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INVESTIGATION OF THE INFLUENCE OF MOLLUSC HYDROLYZATE ON THE ELASTIC PROPERTIES OF WHEAT AND RYE DOUGH

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Abstract. Principal trends of improving wheat and rye product technologies have been analysed in the article. The influence of mollusc hydrolyzate on forming structural and mechanical properties of the dough has been studied, namely, the elasticity of wheat-rye dough. According to the results of the study it was concluded that the hydrolyzate of molluscs contributes to enhance the elasticity and decrease the degree of stretch ability dough during mixing, which positively affects the overall gluten-free dough and makes it stronger.

Keyword: mollusc hydrolyzate, baked goods, flour, elasticity, tensile

1. Statement of the problem

It is known that human health is directly related to the food he consumes daily. The formula of "health is a function of supply" is the basis for the modern food science. RAMS studies have shown that now the food that draws people do not fully satisfy the physiological needs of the people, thereby increasing the overall morbidity, reduced working capacity, significantly reduced life expectancy and population.

Analysis of food consumption in Ukraine in the last decade has shown that the fate of bakery products in the structure of the diet of Ukrainians increased significantly and continues to grow, mainly due to their low cost compared with other foods. An important factor in the development of new products is to improve the organoleptic and physico-chemical properties of the products.

One of the principal problems, which the food industry of our country is confronted with, is to provide the population with foodstuffs of high biological value. At the moment the technology of producing traditional foodstuffs is being improved and new generation of foodstuffs, which meet today's requirements, is being made. These are foodstuffs with balanced composition, low calorie, sugar and fat content, high content of healthy ingredients for functional and therapeutic purposes.

2. Analysis of recent research and publications

Taking into account that bread is one of the principal foodstuffs in our country, the task of reducing caloric content of baked goods and

enriching them with dietary fibres, vitamins and mineral substances is important and urgent.

According to the medical and biological principles to enrich foods must be, first of all, those micronutrients deficiency of which is widespread and most dangerous to the health of the population or specific groups (children, pregnant women, workers of hazardous occupations). The most widely used technologies based on the use of dietary supplements and therapeutic and prophylactic use (drugs beta-carotene, iodine supplements and bran) for preparation of special varieties of baked goods.

Considerable theoretical and practical contribution to the improvement of wheat and rye product technologies has been made by S.M. Antonov, E.I. Shkafov, S.S. Scherbatenko, R.S. Kuzminky, R.D. Polandova, S.I. Koneva and A.S. Romanov.

Many research works of our and foreign researchers are devoted to increasing the content of dietary fibres in baked goods. Enriching bread with bran has become the most widespread practice in bread production [1]. According to the data of foreign researchers the addition of wheat bran at the rate of 5 % to bread allows to increase the cellulose content considerably [2].

There are methods for producing bread using Jerusalem artichoke containing natural polifruktan - inulin, which is converted by hydrolysis into fructose. Due to its composition Jerusalem artichoke has a positive effect on the cardio - vascular activity and increases the defences of humans [3].

For bakery products developed various kinds of food mixes with high biological value. These may include rose hips, nettle leaves, black currant, hawthorn, etc. Such additives enrich bakery carotenoids, organic acids, multivitamins, saponins, while possessing cardiogenic properties in diseases of cardio - vascular system, providing a restorative effect, showing anti-inflammatory properties. The use of medicinal plants containing alkaloids, glycosides, essential oils, flavonoids, tannins, makes it possible to create products with the preventive orientation [4, 7].

To enhance the nutritional value of bakery products are widely used natural products of plant and animal origin, containing biologically active substances.

The most promising is the use of additives of natural origin of domestic production that are possible to increase the nutritional value of baked goods while reducing the cooking process [4, 5].

The processes occurring in the preparation of dough largely determine the quality of the finished product.

Fundamentals physical and chemical reactions of flour in the wheat dough, biochemical, colloidal and microbiological processes is described sufficient detail in [6, 8, 9, 10, 11, 12, 13], but the publications there is lack of information concerning the study of physicochemical, biochemical and microbiological processes which take place when mixing wheat and rye dough and their influence on the qualitative indexes of baked goods.

The quality of baked goods depends on raw materials and in the first place on baking value of flour, ways and modes of carrying out separate stages of technological process of making the goods and on the usage of small amounts of special additives. It was used the mollusc hydrolyzate as such additive.

Composition of mollusc hydrolyzate is a mixture of amino acids and peptides simple, polyunsaturated fatty acids, macro-and microelements in a biologically active form.

The primary raw materials for its preparation are complete proteins clams and mussels *Rapana Black Sea*. In the hydrolysis the proteins are broken down into amino acids and simple peptides, which are easily absorbed by the human body. This is the best form of protein perception by adults and children.

Studies have confirmed the health effects of the hydrolyzate on the human body, which includes an increase in immunity, prevent diseases that are the

result of stress and physical exhaustion. It has antioxidant, allergies and radioprotective properties, has a positive effect on the cardio - vascular and hematopoietic systems, displays the body of toxic elements and radionuclides [14].

100 g of molluscs hydrolyzate containing: protein - 15 g, carbohydrates - 10 g fats - 1 g, ash - 6 g, 109 kcal/456 kJ.

Mollusc hydrolyzate is recommended as a dietary supplement as a secondary raw materials biologically active substances - essential amino acids, taurine, glucosamine biopolymer type and melanoid, macro-and micronutrients (especially calcium, zinc, manganese, copper) for total body strengthening and improving immunity prevention of diabetes and more [15]. Protein hydrolyzate of molluscs is a patented dietary supplement.

It is appropriate to explore the hydrolyzate of mollusc in the technologies of baked goods.

3. Material and methods

During the preparation of any farinaceous dough is exposed to various deforming stress. To obtain the high quality farinaceous products, the dough must possess certain physical characteristics: elasticity and extensibility. It is known that their optimal mix provides an increase of gas-retaining ability and fixation of form for semi-finished of dough.

The objective of the article is to study the influence of the mollusc hydrolyzate on structural and mechanical properties of the dough, notably on elasticity of wheat and rye dough.

Experiments were performed using alveograph «Chopin». This recorder is designed to determine the physical properties of the dough using method for studying the resistance exerted by the air pressure.

The essence of the method consists in the preparation of rye-wheat dough with constant humidity, the formation sampling the dough standard thickness, the dough inflating air in the bubble shape, plotting the differences in pressure inside the bladder over time.

Structural and mechanical properties of the dough were evaluated on the basis of the obtained area under the curve and shape of the curve.

4. The results of the research

Structural and mechanical properties of the dough predetermine its technological characteristics which are the determining factor in forming qualitative indexes of finished goods: volume, form and crumb structure.

Dough is a complex highly concentrated micro-heterogeneous colloidal system for which such properties as elasticity, firmness and viscosity are characteristic at the same time. This enables us to consider dough as both solid and liquid object which has elastic and viscoplastic properties at the same time.

The proteins contained in dough are known to undergo not only swelling and peptization when fermenting but also proteolysis which is caused by proteolytic ferments of flour and yeast [16]. Definite characteristics of dough are formed due to functional and technological characteristics of flour, technological measures during the dough stage and also as the result of colloidal and biochemical processes which take place in the dough [3].

The important quality index of baked goods is form preservation ability which to a considerable degree depends on the quality of flour, especially on the balance of such indexes of gluten as tensile and elasticity. Gluten with good elasticity is known to be used to make good of great volume [4, 17].

Alveographic investigation allows estimating the balance of this correlation. Physical properties of wheat and rye dough with the mollusc hydrolyzate have been studied by us with the help of alveograph of "Chopin" firm. The samples of wheat and rye dough was prepared for study using the following method [18]: a mixture of kneaded dough of wheat flour and rye flour, 2.5% saline, dosed additive within 1.5%, 3.0%, 4.5% mollusc hydrolyzate of the total weight of flour dough, temperature – 25 °C.

Kneading the dough alveography lasted six minutes, where upon the dough ejecting special device kneader through the outlet to the receiving plate. The molded standard-sized discs of the test were placed in an incubator for binning alveograph at 25 °C. Test alveography produced after 26 minutes from the start of mixing.

The usage of mollusc hydrolyzate enables us to speed up the fermenting process, to improve the flavour fading, aromatic properties and the design of the product, to cover fully our body needs in vitamins and microelements and as the result to influence the health of baked goods' consumers considerably.

The mollusc hydrolyzate has antioxidant, antiallergic and radiation protective properties, influences cardiovascular and blood-making systems favourably and takes toxic components and radionuclides out of our body.

The mollusc hydrolyzate contains biogenic stimulators, glycopeptides, polysaccharides, di- and mono-saccharides, vitamins A, E, PP, V and B, provitamins, over 30 macro- and micro-elements including Ca, P, Fe, Cu, Zn, Mn, Mg, Co, J and others [14].

Twenty amino acids including all indispensable ones such as arginine and histidine are identified in the hydrolyzate.

The results of the experimental investigation of the physical properties of dough under the influence of the additive are given in Table 1.

Table 1. The influence of the mollusc hydrolyzate on the physical properties of dough (according to the alveograph data)

Peculiarities of the sample composition	Balance, P/L	Viscosity, P, mm	Tensile, L, mm	Ultimate resilience, W, 10 ⁴ J
Without additives (reference sample)	2.79	92	33	115
1.5 % of the mollusc hydrolyzate	2.88	95	33	120
3.0 % of the mollusc hydrolyzate	3.03	97	32	122
4.5 % of the mollusc hydrolyzate	3.23	100	31	131

According to the received results, when adding the mollusc hydrolyzate the elasticity of wheat and rye, dough increases as compared with the reference sample by 3.26 ÷ 8.7 %. It is evident that the chemical composition of the product under study provides for the increase of viscosity, as the result resistance when stretched under air pressure on the alveograph table increases and the device registers the increase of elasticity index P.

It is confirmed by the increase of ultimate resilience W (Table 1) spent on stretching the studied samples of wheat and rye dough as compared with the reference sample – the wheat and rye dough with some amount of rye enzymatic malt flour without the additive.

It is clear from the table that the addition of the hydrolyzate increases the total content of proteins and amino acids that results in the elasticity increase

of wheat and rye dough while its tensile is a little reduced.

At the same time the ultimate resilience increases (to $131 \cdot 10^4$ J). The total balance indicates the improvement of elasticity properties of the dough.

4. Conclusion

Therefore it's possible to make a conclusion that the mollusc hydrolyzate helps to increase the elasticity and to reduce the tensile rate when mixing the dough that influences the general condition of the dough gluten and adds to its strengthening.

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