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INFLUENCE OF QUINCE POWDER ON THE PROPERTIES OF WHEAT BREAD

Abstract. The scientifically substantiated and experimentally confirmed expediency of application of products of quince fruit processing in the form of powder in the technology of wheat bread production with the purpose to obtain a product that has fortified nutritional properties and a prolonged shelf life. Analysis of finished samples of wheat bread showed that the samples of bread with the addition of products of quince fruit processing have an intense color of crusts, rich taste and aroma. The final bread with the addition of quince powder has a smaller, uniform and thin-wall porosity of the crumb, without voids and signs of hardening. During studying the microstructure of crumb of wheat bread, it was found that the use of quince powder causes the formation of pores evenly distributed throughout the crumb volume that makes it possible to obtain bread with developed porosity and thin walls, a larger specific volume. The addition of quince powder allows to slow the drying, as well as molding of wheat bread for a period of 12 hours to 3 days. Quince powder enriches wheat bread by essential macro- and microelements. The optimum dose of the introduced of quince powder is 3-5%.
Keywords: quince, food additive, staling, molding, potato disease, bread, bakery, production

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Аннотация. В работе научно обоснована и экспериментально подтверждена целесообразность применения продуктов переработки плодов айвы в виде порошка в технологии производства пшеничного хлеба в целях получения продукта с лечебно-профилактическими свойствами и пролонгированного срока хранения. Анализ готовых образцов пшеничного хлеба показал, что пробы хлеба с добавлением продуктов переработки плодов айвы имеют интенсивную окраску корок, насыщенный вкус и аромат. Хлеб с добавкой айвового порошка имеет более мелкую, равномерную и тонкостенную по-

ристость мякиша, без пустот и признаков закала. При исследовании микроструктуры мякиша пшеничного хлеба установлено, что применение айвового порошка обусловливает образование пор, равномерно распределенных по всему объему мякиша, что позволяет получить хлеб с развитой пористостью и тонкими стенками, большего удельного объема. Добавка айвового порошка позволяет замедлить засыхание, а так же плесневение пшеничного хлеба на срок от 12 ч. до 3 суток. Айвовый порошок обогащает пшеничный хлеб полезными макро- и микроэлементами. Оптимальная доза вносимого айвового порошка составляет 3-5%.

Ключевые слова: айва, пищевая добавка, черствение, плесневение, картофельная болезнь, хлеб, хлебобулочное изделие, производство

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Түйіндеме. Бұл жұмыста емдік және профилактикалық қасиеттерімен және ұзағырақ сақтау мерзімімен қамтамасыз етумен өнім алу мақсатында бидай нан өндірісі технологиясында ұнтақ түрінде айва жемісін қайта өңдеу өнімдерін қолдану ғылыми түрде негізделген және эксперименталды түрде расталған. Бидай нанының дайын үлгілерін талдау көрсеткеніндей, айва жемістерін қайта өңдеу өнімдері қосылған нан үлгілері қышқылдардың, дәмінің күштілігі мен хош иістің қанық түсіне ие болады. Айва ұнтағы қосылған нанның жұмсақ қабатының арасындағы тесіктері ұсақ, біркелкі және жіңішке болып, қуыссыз әрі тапталмай піседі. Бидай ұнынан жасалған нанның жұмсақ бөлігінің микроқұрылымын зерттегенде, айва ұнтағын пайдалануда арасындағы тесіктері біркелкі түсіп, нан көмпиіп, қыры жұқалау әрі көлемді болып пісетіні анықталған. Айва ұнтағы қосылған нан 12 сағаттан бастап 3 күнге дейін кеуіп кетпейді де көгермейді де. Ivovy ұнтағы бидай ұнынан жасалған нанды пайдалы макро және микроэлементтермен байытады. Қосылатын айва ұнтағының оңтайлы дозасы 3-5% құрайды.

Түйінді сөздер: айва, азық-түлік қоспасы, сталинг, қату, көгеру, картоп ауруы, нан, нан-тоқаш өнімдері, өндіріс.

Introduction. The creation of new technologies for deep and complex processing of food raw materials that allowing to ensure high consumer properties of products - is a strategic direction of social and economic policy of the Republic of Kazakhstan in the field of ensuring food security. The scientists carried out a considerable amount of theoretical research aimed at realizing in practice modern trends in the use of additives that expand assortment of bakery products; as well as modern technologies for the production of bakery products intended for mass demand, therapeutic and preventive and special nutrition [1].

By solving of a problem of healthy nutrition, modern food technology sets itself the task of developing highly effective food additives with the integrated use of crop products that allow to create a product of functional nutrition [2]. One of the promising types of non-traditional raw materials can be fruits of quince, as well as products of its processing, such as peel, core and seeds contained in it. The use of quince processing products will expand the range of functional bakery products, ensure the formation of high consumer properties.

However, it should be noted a fact that, in recent years, the "producer-consumer" chain has become much more complicated and today requires much more time. When storing bread consumer indicators of its quality are reduced, bread begins to stale, as well as exposed to potato disease and molding. In this regard, the increase in the shelf life of food products in fresh form, and in particular of bakery products, is an urgent task and has a great social and economic effect [3].

Quince has one of the first places among seeds cultures in terms of the composition of biologically active substances. Due to the complete lack of cholesterol and minimal fat content, quince is a best product for dietary nutrition. In addition, quince fruits are rich in dietary fiber. Furthermore a significant content in the fruits of cellulose quince improves the process of digestion of food [4].

Purpose of the study. The purpose of the present study is to develop the fortification technology of wheat bread with a prolonged shelf life by using of quince powder, as an improver and antioxidant.

Scientific novelty. Based on the obtained complex studies, the fortification technology with the addition of quince powder for the production of wheat bread with therapeutic and prophylactic purposes and prolonged shelf life was developed.

Scientifically substantiated and confirmed the expediency and effectiveness of using powder obtained from whole fruits, pulp with skin and seeds of quince fruit, in the production of wheat bread. The use of a quince fruit in the form of a powder makes it possible to increase the concentration of nutrients in wheat bread, and also to extend the shelf life of the finished product without loss of vitamins [5,6].

Practical significance. In the course of the research work, a method has been developed for processing quince fruits, which makes it possible to obtain powders consisting of whole fruits with pulp, peel and bones [5].

A method for the obtaining of wheat with the use of quince processing products has been developed, which opens up new opportunities for the expanding of the range of food products for preventive purposes and allows increasing the shelf life of finished products [6].

Objects of the research. As the objects of the research, depending on the goals and objectives were: wheat bread with the addition of quince powder.

Material and methods.In the presented work, conventional and special physical, chemical, biological and organoleptic methods were used for the controlling the properties of raw materials, semi-finished products and finished products, including photometric (spectrophotometric) and microscopic (scanning electron microscope).

Analysis of the quality of raw materials, semi-finished products and finished products was carried out in accordance with the GOST requirements.

For the determining of the mass fraction of moisture of finished bakery products, the drying method in the Convective Drying Device was used.

For the determining the acidity of finished bread samples, the titration method was used.

The microstructure of the crumb of finished samples of wheat bread was determined by using a scanning electron microscope "JEOLJSM-6490 LV" (Japan).

The antioxidant efficacy of quince fruit powder was evaluated by visual observation of samples of finished bakery products under various storage conditions.

In the course of the study, five laboratory bread samples that prepared by the method of high-grade flour with the addition of quince powder in an amount of 3-9% of the total flour, as well as a control sample without the addition of powder.

Investigation of microstructure of bread crumb was carried out on the basis of the Test Center "SAPA" of M Auezov SKSU. For the analysis, a scanning electron microscope JEOL JSM-6490LV with assured resolution of 3 nm was used, which allows to study objects with a diameter of up to 8 inches.

Determination of the physicochemical parameters was carried out 3 hours after the products had left the furnace and no later than 24 hours, in accordance with the requirements for wheat bread from high-grade flour.

Increased humidity reduces caloric content and worsens the quality of bread, it becomes heavier, less absorbed by the human body. Such bread is more quickly exposed to molding, diseases, easily deformed. Low moisture of bread leads to the fact that it becomes dry, rapidly hardens, its taste deteriorates. Humidity of different products varies from 34 to 51%. Mass fraction of bread moisture is determined for calculation of its yield and verification of the correctness of the process - accuracy of dosing of the main raw materials, flour and water. When the mass fraction of moisture of bread increases by 1%, its yield is increased by 2-3%. For the assess of the process correctness, as well as the taste of wheat bread, acidity was determined.

The products of the quince fruits processing contain a significant amount of macro- and microelements, in this regard, the mineral composition of the bread was investigated with their addition. The determination of the trace element composition was carried out on the basis of the Test Center "SAPA" of M Auezov' SKSU. The analysis was performed by using a Cary-50 spectrophotometer consisting of 6 blocks that has not a power supply and provides a spectrum acquisition at 24000 nm / min in the range of 190-1100 nm with a resolution of 1.5 nm and consumes only 6 Watts just at the time of scanning.

Research results. Organoleptic analysis determined the optimal samples of wheat bread with addition of quince powder.

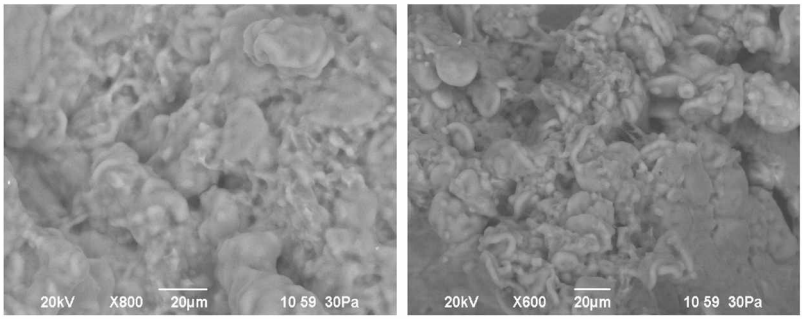
Table 1 – Results of organoleptic analysis of wheat bread samples

Indicators	Withour addition	3% of addition	5% of addition	7% of addition	9% of addition
1	2	3	4	5	6
Shape of bread	rounded enough symmetrical, correct	rounded enough symmetrical, correct	rounded enough symmetrical, correct	rounded enough symmetrical, correct	rounded enough symmetrical, correct
Surface of bread	matte, not burnt, cracks and blasting - not available	matte, not burnt, cracks and blasting - not available	matte, not burnt, cracks and blasting - not available	matte, not burnt, cracks and blasting - not available	matte, not burnt, cracks and blasting - not available
Coloring of bread crusts	Golden-yellow, thickness 2.7mm	more intensive coloring of crusts thickness 2,5mm	more intensive coloring of crusts thickness 2,8mm	more intensive coloring of crusts thickness 2,9mm	more intensive coloring of crusts thickness 3,0mm

End of table 3

1	2	3	4	5	6
Crumb	white color without lumps and traces of impurities, with pressure completely restores the original shape.	the porosity of the crumb is more uniform, smaller, uniform and thin-walled, without voids and signs of hardening, the color of the crumb is darker-beige, the crumb of fresh bread is soft, well baked, not sticky and not wet to the touch, elastic, after slight pressing by finger, it takes the original shape.	The color of the crumb is brown with a grayish tinge, the crumb of fresh bread is soft, well baked, not sticky and not wet to the touch, elastic, after a slight pressure by finger, it takes the original shape.	the color of the crumb is darker-light brown, the crumb of fresh bread is soft, well baked, not sticky and not wet to the touch, elastic, after a slight pressure by finger, it takes the original shape.	the color of the crumb is darker-light brown, the crumb of fresh bread is soft, well baked, not sticky and not wet to the touch, elastic, after a slight pressure by finger, it takes the original shape.
Porous	Uneven and there are large pores on the cut	Uniform, fine pores.	Uniform, fine pores	Uniform, fine pores	Uniform, fine pores
Taste	Fresh, crunching on teeth when chewing is missing	Fresh, crunching on teeth when chewing is missing	Fresh, crunching on teeth when chewing is missing	Pleasant light taste and a slight aroma of quince fruit.	Pleasant light taste and a slight aroma of quince fruit.
Odour	Pleasant, peculiar to this type of product, without foreign odors	Pleasant, peculiar to this type of product, without foreign odors	Pleasant, peculiar to this type of product, without foreign odors	Slight aroma of quince fruits	Slight aroma of quince fruits

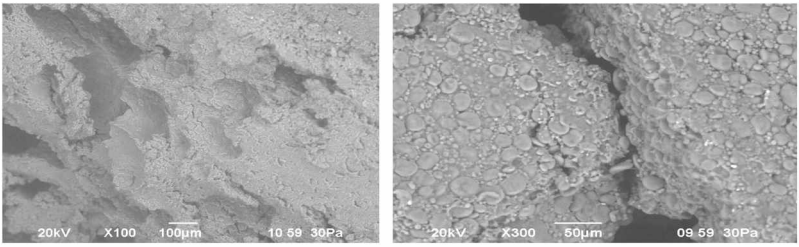
The microstructure of the bread crumb with the addition of quince fruit powder (Figure 1-b) was characterized by the presence of fibers and films, possibly formed by proteinaceous flour molecules and components of quince powder.



a) b)

a) a control sample of wheat bread without quince powder; b) sample with the addition of quince powder;

Figure 1 - Microstructure of the bread crumb



a) b)

a) - control sample without quince powder; b) sample with the addition of quince powder;

Figure 2 - Microstructure of bread crumb (crust)

At the analyzing of the photographs of the samples microstructure, it can be seen that the state of porosity of the bread crumb of the presented samples differs. The porosity of the crumb of bread without the addition of quince powder can be described as an “average uniform”. The use of quince powder causes the formation of pores, evenly distributed throughout the crumb volume. A dense protein-carbohydrate structure is created due to uniform gluten-free protein coating of starch grains that is noticeable in the comparing photos of bread samples with a 5% powder content and control. These changes improve the structure of the crumb of wheat bread, its elasticity and uniformity of porosity (Figure 1, Figure 2)

The results of the studies on determining the mass fraction of moisture are presented in Table 2.

Table 2 – Moisture content of wheat bread

Amount of added additive, %	Moisture content, %
Without additive	52,49
3	48,5
5	47,9
7	46,15
9	45,31

From Table 2 it can be seen that with increasing the amount of additive added, the mass fraction of moisture decreases.

Figure 3 shows the acidity values of samples of wheat bread. From Fig. 3 it can be seen that with the addition of 3% quince powder, the acidity of the finished product increased by 0.2grad compared to the control sample without the additive. For the 5% of quince powder is added, the acidity of the finished product is also increased by 0.2 g compared to the control one. The introduction of 7% and 9% of quince powder to the total weight of flour increases the acidity of wheat bread by 0.4 g compared to the control sample. According to the obtained data, it can be concluded that an increase in the amount of additive added raises the acidity of finished products slightly. All the obtained values are within the limits of norms, the index of which should not exceed 3grad for wheat bread of the highest grade according to the requirements of normative data. Thus, according to the acidity index of wheat bread samples, samples with the introduction of quince powder in an amount of 3-7% of of the total amount of flour introduced.

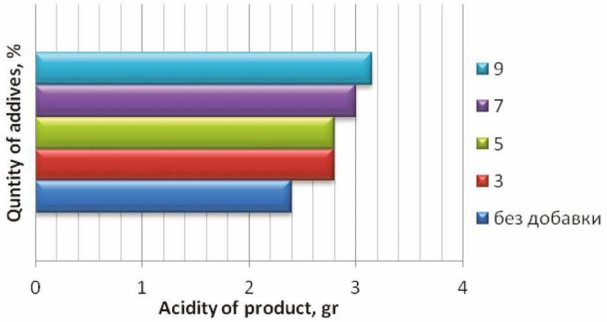


Figure 3 - Determination of the acidity of wheat bread

The next stage of the study was the establishment of the influence of quince powder on the quality of wheat bread during storage. When storing bread, microbiological processes can occur in it that worsen the quality of

the bread and lead to its microbiological damage. The most common is the potato disease of bread. The causative agents of potato disease include spore-forming bacteria - Bacillussubtilis and Bacilluslicheniformis (potato bacillus), which are distributed in nature in soil, air, plants. Potato bacillus has the form of a thin stick with a size of 0.5-0.6/3-10μ, often forming long filaments. Vegetative cells are mobile, forming oval spores. On the surface of liquid media the potato bacillus forms a powerful folded film, on slices of bread - a folded coating (hence the name) [7].

In bread with the manifestation of potato disease, the quantity of aldehydes and other compounds with a sharp putrefactive odor sharply increases, the crumb becomes wet and sticky with the formation of threads when the bread is broken. During storage, especially in warm and humid conditions, more dramatic changes are observed: the crumb becomes brown or yellow-brown in color [7].

One of the ways to prevent bacterial damage of bread and suppress potato disease is to increase the acidity of bread and bakery products. Increasing the acidity of bread and bakery products inhibits the vital activity and reproduction of pathogens, so potato disease is mainly observed in wheat bread with low acidity [7].

The most common and harmful type of microbiological damage of bread is mold molding, caused by mold fungi [8].

For the rising of bread mold is facilitated a storage of bread in plastic bags. Due to the evaporation of water from the bread, they create an increased moisture that contributes to the development of mold [8].

The test samples were stored at the room terms and contained in polyethylene packaging and without it at an air temperature of t = 25-28 °C and relative humidity of not more than 80%.

The results of the studies are presented in Table 3 and 4.

Table 3 – Changes occurring in the bread at the storage without plastic packaging

Storage period	The changes taking place in the bread				
	Bread without the addition of quince powder	Bread with the addition of 3% quince powder	Bread with the addition of 5% quince powder	Bread with the addition of 7% quince powder	Bread with the addition of 9% quince powder
1	2	3	4	5	6
12h	Bread begins to dry out at the edges, crumb in the center is soft.	Without changes, the soft crumb			

End of table 3

1	2	3	4	5	6
24h	The sample becomes more solid.	There was a dry crust	Without changes		
36h	Bread continues to dry out.	Bread continues to dry out.	Bread begins to dry out at the edges	Bread begins to dry out at the edges	
48h	The sample was completely dried up	Bread continues to dry out. Becomes more solid.		A dense thin dry crust appeared	Bread begins to dry out a little at the edges
60h			The sample was completely dried up	The sample was completely dried up	Bread continues to dry out.
72h					The sample was completely dried up

Table 4 – Changes occurring in bread when stored in a plastic bag

Storage period, days	The changes taking place in the bread				
	Bread without the addition of quince powder	Bread with the addition of 3% quince powder	Bread with the addition of 5% quince powder	Bread with the addition of 7% quince powder	Bread with the addition of 9% quince powder
1	Without changes, the crumb soft, without extraneous smacks				
2	The sample had an unpleasant stale smell (rancid)	Without foreign odors. Mold is absent.			
4	A white mold appeared on the sample	The sample has an unpleasant stale smell	Without foreign odors. Mold is absent.		
5	Mold is actively expanding	A white mold appeared on the sample	There was an unpleasant rancid smell		Without foreign odors. Mold is absent.
6	Mold is actively expanding.		There was a white mold		
7	Mold is actively expanding				There was a white mold

Based on the obtained data, the diagrams of drying speed (Figure 4) and molding (Figure 5) of wheat bread with added quince powder are presented.

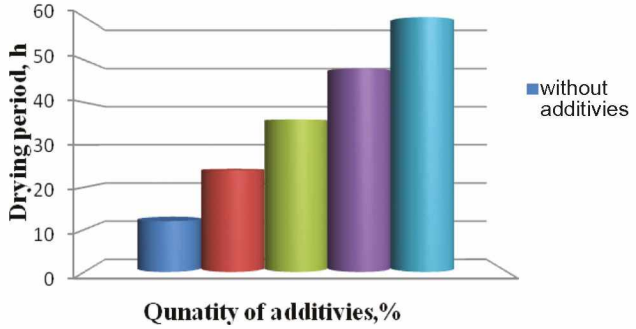


Figure 4 - Drying of bread

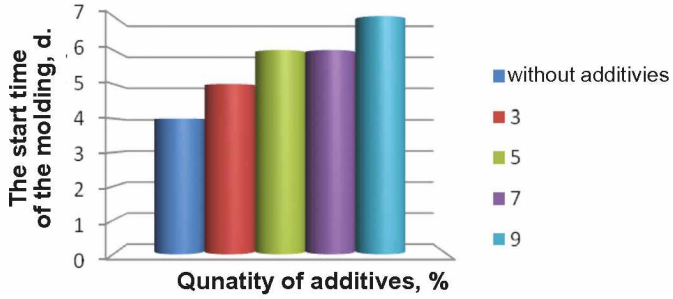


Figure 5 - Drying of bread

The content of microelements in the samples of wheat bread is shown in Table 5.

Results and discussion

It should be noted that with the increase in the amount of added quince powder, the finished products acquire a sweetish taste that can be explained by the high content of quince, glucose, fructose, sucrose (up to 10.85%) in the ripe fruits.

According to the organoleptic parameters, samples of wheat bread with the addition of quince powder in an amount of 3 to 7% to the total amount of added flour are optimal.

Table 5 – The content of macro- and microelements in the samples of wheat bread

№	Chemical element name	Element content, mkg/l				
		Bread without the addition of quince powder	Bread with the addition of 3% quince powder	Bread with the addition of 5% quince powder	Bread with the addition of 7% quince powder	Bread with the addition of 9% quince powder
1	Mg_{24}	55626,01	60026,01	60139,01	60363,93	66691,5
2	K_{39}	451512	471562	471612	506757,6	529972,5
3	Ca_{44}	8820211	91202,91	92102,91	94291,83	103728,4
5	Cr_{53}	44,91	54,91	55,45	56,18	56,83
6	Mn_{55}	1051,16	1030,06	998,06	990,06	973,65
7	Fe_{57}	6540,11	6840,76	6850,76	6880,22	6999,87
12	As_{75}	15,16	13,36	12,16	10,25	4,01
13	Rb_{85}	356,14	336,54	334,24	332,93	325,56
14	Sr_{88}	424,1	444,1	524,1	570,31	713,66
15	Zr_{90}	5,75	5,55	5,15	4,66	4,35
16	Mo_{95}	75,12	71,22	69,78	67,7	67,28
17	Ag_{107}	18,75	18,45	17,15	16,28	14,55
18	Cd_{111}	4,88	5,38	7,38	9,64	10,67
19	Sn_{118}	6,85	5,65	3,25	2,29	2,07
21	Pb_{208}	1911,69	1811,09	1631,09	1446,09	1323,99
22	U_{238}	12,34	11,84	9,67	6,71	5,75

A comparative study of the microstructure of the crumb of wheat bread prepared both with the addition of quince powder and without it (Figure 1) showed that all samples of crumb of wheat bread had a continuous and well-formed structure of the protein in the form of spatial elongated films. Samples of crumb of bread with the addition of quince powder (Figure 1, variant b) had a well branched spatial structure, where the starch grains of different sizes are clearly visible. A sample of crumb of wheat bread, prepared with the addition of powder, was characterized by a more branched spatial thin-plate structure of the protein. The grains of starch are evenly embedded in the finely divided structure of the protein. There are no distinguishable individual starch granules.

The analysis showed that undissolved particles of dietary fibers of quince fruit formed a complex with the protein matrix, evenly distributed inside the starch grains in the form of small impregnations.

In Figure 2, it is shown that the dense, more crystalline microstructure of the interporous walls with the introduction of quince powder became more amorphous, loosened. Perhaps the food substances of the introduced powder formed a thin monomolecular layer around the gas bubbles, which allows to delay the discharge of gas into large bubbles and ensures uniform, fine porosity, the formation of thin interpores.

During the studies, it was found that the optimum samples for the mass fraction of moisture are samples with the introduction of quince powder in an amount of 3-9% to the weight of the added flour (Table 2).

On the basis of the data obtained, a diagram of the determination of the acidity from the amount of queen powder introduced is presented (Figure 3). From Figure 3 it can be seen that with the addition of 3% quince powder, the acidity of the finished product increased by 0.2grad compared to the control sample without the additive. For the 5% of added quince powder, the acidity of the finished product is also increased by 0.2 g compared to the control one. The introduction of 7 and 9% of quince powder to the total weight of flour increases the acidity of wheat bread by 0.4 g compared to the control sample.

During the storing of wheat bread with the addition of quince powder it is established that: for the 3% of added quince powder, the drying of wheat bread takes place 12 hours later, compared to the control sample (without quince), and its molding - per day. The addition of 5% slow down the drying process of wheat bread for one day, for the molding – 2 days. With the addition of 7% of the additive to the total weight of flour, the drying process of bread slows down for 36 hours, and the molding process for 2 days. The addition of 9% of quince powder is reduced the drying of wheat bread for 48 hours later, compared to the control sample, and its molding takes 3 days (Figure 4, 5).

From Table 5, it can be seen that the introduction of quince powder makes it possible to fortify wheat bread by macro and microelements that essential for the human organism such as calcium, sodium, potassium, magnesium, copper, phosphorus, manganese and chromium.

Conclusions

Solving the problem of creating products with fortified functional properties, as well as prolonged shelf life, it is advisable to guide on a mass consumer food product as bread.

Bread for more than a thousand years is part of the human diet and for many peoples of the world is its basis. According to the statistics agency of Kazakhstan, the consumption of bread and bread products is about 110 kg per capita per year that is above the established minimum rate of about 240 grams per day, or 88 kilograms per year. According to the experts, today the development of the market of bakery products is mainly due to the expansion of the assortment, as well as the demand for national breads [9].

1. The theoretical part of the analysis of domestic and foreign scientific and technical literature and patent information on the problem under consideration. The main trends of development of practical solutions on the research topic are indicated.

2. It is scientifically substantiated and experimentally confirmed the expediency of using quince fruit products in the form of a powder in the technology of wheat bread production in order to obtain a product with therapeutic and prophylactic properties and a prolonged shelf life.

3. Study analysis showed that the samples of bread with the addition of products of processing fruits of quince have a more intense color of the crusts, a rich taste and aroma. In addition, products with the addition of quince powder have a smaller, uniform and thin-walled porosity of the crumb,

3. Analysis of finished samples of wheat bread showed that the samples of bread with the addition of products of quince fruits processing have a more intense color of the crusts, a rich taste and aroma. In addition, products with the addition of quince powder have a shallower, uniform and thin-wall porosity of the crumb, without voids and signs of hardening. At the same time the crumb gets darker color - from beige to light brown or brown. Also, it was revealed that with the increase in the amount of added additive, the finished products acquire a sweetish flavor.

4. During the analyzing of the microstructure of crumb of wheat bread, it is established that the use of quince powder causes the formation of pores evenly distributed throughout the crumb volume, which makes it possible to obtain bread with developed porosity and thin walls, a larger specific volume.

5. The study of the influence of quince powder on the physico-chemical quality indicators of finished wheat bread is shown that with the increase in the amount of additive added, the mass fraction of moisture of finished products decreases. It is established that the acidity index of the finished

bread also increases with the increase in the amount of quince powder added. All the values obtained correspond to regulatory requirements.

6. It is proved that the application of quince powder makes it possible to slow down drying, as well as molding of wheat bread for a period of 12 hours to 3 days.

7. The influence of quince powder on the mineral composition of wheat bread, it is indicated the addition of a powder makes it possible to enrich the wheat bread by macro- and microelements essential for the human organism such as calcium, sodium, potassium, magnesium, copper, phosphorus, manganese and chromium. It is also established that when a quince powder is added to the recipe of wheat bread in a finished baked bread product, heavy metals such as arsenic and lead are reduced.

8. Organoleptic and physicochemical indicators of the quality of wheat bread with an additive set the optimal dose of applying quince powder in an amount of 3-5% to the total weight of flour.

9. A method for the production of wheat bread by using the quince processing products has been developed, which makes it possible to impart preventive properties to the finished product, to improve its quality, and also to extend the shelf life of it.

Practical suggestions. For a full diet in the daily diet of an adult nourishment should be about 330 grams of bread. Children need a bit less - 120-300 grams, teenagers a little more - 350-400 grams of bread daily. Thus, with a consumption of 300 g/day of bread containing quince fruit powder, the daily requirement for calcium will be satisfied by 12.5%, potassium by 25%, phosphorus by 21.5%, copper by 37.5%, zinc - by 30%, manganese - by 33%, as well as the daily requirement for such elements as chromium and magnesium will be met.

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