

EFFECT OF ION-OZONE ON THE RHEOLOGICAL PROPERTIES OF THE PASTA PRODUCT PREPARED BY ADDING ADDITIVE TO SOFT WHEAT FLOUR

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An important way to eliminate the lack of durum wheat flour required for pasta used in the diet is to expand the range of food products enriched with functional ingredients that have a positive effect on people's health. The main direction of our scientific work is the production of a new type of pasta product by using the high-quality triticale wheat containing biologically active substances, which is used as a high-potential raw material for domestic production. By adding triticale flour to soft wheat flour, preparing a new range of pasta products, it is possible to increase its rheological properties by treating it with ionozone. According to the results of the research, it was observed that the elasticity of the dough increases by 3 mm, the deformation of the dough by 13 J, and the strength by 45.06-58 grams.

Keywords: triticale, pasta, strength, dough deformation, elasticity, soft wheat, mixture.

ВЛИЯНИЕ ИОНОЗОНА НА РЕОЛОГИЧЕСКИЕ СВОЙСТВА МАКАРОННЫХ ИЗДЕЛИЙ, ПРИГОТОВЛЕННЫХ С ДОБАВЛЕНИЕМ СМЕСИ К МЯГКОЙ ПШЕНИЧНОЙ МУКЕ

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Важным способом устранения недостатка муки из твердых сортов пшеницы, необходимой для макаронных изделий, используемых в рационе, является расширение ассортимента продуктов питания, обогащенных функциональными ингредиентами, оказывающими положительное влияние на здоровье людей. Основным направлением нашей научной работы является производство нового вида макаронных изделий с использованием высококачественной пшеницы тритикале, содержащей биологически активные вещества, которая используется как высокопотенциальное сырье для отечественного производства. Добавляя муку тритикале в муку из мягкой пшеницы при приготовлении нового ассортимента макаронных изделий, можно повысить ее реологические свойства путем обработки ионозоном. По результатам исследований отмечено, что эластичность макаронной муки увеличивается на 3 мм, деформация теста на 13 Дж, прочность на 45,06-58 грамм.

Ключевые слова: тритикале, макаронные изделия, прочность, деформация теста, эластичность, мягкая пшеница, смесь.

ЖҰМСАҚ БИДАЙ ҰНЫНА ҚОСПА ҚОСЫП ДАЙЫНДАЛҒАН МАКАРОН ӨНІМІНІҢ РЕОЛОГИЯЛЫҚ ҚАСИЕТІНЕ ИОНОЗОННЫҢ ӘСЕРІ

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Тамақтану рационнда қолданылатын макарон өніміне қажетті қатты бидай ұнының жепіспеушілігін жоюдың маңызды тәсілі адамдардың денсаулығына жағымды әсер ететін функционалды ингредиенттермен байытылған тағам өнімдерінің ассортиментін кеңейту болып табылады. Ғылыми жұмысымыздың басты бағыты қолда бар, отандық өндіріске жоғарғы потенциалды шикізат ретінде қолданылатын, құрамында биологиялық белсенді заттары бар тритикале бидайының жоғарғы сұрыбын пайдалану арқылы макарон өнімінің жаңа түрін өндіру болып табылады. Жұмсақ бидай ұнына тритикале ұнын қосу арқылы макарон өнімінің жаңа ассортиментін дайындай отырып, оны ионозонмен өңдеу арқылы реологиялық қасиетін арттыруға болады. Зерттеу нәтижесі бойынша макарон ұнына қоспа пайдалану арқылы созылғыштығы 3 мм - ге, қамыр деформациясы 13 Дж -ге, беріктілігі 45,06-58 грамға белгілі режимде артатындығы байқалды.

Түйін сөздер: тритикале, макарон, беріктілік, қамыр деформациясы, серпімділік, жұмсақ бидай, қоспа.

Introduction. The main source of raw material for traditional pasta products is crushed high-grade durum wheat. When following the technological procedure of production, pasta products are yellow-golden in dry state, have high strength and are distinguished by the transparency of water after long boiling, as well as the light orange color without losing their shape and sticking to each other. However, due to the scarcity of durum wheat and its high cost, pasta must be made from soft wheat flour or a lower variety of durum wheat.

In order to solve the problem of providing the population with healthy food, the Government of Kazakhstan is taking steps to create healthy nutrition centers in the regions and districts, to enrich food products with vitamins and microelements in order to maintain a healthy lifestyle. Development of production of food products enriched with irreplaceable additives for the food industry; tasks of creating and creating new food products specifically aimed at prevention of various diseases and general strengthening of human health are set [1]. Triticale, which was studied as a mixture, is an agricultural crop synthesized as a result of combining the chromosome complex of two different botanical plants - wheat and rye. In general, triticale is divided into two types: winter and spring. In Kazakhstan, only one variety of winter triticale "Taza" gives good yield in Almaty, Zhambyl, South Kazakhstan regions [2].

One of the tasks facing the modern development of food production technology is the development and implementation of rational resource-saving and environmentally friendly technologies. Analyzing the data in the scientific and technical literature, finding a solution to these problems is the use of this ion-ozone technology. That is, the use of ion-ozone water strengthens the spatial structure of the adhesive protein and improves its technological properties while ensuring environmental cleanliness. There is no completely scientifically researched literary information about the use of ionized water in the food

industry according to this technology. Therefore, the question of studying the difference of its rheological properties with the control sample was put forward by mixing whole wheat flour with water prepared by ionospheric technology [3]. The reason wheat is ground whole is that the resulting flour contains all the beneficial properties of the wheat grain, that is, whole parts from the seed to the husk. Whole ground flour has a high mass fraction of leeks, vegetable protein, trace elements, vitamins of group B, E, PP and folic acid amino acids.

The granulometric composition of the flour directly affects its ability to absorb moisture, as a result, the physical properties of the dough and raw product, the strength and density of the pasta, and the preservation of its shape depend on it. In this regard, if the flour grains are too small, when kneading the dough, adding a certain amount of water makes the flour dough stretchy and less spreadable, while the flour grains are coarsened, that is, when it is made from semolina flour, the dough becomes more flexible and spreadable. A larger amount of water is added to increase the flexibility of the type developed from baker's flour compared to shortbread flour. If this is not the case, the elastic dough prepared from bakery flour will be crushed through the holes of the matrices. As a result, the process of compression in the auger chamber worsens, friction with the auger blades increases, the mechanical destruction of the adhesive material increases, its adhesive ability decreases, and as a result, brittle pasta with poor strength is compressed. In general, the most suitable flour for pasta production is coarse semolina. According to the requirements of the existing State Standard 12306-66 and 12307-66, the coarseness of high grade pasta flour should be 200-350 microns [4, 5].

Materials and methods. Grain types taken for scientific research were ground whole. Wholemeal flour is a type of whole wheat that has been milled and not sifted.

The size of flour grains is 204 μm and 309 μm . The rheological property of the dough depends on the type of flour obtained and the temperature of the water. The temperature of water necessary for kneading dough is between 50-60 $^{\circ}\text{C}$. Dough humidity was 37-38%. The concentration of ionized water is 16.7×10^3 . The amount of triticale flour, the size of dispersed particles and the concentration of ionized water were taken as factors affecting pasta dough and quality [6].

According to the scientific research work carried out

in order to increase the nutritional value of the pasta product, a pasta product was prepared by kneading the dough with ionized water to increase its rheological properties by adding whole ground soft wheat flour treated with ionozone mixture to whole ground soft wheat flour. The rheological properties of the prepared dough were studied in the alveograph device.

The properties of flour according to State standard 51415-99 (ISO 5530-4-91) were studied in the alveograph device:



Figure 1 - Alveograph device

Determination of rheological properties and strength of pasta is carried out using a special device "Structurometer ST-2".

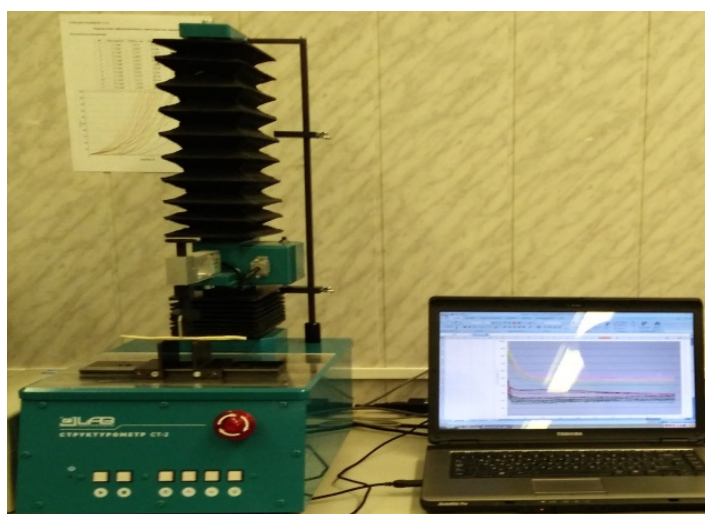


Figure 2 - Structurometer ST-2 device

It is a device that determines the strength of raw materials, semi-finished products and ready-made food products. Aiming to determine the rheological characteristics of food products, the study is carried out on the basis of monitoring the kinetics (change of mechanical load over time) and dynamics (measuring the mechanical load on the depth of the indenter) of the load force measured using the movement of different indenters fixed vertically according to the speed law.

Results and discussion.The granulometric size of the whole ground flour obtained from soft wheat of the "Almaly" variety and triticale "Taza" variety grain obtained for the study is grinding is 204 μm when a current frequency was 50 Hz, while the grain size of triticale obtained as a mixture grinding is equal to 309 μm when used a current frequency of 20 Hz.

The main direction of our scientific work to

find a solution to the above-mentioned problems is the triticale crop whole involved with flour using ionized water alveograph based on consideration of the rheological properties of the prepared pasta dough device according to research was conducted. The obtained data are shown in Table 1.

Using an alveograph, the method of determining the physical characteristics of the dough is to knead the dough from wheat flour and sodium chloride solution at a constant humidity, check the standard thickness to prepare a sample from the dough, blow them with air in the form of a bubble, and note the difference in pressure inside the bubble over time.

The alveograph device determines the physical properties of pasta dough by air pressure resistance. The elasticity, stretchability and deformation energy of the studied dough were determined.

Table 1 - Alveogram parameters of pasta dough prepared from different dispersion ionized triticale flour and ion-ozone water

Number of experiences	Influencing factors			Alveograph indicators		
	Amount of triticale flour, %	Dispersed particle size, μm	Concentration of ionized water, Unit/g	Elasticity, mm	Elongation, mm	Dough deformation energy, J
1	20	204	16.7 x 10 ³	134.0	24.0	150
2	10	309		147.0	21.0	153
3	20	204		129.0	18.0	121
4	10	309		130.0	16.0	108

The table describes the change in alveograph device indicators when pasta dough made from whole wheat flour is affected by 3 different factors. It was observed that the concentration of ionized water affects the rheological properties of the dough, that is, its elasticity, stretchability and dough deformation. It can also be seen that it depends on the amount of triticale. Dispersed particle size 204 μm, concentration of ionozonated water 16.7 x 10³ unit/g It was observed that the elasticity of triticale added by 20 grams compared to 10 grams increased by 3 mm, and the dough deformation increased by 13 J when the dispersed particle size was 309 microns. According to

the results of elasticity, the amount of 10% triticale increased compared to 20%. If we compare with these values of the control sample shown in the table, the indicators of all the samples of kneaded dough using ionized water are high. It can be seen in the picture below.

Elasticity is the ability of the dough to quickly recover its original shape. According to the results of this change, the elasticity of pasta dough increases by 2 times in the first experiment, 1.5 times in the second, 1.4 times in the third, and 1.47 times in the fourth experiment.

Amount of triticale, % / grain size of flour, μm

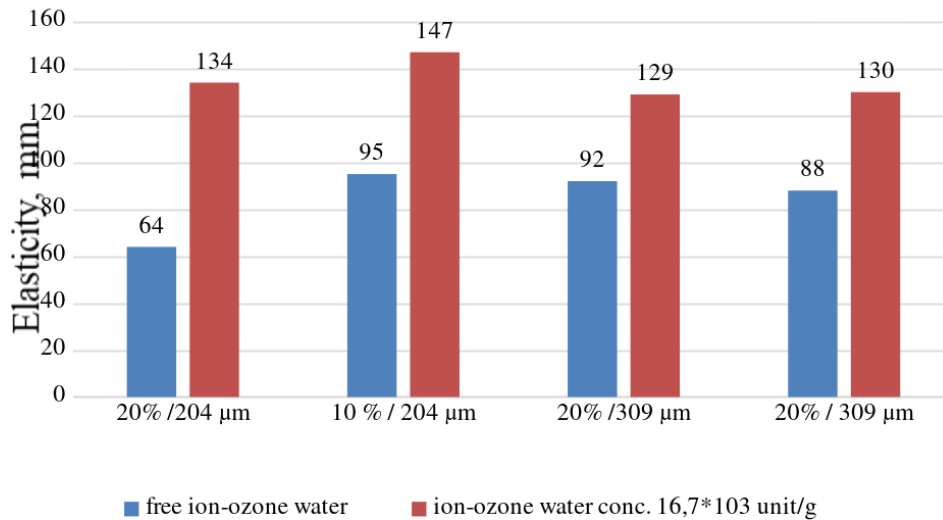


Figure 3 - Effect of triticale flour with ionized water on the elasticity of pasta dough

Too stretchy pasta dough has a negative effect on the quality of the finished product, that is, it causes a change in the shape of the pasta and increases the crumbliness of the product. All these indicators depend on the amount of glue in the flour. When the dough is pressed and, accordingly, due to the increase in the temperature of the dough, it goes to a uniform elastic-stretchy form. The best elastic-stretchy form of the dough is formed when its temperature is 55°C.

As the elasticity of the dough increases, its strength

and density decrease. Therefore, the structure of the dough should not be too dense, too strong, too elastic-stretchy, but should be kneaded in a certain way. In the results of the conducted research, the elasticity of pasta dough kneaded with ordinary water without ionization did not show a significant difference.

The strength of pasta made from whole milled wheat and triticale flour tested using a device for determining the strength of pasta products is confirmed by the results shown in the table below.

Table 2- Strength of pasta made from "Almaly" wheat and "Taza" triticale.

No	Tests	Whole wheat pasta	A product made from wheat flour and water treated with ion-ozone
1	"Almaly" wheat	162.6 g	207.66 g
2	"Almaly" wheat + triticale 10%	169.33 g	227.33 g
3	"Almaly" wheat + triticale 20%	182.33 g	212.66 g

According to the results of the research in the table, the strength of pasta made from soft wheat flour corresponds to 162.6 g, while the sample prepared by treating this flour and dough kneading water with ionozone increases by 45.06 grams. Adding 10 percent of triticale to this flour equals 169.33 g, and its strength after processing increased by 58 grams. With the addition of 20 percent triticale, it showed 182.33 grams, while the strength of the product made from wheat flour and water treated with ionozone increased to 212.66

grams. As a result, it is observed that the structural mechanical properties are strengthened with the help of ionozone.

The ionized, that is, activated, water molecule is a doubly symmetric proton donor and acceptor, it can donate two protons when bound to other molecules and accept two protons from other molecules. This interaction is called hydrogen bonding. Hydrogen bonding in the system of water molecules determines the geometry of the crystals and the properties of liquid

water. As a result, the water molecule acquires a special structure, causing a tendency for molecules to group together. Water with an ordered structure is active with the contact product, and as a result, it tries to increase the required amount of elements in its content [7].

Conclusion. An important way to eliminate the lack of non-replaceable nutrients in the diet is to expand the range of food products enriched with functional ingredients that have a positive effect on people's health. In this regard, recently, a lot of attention has been paid to the preparation and production of enriched, dietary, functional food products with the addition of preparations of biologically active substances or natural components. Ion-ozoned water acts as a highly oxidizing agent. When cooking pasta prepared with such water, the cooked pasta is more

voluminous and porous than the control sample. And the shape of the control sample was smooth and compact. The ion-ozone technology not only performs the function of disinfection, but also carries out the oxidation-reduction process, as a result of the quantum-physical process, the technological and biochemical properties increase, and in general, the nutritional value of the obtained products increases [8. 9]. Kazakh scientists have invented various electrophysical (magnetic, electromagnetic, ultrasonic, ionic, ozone and ionosonic) methods of grain products storage and processing. The use of general electrophysical methods in production reduces energy costs, environmental pollution, and increases product yield while improving quality. Especially electric and magnetic fields destroy harmful microorganisms.

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