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THE EFFECT OF HYDROTHERMAL TREATMENT ON THE PHYSICO-CHEMICAL AND GEOMETRIC CHARACTERISTICS OF LOCAL WHEAT VARIETIES GROWN IN UZBEKISTAN

Kasimov Behzod Alisherovich
Trainee researcher of the Department of Food Technology, Tashkent Institute of Chemical Technology

Aykhodhayeva Nadira Karimullayevna
Candidate of Technical Sciences, Associate Professor of the Department of Food Technology, Tashkent Institute of Chemical Technology

Gulnoza Zinatullayevna Djakhangirova
Doctor of Philosophy of Technical Sciences (PhD), Associate Professor of the Department of Food Technology, Tashkent Institute of Chemical Technology

Abstract
Wheat grown in Uzbekistan in a dry and hot climate has its own individual qualitative characteristics, differs in physic-chemical composition, technological properties from imported. When developing technological methods of grain processing in recent years, the use of a high-performance complex of new generation equipment with a high technological effect is taken into account. In particular, properly carried out hydrothermal treatment of grain mass directly affects the physic-chemical properties of grain. The main task of hydrothermal processing (GTO) of grain is to change its technological properties in the direction of their optimization and subsequent stabilization at this level. Therefore, this process is one of the main methods of controlling the technological properties of grain.

Introduction

At the same time, the process is carried out in such a way as to strengthen the maximum possible degree of difference in the strength of the shells and the endosperm: in flour milling, it is necessary to reduce the strength of the endosperm and increase the shells. Such a purposeful change in the structural and mechanical properties of these anatomical parts facilitates their separation during processing and obtaining in the form of independent flour and bran products during grinding, or the whole kernel and grain peeling products during the production of cereals. In addition, there is a noticeable decrease in the energy for grinding, which is also of great importance in the production conditions.

During hydrothermal processing (GTO) of grain in mills, both complex machines and apparatuses equipped with automatic control and regulation systems and simple devices such as hoppers for cooling are used. During the TRP process, the grain is affected by water, heat, and in some versions of the process by pressure.

The grain is moistened in various ways: add water to the grain mass, wash it in special washing machines or steam it in special steamers. The moistened grain is warmed up, or the subsequent stages of the process are carried out at normal temperature. Therefore, the parameters of the TRP are humidity, temperature, pressure and duration of the process as a whole and in its individual stages.

The physic-chemical properties of wheat grain are determined by a large number of indicators, the choice of which depends on the task at hand, determining various aspects of these properties. For wheat grain, as a raw material for flour production, the following indicators are of primary technological importance: the geometric characteristics of the grain, its nature, the mass of 1000 grains, the size and alignment of the grain batch in size, vitreous, density and specific volume, specific surface area of the grain.

The shape of the grain and the condition of its surface affect the density of their laying during the formation of the layer: the ratio of the volume and the external surface of the grain is important for the processes of heat and mass transfer during hydrothermal treatment.3.

Numerous data of the authors give the following conclusions that grain size is one of the most important signs determining its technological properties. During the transition, it increases by 0.20 – 0.50%, the nature decreases by 60 – 70 g / l, the mass of 1000 grains by 50 – 70%, the endosperm content by 3 – 5%. At the same time, the specific external surface increases: this determines the increased ability of small fractions to absorb water, and there is an increased intensity of formation of micro cracks and other physic-chemical processes.

Under the influence of GTO, all indicators of the physic-chemical properties of grain change (with the exception of the mass of 1000 grains). With cold conditioning of wheat, swelling occurs so that the volume of grain of small fractions increases more than the volume of large. In this regard, the alignment of the batch increases, which positively affects the results of subsequent technological operations.

During the cooling, the nature of the grain first sharply decreases, and then increases somewhat. This is due not only to the swelling of the grain, but also to changes in the moisture content of the shells, which affects the coefficient of internal friction of the grain mass.

The virtuousness of the grain decreases depending on the humidity of the process temperature and its duration. The virtuousness of wheat loosening of the endosperm during cold conditioning correlate well, since both are associated with the formation of micro cracks.

Physic-chemical changes occurring in the grain under the influence of heat and moisture, external are manifested in changes in the geometric dimensions of the grain and its density.

Studying the change in the linear dimensions of wheat grains during hydrothermal treatment, it was found that its dimensions increase after conditioning in most cases. Moreover, when the grain is moistened, first of all, changes in the thickness of its shells and the aleuronat layer are observed. The thickness of the fruit shells varies to a greater extent than the aleuronat layer. Observing the change in the integumentary tissues of air-dry grain during moistening, it was found that with an increase in grain moisture to 18%, the thickness of the aleuronat layer increases by 40%, the shells without the aleuronat layer by 50%, and the shells and the aleuronat layer by 55%, compared with dry grain. All this suggests that in the process of hydrothermal grain processing, there is not only an increase in grain size by the action of moisture, heat and time, but also the alignment of grain batches by size.

Grain density is an indicator that comprehensively reflects the features of its structure, chemical composition, geometric dimensions and other advantages of grain.4.

According to G.A. Egorov's research, under the influence of GTO, all indicators of the physic-chemical properties of grain change, with the exception of the mass of 1000 grains. Therefore, we decided to investigate the effect of GTO on the mass of 1000 grains.

Our theoretical studies have shown that when determining the weight of 1000 grains, a unit is expressed by a grain mass of 1000 units in relation to the amount of dry matter. As for the amount of dry matter, the weight of 1000 grains is calculated according to the formula [5, 6].

$$mk = \frac{mx(100 - w)}{100}$$

Here: mx - at the actual humidity of 1000 units, the mass of grains; gr (in grams). w – grain moisture content; % (as a percentage).

Also in our theoretical studies, when studying the geometric parameters of the physic-chemical properties of grain, the amount of the endosperm of wheat grain is determined, and when calculating the yield of flour from it, grain sizes are also determined, that is, length, width, thickness using a caliper. According to the dimensions obtained depending on the length, width and thickness of the grain, its size and the area of its outer surface are determined [7].

Размер зерна:

$$V = K \cdot a \cdot b \cdot l$$

Здесь: *V*-размер зерна; mm^3(миллиметр). К-коэффициент, полученный из опыта.

Для пшеницы, ячменя, ржи и овса K=0,52, a, b, l зерна ширина, толщина, длина; мм (миллиметр).
Площадь наружной поверхности:

$$F = 1{,}12 \cdot a^2 + 3{,}7 \cdot b^2 + 0{,}88 \cdot l^2 - 10$$

рассчитывается по формуле.

F - площадь внешней поверхности зерна; мм^2 (миллиметр).

In our research results, the initial moisture content of local grain varieties obtained from the elevator was ASR varieties-11.2%, DAVR varieties-13.2%. Grain moisture after the first soaking was 15.3%, after the second soaking-15.8%, and after the third soaking-16%.
The results of experiments to determine quality indicators such as the amount of grain admixture of local wheat varieties ASR and DAVR amounted to 4.2...4.3%, weed admixture -2.1...2.2%, vitreous -51...53% of the total grain weight and nature -751...753g/l.
The results obtained for determining the mass of 1000 grains of grain depending on humidity are shown in Table 1.

Table 1. Weight change of 1000 wheat grains depending on humidity

ASR wheat variety				
Grain moisture %	11,2	15,3	15,9	16
1000 pieces of grain mass, gr(gram)	40,1	41,9	42,08	42,15
Wheat grade DAVR				
Grain moisture %	13,2	15,3	15,8	16
1000 pieces of grain mass, gr(gram)	41,2	43,0	43,09	43,16

Also, changes in the physico-chemical properties of grain in the geometric description of local samples of winter soft wheat grown in the republic, depending on humidity, were experimentally investigated and studied; the results are shown below in Table 2.

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Table 2. Change in the geometric description of wheat grain depending on humidity

Grain moisture, %	The dimensions of the granular strip, mm (mm).			Volume mm3	Square on top-news mm²	Grain shape
	width	thickness	Length			
wheat variety						
W	a	b	L	V	F	V/F
11,2	3,12	2,90	6,58	30,96	70,62	0,44
15,3	3,25	2,95	6,79	33,85	75,12	0,45
15,8	3,27	2,96	6,82	34,33	75,85	0,45
16	3,28	2,96	6,83	34,48	76,04	0,45
wheat grade						
13,2	3,04	2,55	6,50	26,20	61,98	0,42
15,3	3,16	2,62	6,72	28,50	65,56	0,43
15,8	3,18	2,64	6,73	28,94	66,21	0,44
16	3,19	2,65	6,74	29,19	66,60	0,44

Experimental studies have shown that at the initial moisture content of wheat grain ACP from 11.2% and DAVP 13.2 to 15.2%, the width increased by 0.12 mm, thickness by 0.05-0.07 mm, length by 0.21-0.22 mm, 2-when grain moisture moisture from 15.3% to 15.8%, the width increased by 0.02 mm, thickness 0.01-0.02 mm, length - by 0.01-0.03 mm. 3-with an increase in grain moisture from 15.8% to 16%, the geometric dimensions of the grain practically did not change. During the experiment, a variation of 0.12- 0.16 mm wide, 0.05-0.07 mm thick and about 0.2-0.3 mm long was observed in 3 repetitions. Due to the geometric dimensions of the grain, the total variation in the shape of the grain did not exceed 0.01-0.03%.

In our experiments, the physic-chemical properties of grain, the composition and amount of impurities in nature, 1000 units of grain weight were determined using standard methods. The determination of the geometric characteristics of the grain by physical and chemical properties is not included in the standard. The reason is that there are several detection methods when one of which is dramatically different from the other. The effect of changes in the physic-chemical properties of grain depending on humidity can be explained by changes in its structural and mechanical properties on the load distribution on the surface of the crushing shaft. Since the structural-mechanical, physic-chemical and biochemical properties of the grain mass are interrelated with each other, in our experiments, a change in the physic-chemical properties of the grain from the optimal norm, depending on humidity, leads to a change in the shape of the grain from its structural-mechanical properties and, consequently, to an uneven distribution of the load on the surface of the crushing shaft. This leads to a decrease in the economic efficiency of the enterprise.

As a result of laboratory studies, it was found that the density of grain depends on its structure, virtuousness, gluten content, degree of maturity and damage to grain as a result of various adverse effects.

Significant density changes occur during hydrothermal grain processing. When moistened and dried, as a result of internal moisture transfer, complex structural transformations occur in the grain, which entail a change in density.

The swelling of the moistened grain leads to an increase in its initial volume and a decrease in density (specific gravity). Within 10-25% humidity, the change in grain density can be determined by the equation:

$$\rho=1{,}460-0{,}008*B,$$

ρ- density in г/см^3

B- humidity in % in terms of dry matter.

Thus, laboratory studies show that the process of internal moisture transfer has a significant impact on the size and density of grain. Grain density, being an indicator of the physic-chemical state of the grain, reacts well to the slightest changes. The processes occurring in the grain under the influence of moisture, heat and time can serve as an objective indicator of the grain structure.

So, the physic-chemical properties of grain significantly affect its technological properties. Both are subject to certain changes, depending on the state of external conditions. These changes are also interrelated with the structural and mechanical properties of the grain.

Thus, the indicators of the physic-chemical properties of grain with changes in humidity and temperature are developed in such a way that special areas of values of these parameters are revealed.

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