



TO STUDY THE EFFECT OF FRACTIONATION OF WHEAT FLOUR VARIETIES ON THEIR BAKING PROPERTIES

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ANNOTATION

The article is devoted to improving the functional properties of wheat grains with a low wheat content, grown in an arid climate. It is also intended to study the improvement of the functional properties of varietal bread flour made from these wheat grains without additives or additives. The scientific novelty of the study is that the baking properties of baked flour grown in dry climates are improved without additives by separating damaged starch grains from baked flours.

KEYWORDS: *baking, fraction, granule, dispersion, flour size, functional, wheat.*

INTRODUCTION

Today in the world there is an increase in the production of wheat grain and a decrease in baking properties as a result of research aimed at increasing its productivity in order to more efficiently use the land.

It was studied that the vitreousness of wheat grains plays an important role in grinding high-quality flour, it is easily separated from the endosperm shell, and flour has high baking properties [1]. The reason for the low viability of wheat grains grown in an arid climate was studied by the action of the harmful wind during their ripening [2, 3]. It is recommended to study the effect of hydrothermal treatment on the rational use of the technological potential of wheat grain grown under these conditions [4].

It was studied that when preparing wheat grains for grinding high-quality flour, the preparation of a mixture of lots of grains of different quality and the same hydrothermal treatment leads to a decrease in their baking properties [5, 6].

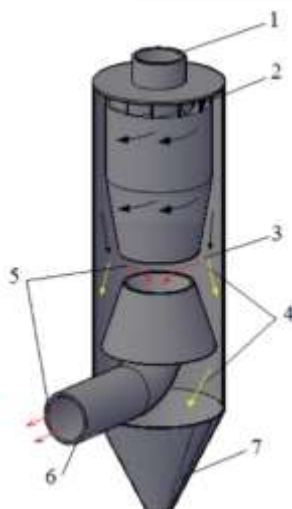
The aim of the study was to study the improvement of the functional properties of varietal bakery flour obtained from wheat grains grown in arid climates, without additives or additives.

In countries with developed mills, special types and varieties of flour with enhanced functional properties are used for the production of bread, pasta and flour confectionery. Given the fact that durum

wheat is not grown in the country, it is important to use different types and varieties of flour for the production of bread, pasta and flour confectionery from flour from soft wheat grains. There is no perfect technology for dividing them into fractions according to functional properties and production of bread, pasta and flour confectionery products that meet regulatory requirements. This requires deep research in this area.

Bread is the most widely consumed food in the daily diet of the population of the republic, and one of the urgent tasks is to make it environmentally friendly and without synthetic additives.

It was revealed that wheat grains with high baking properties are in short supply and do not meet the regulatory requirements for the production of bread, pasta and flour confectionery without additives. However, in recent years, porosizers containing sodium dihydrogen phosphate, sodium dihydrogen pyrophosphate (E 450), sodium bicarbonate, calcium monophosphate, ammonium tartrate, calcium sulfate, corn starch and others have been widely used. They are sometimes called yeast. According to the warning of the medical staff, uncontrolled use of phosphorus leads to an imbalance between phosphorus and calcium in the body [7-11]. Excessive consumption of phosphate impairs calcium absorption, which leads to the accumulation of calcium and phosphorus in the kidneys and the development of osteoporosis. Caution



should be exercised when consuming phosphate-containing foods. People who eat foods high in natural phosphorus are at risk. For example, sodium dihydrogen pyrophosphate (E 450) causes intestinal upset. In addition, modified starch is used in these mixtures.

Research has shown that gluten proteins and intact starch grains provide the baking properties of wheat grain. Therefore, the protein fraction and intact grains of wheat flour starch from wheat grains with this index reflecting the baking properties can be divided into fractions in accordance with their aerodynamic properties. As a result, it was theoretically possible to obtain competitive high quality bread, pasta and flour confectionery.

In order to improve the functional properties of varietal flour obtained from local wheat grains, the first task is to divide them into fractions according to aerodynamic properties, analyze the physicochemical properties and determine the purpose of production. In parallel, in the experiment, samples of flour from wheat grains, which have high baking properties and are not grown in an arid climate, were divided into equal fractions, and compared with the results of preliminary experiments. Therefore, the first object of research was selected flour from soft wheat of the 1st grade, grown in the arid climate of the republic, and flour from wheat of the highest grade, grown in the north of the Republic of Kazakhstan. These samples were divided into three fractions in accordance with their aerodynamic properties: less than 10 microns, the distance between them is 10-20 microns and more than 20 microns. Fractionation by size was carried out in the laboratory of the Institute of Mechanics and Seismic Strength of Structures. M.T. Urazbaeva of the Academy of Sciences of the Republic of Uzbekistan in a centrifugal air separator. This device works in the following order. The original product is fed with primary air through line 1 above the separator. With the help of control vanes 2, the air flow is given a circular motion. Under the action of centrifugal forces of inertia, particles move to the outer cylindrical wall of the separator body and fall into the classification zone 3 between the cone and the walls (Fig. 1). Extensive research has been carried out in this device to sort the scattered particles by size and density.

Particles less than 7 μm in size have been effectively studied theoretically and experimentally [12, 13]. Due to the mass size of large particles (yellow line) 4, they accumulate around the inner walls of the separator under the action of centrifugal force, and under the action of inertia, the separator falls into the hopper 7. Small particles (red line) 5 are carried away by air and are removed from the separator through the exhaust pipe 6. Thus, the original flour is divided into fractions.

Figure 1. Scheme of air-centrifugal separator, which separates wheat flour into fractions by size.

It has been studied that the susceptibility of flour starch depends mainly on the size of the flour particles, the size of the starch grains and their degree of mechanical damage. It has been found that the smaller and more damaged these particles are, the greater their susceptibility to α -amylase, and the higher the gas-forming capacity of such flour [14 - 16].

The size of flour particles has been studied to affect the rate of biochemical and colloidal chemical processes in the dough, and hence the properties of the dough, the quality and yield of bread [17-19]. It has been studied that the size of high and first grade flour particles varies from a few micrometers (μm) to 180-190 μm . It has been found that about half of the particles in a typical bakery flour are smaller than 40-50 μm , and the rest in the range of 40-50 to 190 μm , and that the flour particles obtained from soft wheat are smaller than the particles of durum wheat flour [20].

The size of wheat grain starch grains has been studied to have a significant effect on the production of bread, pasta and flour confectionery. In particular, it was found that it is not advisable to produce bread from wheat flour with starch grains in the range of 1-9 microns, ie they reduce the rheological properties of the dough. Production of high quality bread products from wheat flour with starch grains in the range of 9-18 microns. It is especially recommended for the production of pasta from wheat grains with a grain size of 18 μm higher than starch grains [5, 21, 22]. It was found that the size of starch grains of wheat grains varies depending on climate, agro-technical processing, type, navigation. However, in order to determine the size, dispersion and granulometric composition of starch grains of soft wheat grains compared to hard types, they were detected in a granulometric measuring device called GIU-1 at MGTU named after B.E. Bauman.

The following laboratory equipment and methods were used to study the effect of the size of the flour samples obtained for the study on its baking properties.



RESEARCH MATERIALS AND METHODS

The object of the study was the first variety of local type IV soft wheat grown in arid climates and high-quality baked type IV soft wheat flour grown in the northern part of the Republic of Kazakhstan. Their baking properties were determined using the following laboratory equipment and standard methods.

The whiteness of the flour samples was determined using laboratory equipment "SKIB-M" (Russia) according to GOST 26361-84, and the amount of gluten was determined using laboratory equipment "Perten Inframatic 9500 IK" (Sweden) and a simple method based on GOST 17839-89.

The quality (deformation) of gluten was determined according to GOST 17839-89 on laboratory equipment "IDK-5M" (Russia) and the moisture content of flour samples in a laboratory drying cabinet "SESH-3M" (Russia) based on GOST 9404-88.

The number of drops was determined on the basis of GOST 27676-88 on laboratory equipment PChP-3 (Russia) and GOST ISO 17715-2015 on laboratory equipment SDmatic (France).

Its sedimentation analysis was carried out on laboratory equipment Y15 (Turkey).

RESEARCH RESULTS AND DISCUSSIONS

An objective assessment of the dispersity and particle size distribution of wheat bakery flour, the study of their dependence on the quality of flour and bread is an urgent task. When determining the dispersion of flour, not only the size of the flour particles, but also the quantitative assessment of their shape makes it possible to objectively assess their baking properties. This study first examined the importance of studying the effect of flour particle size on its baking properties.

The scientific novelty of the research lies in the study of changes in the baking properties of the first grade flour from low-grain wheat grown in an arid climate, with a fraction of less than 10 microns. It also includes a comparative analysis of the baking properties of premium wheat flour grown in the northern part of Kazakhstan, with the release of a small fraction of 10 microns of premium flour.

Crushed starch granules increase the water absorption capacity of the dough, affect its rheological properties, increase nutrient reserves for yeast and increase the susceptibility of fungi to alpha-amylase. Although the starch content of whole wheat grains is 67-68%, it has been studied to be 78-82% after milling. The semi-crystalline structure of starch grains in the endosperm of wheat grains can be damaged as a result of any mechanical impact, especially during grinding. Damaged starch is very important for baking, since damaged starch absorbs 4 times more water than its own weight, but in natural starch this figure was equal to 0.4 [23].

Damaged starch granules are also selectively affected by specific enzymes (alpha and beta amylase). It was found that some of these enzymes cannot act on intact starch grains due to the protective coating on the surface [24].

Therefore, table 1 shows the results of the experimental separation of flour samples into fractions by size when changing their baking properties.



Table - 1
Influence of annuality of flour samples obtained for research on baking properties

Flour samples	Its quality indicators							
	Flour fractions	Whiteness	The amount of gluten %	I.D.K Conditional unit indicator	Humidity %	Number of drops	Damage to starch	Sedim
First grade flour	Initial quality indicators	50	26.7	79	13.5	582	21.8	21
	10 mkm each	55	26.4	85	11.4	541	29.4	24
	10-20 mkm interval	50	29.7	72	11.5	519	24.1	33
	20 higher than mkm	44	27.8	75	12.2	585	16.6	27
High quality flour	Initial quality indicators	66	30.2	63	13.2	196	24.5	61
	10 mkm each	66	28.4	65	11.2	184	29.3	63
	10-20 mkm interval	63	31.7	66	11.5	208	23.7	60
	20 higher than mkm	61	30.8	70	12.4	217	18.2	57



We focused on the significance of the effect of flour size and starch grain damage on its baking properties in the introductory and discussion parts of the study. Now, from the experimental results (Table 1), it can be seen that two samples of flour of different quality had different effects on the baking properties. In particular, when we divided the weak first grade flour into fractions in the rectifier, significant changes were observed compared to the fractions of the premium strong flour. That is, its color index in the first class increased by 5 units in a small fraction of 10 microns compared to the control, and in the fraction over 20 microns decreased by 6 units. In this strong high quality variety, no increase was observed, and in the fraction greater than 20 μm , a decrease of 5 units was observed. From this we can conclude that when dividing strong flours into fractions by size, their color changes slightly.

Compared to the gluten content of the flour samples, the weak first grade was 3% higher than the control, and the strong higher grade was 2.2%. For this indicator, fractionation has a significant effect on weak flour.

The conventional unit of gluten IDK is of great technological importance for an objective assessment of the baking properties of wheat flour. When we divided the flour samples into fractions by size, we observed a decrease in the baking properties of the IDC standard block from 63 to 70 compared to the control of the high-grade strong flour sample. In the weak first class, it was observed that in the fraction in the range of 10-20 μm it improved by 7 conventional knowledge, and in the fraction of 10 μm it decreased by 6 conventional units in comparison with the control. From this we can conclude that a weak first grade improves the conditional unit indicator of the fractional IDC.

Technologically significant changes in flour moisture and the number of drops did not occur. Naturally, flour drying is observed during fractionation.

The finer the flour, the more starch is formed. However, it turned out that this indicator also depends on the sown area of wheat, climate, agricultural processing and physicochemical parameters. In other words, the results of the experiment showed that wheat of the first grade, grown in an arid climate, had a share of 10 microns less and a share of 10-20 microns, which increased by 5-11%. This can be explained by the size of the starch grains in the endosperm of wheat grown in arid climates. It is these starch granules that are reflected in the results of experiments with mechanical damage during grinding.

Starch is the main polysaccharide of grain, and the degree of damage during grinding is an important characteristic of the resulting flour. It has been established that the amount of damaged starch grains depends on the hardness and type of grain, the type of technological scheme used for grinding grain [25]. This indicator determines its water absorption capacity. (the moisture capacity of damaged starch is 10 times higher than that of natural starch), which, in turn, affects the rheological properties of the dough. At the same time, the amount of damaged starch determines the degree of its enzymatic hydrolysis, in other words, its ability to form sugars and gases.

It can be noted that mechanical damage to starch was 16.6 conventional units in the large fraction of weak flour of the first grade and 18.2 conventional units in the corresponding fraction of strong flour of the highest grade. If we take into account the fineness of grinding of premium flour, then we can conclude that flour of the first grade requires fractionation, given the low baking properties of ground wheat grain. According to this indicator, even in small fractions, the first grade was 0.1% higher.

The sedimentation index of the fractions of the flour samples showed that the strong high-grade variable had little variation in all fractions. A partial slight decrease is observed in the large fraction. The insignificance of its influence on the quality of bread in the production of bread is indicated in the normative norms. However, a sharp change in control was observed for the first grade flour fractions. The average flour yield was below the standards.

The experimental results show that it is possible to improve the functional properties of flour from soft wheat grains grown in dry climates by fractionation.

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