің микробиологиялық қауіпсіздігін төмендетеді. Алынған нәтижелер итмұрын жапырағы сығындысы дайын өнімнің тағамдық құндылығын арттырады және дайын өнімнің сақтау мерзімін ұзартатындығын көрсетеді. Осылайша, итмұрын жапырағы сығындысы қосылған нан өнімдерін 72 сағаттан 96 сағатқа дейін сақтауға болады.

Түйін сөздер: *тұтас дәнді нан, микробиологиялық көрсеткіштер, өсімдік шикізаты, сығынды.*

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ВЛИЯНИЕ ЭКСТРАКТА ЛИСТЬЕВ ШИПОВНИКА НА КАЧЕСТВЕННЫЕ И МИКРОБИОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ ЦЕЛЬНОЗЕРНОВОГО ХЛЕБА

В настоящее время обеспечение высокого качества и безопасности пищевых продуктов является важным условием рационального питания, поддержания здоровья, умственной и физической работоспособности и поддержки защитных систем организма. Современная экологическая ситуация является одним из факторов, определяющих состояние питания населения.

В качестве растительного сырья использовали экстракт листьев шиповника. Установлено эффективное количество экстракта листьев шиповника. Экстракт листьев шиповника содержит биологически активные вещества, относящиеся к классу различных соединений флавоноиды, дубильные вещества, гликозиды, алкалоиды, оганские кислоты, которые помогают снизить микробиологические показатели зерна и продукта. Цельнозерновой хлеб хранился при комнатной температуре (t= 20 ÷ 25 0C) при высокой влажности 40-50%.

КМАФаНМ не был обнаружен через 96 часов в образце хлеба с 4% экстрактом листьев шиповника. В контрольной выборке наблюдается увеличение КМАФаНМ после 24 часов хранения. На контрольном образце на 2-й день начала формироваться плесень, а на образце хлеба с добавлением 4% экстракта листьев шиповника плесени не обнаружено. Результаты исследования показали, что экстракт листьев шиповника снижает микробиологическую безопасность продукта. Полученные результаты свидетельствуют о том, что экстракт листьев шиповника повышает пищевую

ценность готового продукта и продлевает срок хранения готового продукта. Таким образом, хлебобулочные изделия с экстрактом листьев шиповника могут храниться от 72 до 96 часов.

Ключевые слова: *хлеб цельнозерновой, микробиологические показатели, растительное сырье, экстракт.*

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Received 30.03.2026
Revised 14.05.2026
Accepted 20.05.2026