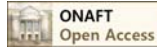




УДК 664.665.761

DOI <https://doi.org/10.15673/gpmf.v21i3.2230>

O. Makarova, PhD, Associate Professor, *E-mail*: olga-odes@ukr.net
<https://orcid.org/0000-0001-5365-871X>, ResearcherID: F-5136-2016

Kateryna Khvostenko, PhD, Associate Professor, *E-mail*: epinchuk@ukr.net
<https://orcid.org/0000-0002-0552-6576>

Nataliia Sokolova, PhD, Associate Professor, *E-mail*: techinstoffood@gmail.com
<https://orcid.org/0000-0002-2278-6687>, ResearcherID: B-2880-2016

Scopus Author ID: 57215573979

Anastasia Fateeva, Senior lab assistant, *E-mail*: fateeva.a.s.26@gmail.com
<https://orcid.org/0000-0002-7871-9774>, ResearcherID: Q-5598-2016

Karyne Avetisian, PhD, Associate Professor, *E-mail*: karkush@ukr.net
<https://orcid.org/0000-0003-1072-5227>

*Department of bakery, confectionary, pasta and food concentrates technologies
 Odessa National Academy of Food Technologies, 112, Kanatna Str., Odessa, Ukraine, 65039*

PASTRY BASED ON FLOUR WITH SPECIFIC CHARACTERISTICS

Abstract

Preservation of initially high quality of the pastry based on the natural ingredients throughout their shelf-life is a major factor to ensure their competitiveness. One of the effective ways of solving this task is using the types of wheat flour with specific characteristics. Differential approach to the technological characteristics of flour, depending on baked goods types, makes it possible to ensure the stability of the technological process and the quality of the produced products without usage of inorganic improvers. Among the types of wheat flour with specific characteristics the flour of waxy wheat, the starch of which does not contain amylose, which plays an important role in the stealing of flour products, is of particular interest. The studies found that waxy wheat flour characterised with higher gassing power and water absorption compare with control. According to their technological characteristics it is suggested to use wheat flours with specific characteristics in the technology of yeast-containing cakes, hardtacks with lower sugar capacity. Flour of extra-soft wheat Oksana is characterized by low water absorption and weak gluten, which are desirable technological properties for the production of most types of confectionery dough. It was found that waffles and wafers based on extra-soft wheat Oksana flour are characterized with lower density and better porosity and texture compared with the control. It is shown that the use of waxy wheat flour and biscuit wheat flour in the technology of mentioned pastry types leads to the technological process intensification, stabilization of their rheological characteristics, product quality and their freshness without adding of improvers.

Keywords: waxy wheat, extra-soft wheat, wheat flour, pastry, quality, staling.

Introduction

In the total volume of confectionery products, pastry occupy a large share [1]. Food manufacturers pay considerable attention to the production of these products in order to increase the profitability of their enterprises. Therefore, in addition to expanding the pastry assortment, it is actual task to ensure its stable quality during the whole period of storage, which will enhance the competitiveness of products in the current conditions of market [2].

The task of improving, stabilizing the quality of pastry is closely related with the problem of providing necessary quality characteristics of raw materials, their effective and purposed usage. Thus, the technological properties of wheat flour, a main ingredient of the flour product, is a significant factor that determines the technological process, the quality of semi-finished products and the texture of final products [3]. The requirements for flour quality characteristics, due to the considerable variety of flour products, should vary in a sufficiently wide range and depend on the used method of leavening, the structural and mechanical properties of the dough mass-

es, the peculiarities of their technological process, which ensure the required texture of products, etc.

In Ukraine the whole assortment of flour products are produced from bakery wheat flour, which is not always technologically suitable for the production of high-quality pastry products. After all, the technological properties of flour for production of bread and pastry dough should be different [4-6].

Considering the foregoing, it is necessary to investigate the possibility of using wheat flours with specific characteristics, bred in the south of Ukraine, in the technology of pastry for the stabilization of their quality and enhancement of their shelf-life without using the improvers with chemical origin.

Analysis of literature data and problem statement

The current dynamic development of the food industry and market relations require to respond quickly for consumer demands by the manufacturer of pastry products [7]. This tendency provide the production of high-quality products and to ensure its organic origin and environmental friendliness [8].



Dough's pastry is one of the most multicomponent structure, which structure-mechanical properties depend on recipe ingredients and their correlation, and technological parameters also. The dough for wide assortment of pastry differs according to their rheological characteristics, which obtain a finished product quality with a desired texture [5, 9]. For this reason, usage of flour with specific characteristics is important for at the production of pastry with various structure. In this case the most expedient for most pastry production is the usage of wheat flour with weak elastic gluten, which is unsuitable for obtaining high-quality bread.

In Ukraine in spite of other countries [10], bakery wheat flour is the only one type of wheat flour, which is used in the production of bread and pasta products. This significantly complicates the work of technologists, leads to cost increase, negative effects on the quality of products. For effective and fast solving these problems the manufacturers often add food supplements, which have inorganic origin in greater extent, which is a risk factor for the consumer's health.

Differential approach to flour quality, depending on its use, is widespread [5,6,11]. For example, in the Europe and the USA, purposed flour is produced by the selection of wheat mixtures [12, 13]. Sometimes the blends are prepared from whole grain meals with either hard or soft wheat flour and processed into bread, cake, cookie or snack products. All bakery and pastry technologies demand special properties of flour. Treated heat flour is recommended for fancy cakes and some types of cookies production. Such type of flour can be "inactivated" or enzymatically inactive. Its treatment can be strong (with the denaturation of the whole protein) or soft, which weakly changes the properties of the flour.

The use of flour from various varieties of wheat and their mixtures for the production of certain types of products is actual. Breeders are constantly elaborate new varieties of wheat, which characterized with specific technological properties of the flour produced from it. These characteristics practically do not effect on the taste of the product, but significantly effect on the structure and quality of products. This influence is different for various types of pastry products depending on the presence and ratio of sugar and fat, as well as the method of dough leavening.

It has been established that pastry products made from soft wheat flour characterized with higher quality compared with the products based on ordinary bakery wheat flour. The positive influence on the product quality is determined by several basic physical and chemical properties, a fine dispersion, a characteristic natural soft looseness with a low percentage of damaged starch granules [14].

Waxy wheat flour represents a special interest among the new varieties of Ukrainian breeding crops with specific characteristics. A numbers of studies have been conducted to confirm its potential as a main component of the flour products recipe due to its modified starch (non-amylose) content (Fig.1).

It was found that the introduction of waxy wheat flour into the recipe of bakery goods causes to the increasing of their consumer characteristics throughout the storage period [14, 15]. It should be taken into account

that the recommendations of foreign scientists and technologists regarding to the use of flour with specific characteristics for the manufacture of certain types of products can not be uniquely projected for the production of

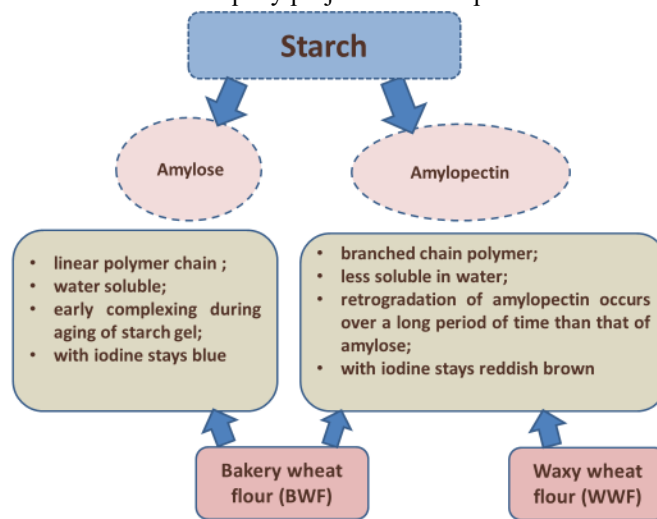


Fig. 1 - Waxy wheat starch

pastry in our country, taking into account the specifics of their classification and technology. Consequently, the pastry quality improvement is closely connected with the question of efficient and rational use of grain resources according their characteristics and the requirements of the technological process.

The main aim is to investigate the effectiveness of the wheat flours with specific characteristics usage for the quality improvement and its stabilization during pastry (yeast-containing cakes, hardtacks, wafers and waffles) shelf-life without using of inorganic origin improvers.

Based on it the study stages were:

- determining the technological properties of wheat flours with specific characteristics and substantiating the choice of pastry for their rational use;
- investigating the influence of the waxy wheat flour mass fraction on the intensity of the fermentation process of yeast-containing cakes and hardtacks semi-finished products;
- investigating the influence of the biscuit Oksana wheat flour on the viscosity of wafer's and waffle's dough;
- evaluating the quality of pastry and its change in the process of storage.

Materials and methods of research.

In this study wheat flour produced from waxy wheat Ukrainian specie Sofiika was used for the yeast-based cake's and hardtacks with reduced sugar content production. Jerusalem artichoke powder and maltose syrup were used as a sugar substitute agent in the hardtacks recipe. Extra-soft wheat flour (Oksana specie), which breded in Ukraine, was used in the wafers and waffles technologies.

The intensity of gas formation in the dough was measured by AG-1M. This method is based on determining the amount of carbon dioxide formed during the dough fermentation by the volumetric method [16].



Comparative analysis of the wheat flour quality included the determination of the raw gluten content was realized by the methods presented in [14], the level of gluten plasticity measured by IDK (special device designed for determining the gluten quality group), its elasticity, estimated by the value of its deformation under the load effect. The results of measuring the gluten elasticity are expressed in conventional units of the device scale. Depending on the value of measuring results, gluten is related to the correspondent quality group.

The moisture content of flour was determined by heating a small sample of flour for 1 hr at 130°C and taking the loss in weight as the moisture content according to ISO 27971:2015. Water absorption is the amount of water required to center the farinograph curve, which was determined using Farinograph (Brabender).

The effective viscosity (η , Pa·s) of the dough was determined with a rotational viscometer "Reotest-2" immediately after the preparation of wafer's dough at a temperature of 18-20°C [17].

The determination of the hardness of the products was carried out on a device, which measured the force P of sample break down. The hardness in kg/m² was calculated

$$H_0 = \frac{P}{S}, \quad (1)$$

where H_0 – the hardness, kg/m²;

P – force acting on area, kg;

S – contact area, m².

For the determination of the product's density (ρ , g/cm³), the volume of wafers/hardtacks is measured by the calculated method based on the results of two-time weighing of the product (in the air and in water). To prevent wetting, the object of the study is pre-coated with a layer of paraffin, which provides protection of its surface while immersion in water.

To determinate the density the product has been weighing on a technical scale to the nearest 0,01g. Then it is dipped into molten paraffin, whose temperature is close to its hardpoint, and quickly removed. When the paraffin on the surface of the sample has hard, it is again weighed and placed in suspension. The paraffinized sample was weighed twice with the suspension: in air and fully immersed in water at a temperature of about 20°C. The density measured in g/cm³ calculated by the formula

$$\rho = \frac{m}{V_3 - (V_1 + V_2)}; \quad (2)$$

where ρ – density, g/cm³

m - mass of product, g;

V_1 - volume of suspension, cm³;

V_2 - volume of paraffin, cm³;

V_3 - volume of paraffined product with suspension, cm³.

The acid accumulation was evaluated on the basis of change of its total titratable acidity. It was defined as the amount of 0,1N NaOH solution (mL) used to neutralize 5 g sample weight homogenized with 50 ml of

distilled water. These analyses were carried out every 30 min during all term of fermentation (90 min) [17].

The water absorption capacity of products was determined by measuring the water absorption when it submerged in water at a temperature of 20°C for a set amount of time [17]. Determination of moisture content was made according to ISO 712:2009.

The specific volume was calculated by dividing the volume by the weight of the baked product [17].

Structural-mechanical properties of soft waffle and cake's crumb was determined on the automatic penetrometer AP-4/1 [17].

Results and discussions

Technological properties of wheat flours with specific characteristics (waxy wheat flour – WWF and biscuit Oksana wheat flour - BOWF) were studied.

The results of the evaluation of the technological properties of waxy wheat flour indicate that an increase of the mass fraction of non-amylose flour promotes the growth of the gassing power of mixtures with BWF (table 1).

Table 1 - Technological properties of flour mixtures

Mass fraction of WWF, %	Amount of CO ₂ , ml CO ₂ /100 g flour (after 5h of fermentation)	Water absorption, %
0	1314	59,0
20	1380	61,0
40	1580	63,0
60	1760	65,0
80	1815	66,0
100	1900	67,0

The normal gas-forming ability of wheat all-purpose flour for 5 hours of its fermentation is 1300-1600 ml of carbon dioxide. It is known that for the formation of such an amount of carbon dioxide, yeast must ferment at least 6 g of glucose. In this period yeast has obtain about 1 g of glucose getting from own flour sugars, and the remaining 5 g are formed as a result of amylolytic starch degradation. The increase of the carbon dioxide amount for samples with waxy wheat flour can be explained by the increased content of its own sugars in the content, which are the main energy material for yeast cells, and also by the more intense amylolysis of its starch. The increase in the water absorption capacity of flour from waxy wheat by 8 % compared to bakery wheat flour (BWF) is caused by greater sensitivity of non-amylose starch grains to mechanical damage during grinding, which contributes to the increase of their hydrophilic properties.

A comparative analysis of the wheat flour quality of bakery wheat flour (BWF) and biscuit Oksana wheat flour (BOWF) showed (table 2) that the extra-soft wheat flour is characterized by weaker gluten and it's lower content. Qualitative characteristics of gluten-forming fractions of protein BOWF correspond to the weak III quality group. Also, this type of flour had a lower by 7 % water absorption capacity.

Considering the technological properties of biscuit Oksana wheat flour, a study of the feasibility of using in the technology of wafer products, for the production of which it is recommended to use flour with weak gluten.

Table 2 - Comparative analysis of the wheat flour quality

Quality indicators	Bakery wheat flour (BWF)	Biscuit Oksana wheat flour (BOWF)
Moisture content, %	14,2	14,3
Content of wet gluten, %	24,5	21,6
Plasticity for IDK, device units	70	85
Water absorption, %	59,0	52,0

The influence of replacing 50 % and 100 % bakery wheat flour on BOWF on the properties of batter and products from it - wafers (wafer sheets) and waffles with chemical method of leavening has been investigated.

It is obtained that substitution of BWF with BOWF leads to the lower viscosity of wafer's and waffle's batter and the destruction of its structure occurred at lower viscosity gradients than for control sample to a greater extent, these changes are observed with a complete replacement bakery of BOWF (fig. 2). An increase in shear rate is accompanied by a decrease in batter viscosity. At a shear rate of more than 9 s^{-1} – there approximates the viscosity of the dough to a steady value. After all, under the influence of the growing shear rate, the interaction between the particles decreases, and their orientation increases in the direction of the flow.

Thus, the viscosity of the dough based on BOWF was more reduced for waffle by 2,8 times and wafer by 1,6 times, in compare with control (at the shear rate $\gamma = 3 \text{ s}^{-1}$). The viscosity decrease may due to the weaker gluten and the low water absorption capacity of the flour of BOWF, which increases the content of the liquid phase in the dough, which contributes to better coverage of flour particles with a hydration shells and simplifies their dispensing under mechanical action, without sticking.

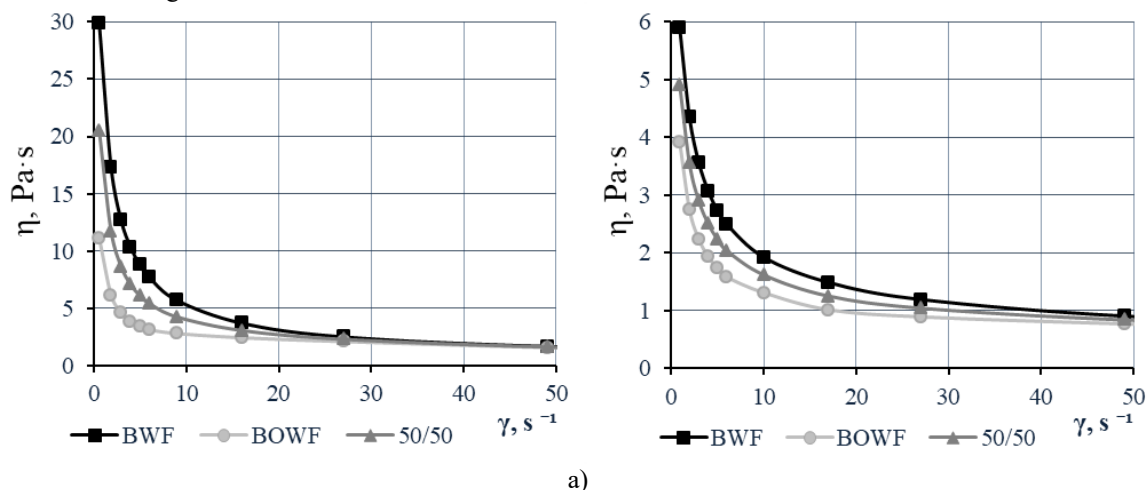


Fig. 2 - Viscosity of waffle's (a) and wafer's (b) dough

The obtained results of the quality of the finished products research show that the replacement of BWF with BOWF in the recipe of waffles leads to the improvement of the finished products quality (fig. 3a). Thus, in comparison with control, waffles were characterized by a 4,6 % increase in specific volume and increased by 8,3 % as a measure of the total compression of the crumb, this is typical for high porosity. This is probably due to the weaker gluten of BOWF, the formation of dough protein structure, which is more easily stretched under the influence of gas substances, that extend during baking.

It is obtained that waffle products based on BOWF are characterized by an increased volume, an intense color of the surface and a well-developed porous structure of the crumb. Replacement of baking flour with biscuit flour leads to the higher quality formation of wafers.

For wafer sheets density and the hardness index (fig. 3b), which correlates with the texture of products and characterizes their fragility, was determined. Thus, the hardness of wafer sheet at full replacement of BOWF is lower by 8,4 %, and about twice lower density comparing with the control sample. Reducing the hardness and density of samples based on BOWF can be explained by the formation of a less dense gluten structure due to the lower content of glutelin and prolamine protein fractions, which is characteristic for this type of flour, and leads to the increase of product porosity.

The wafers, based on BOWF, were characterized with desired crisp properties, without cracks and leaks, equal color and more homogeneous density compared to control, due to a decrease in the viscosity of the batter, which contributed to its better distribution on the baking surface.

According to the results of the investigation of technological properties of waxy wheat flour and its blends with bakery wheat flour the choice of pastry, in the production of which it is advisable to use new type of flour, has been justified. Waxy wheat flour has a higher gassing power, which can contribute to the intensification of technological process in the production of pastry products, the formation of a porous structure which is caused by the process of fermentation, and will help to stabilize their quality in the case of partial or complete

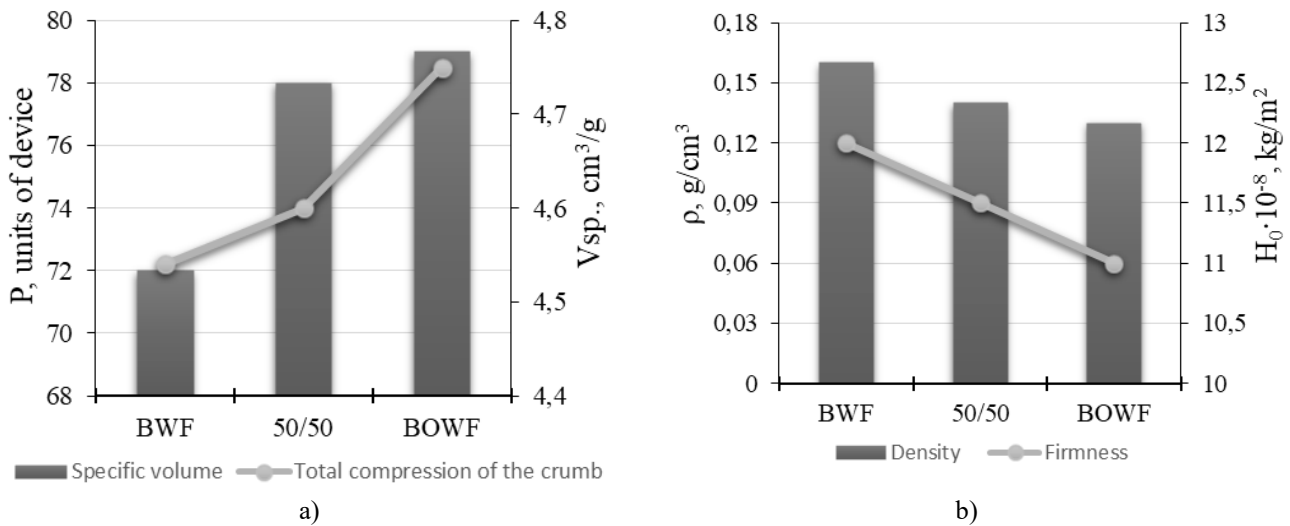


Fig. 3 - Quality index of the waffle (a) and wafer (b) products

exclusion of sugar from the recipe, which not only determines the taste of the product but also causes required intensity of biotechnological processes in the production of these products. Also, effective results can be achieved by solving the problems of rapid staling of yeast-containing cakes using in their production the waxy wheat flour, which has lower peak temperature (BWF - 88°C, WWF - 74°C) and its starch consists of amylopectin. This polysaccharide has higher resistance to retrogradation compared with amylose, which is the essential component of the starch of the bakery wheat flour [6].

Its usage in the production of hardtacks with Jerusalem artichoke powder and maltose syrup instead of the sugar in the recipe content was accompanied, by the increase of the carbon dioxide amount and final titratable acidity of the semi-finished products (fig. 4), which indicates intensification of alcoholic and lactic acid fermentation in the process of their production compared with the control sample. Based on the obtained results, it is suggested to reduce the fermentation process duration of the dough for the samples based on the WWF up to 30...60 min depending on the used type of sweetener.

It was determined that the combined use of waxy wheat flour with natural sweeteners, despite the exclusion of sugar from the recipe, was accompanied by the higher water absorption and lower density of the hardtacks compared with control samples based on the bakery wheat flour [18]. Such results indicates the better porous structure formation for the investigated samples.

The study of the quality change of hardtacks during storage showed that the introduction of non-amylose flour into their recipes provides the quality stabilization of samples. The hardtacks based on waxy wheat flour with Jerusalem artichoke powder and maltose syrup, as sugar substitutes, were characterized with better quality indicators compared to the control and similar samples based on bakery wheat flour with natural sweeteners after 90 days of storage (table 3).

Also the effect of BWF to WWF ratio on the yeast-based cakes quality was studied (fig.5). It found that samples with 60 % WWF were characterized with the highest porosity compared with the control. Such results can be obtained due to the higher gassing power of non-amylose type of wheat flour.

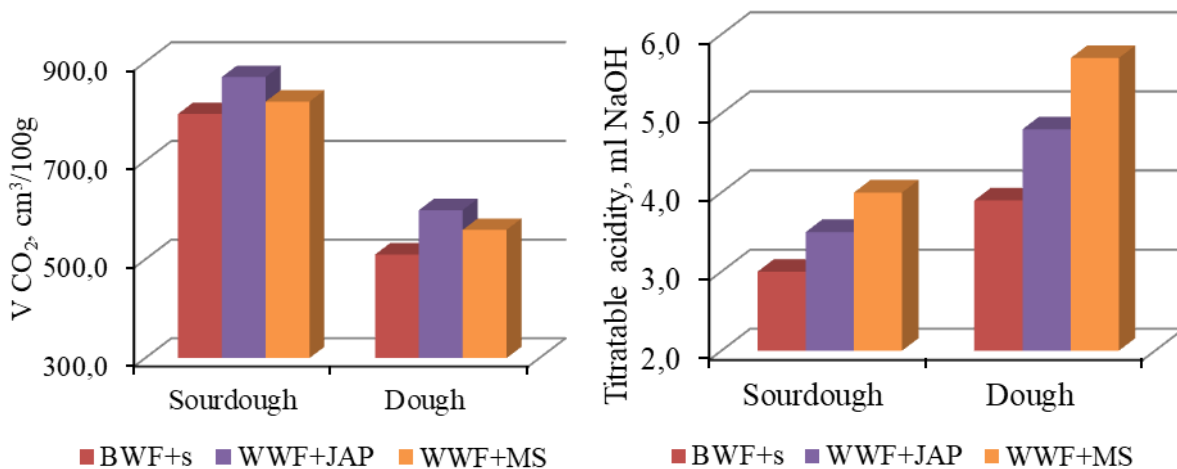


Fig. 4 - The carbon dioxide amount (a) and final titratable acidity of semi-finished products:

BWF – bakery wheat flour; WWF – waxy wheat flour; s – sugar; JAP – Jerusalem artichoke powder; MS – maltose syrup.

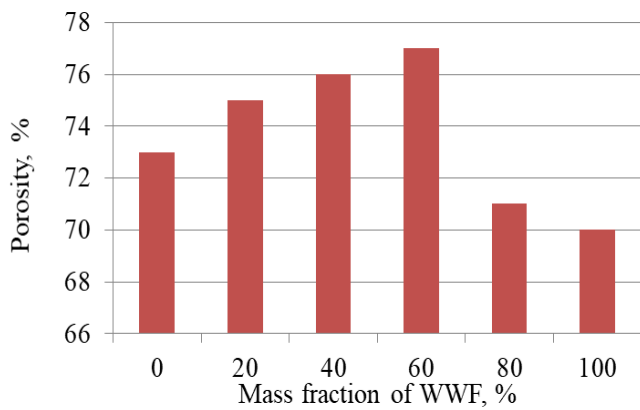


Fig. 5 – Cake's porosity

Table 3 - Quality of hardtacks (90 days of storage)

Index	Samples				
	BWF+s (control)	BWF+JAP	BWF+MS	WWF+JAP	WWF+MS
Moisture content, %	8,9	8,4	8,8	9,3	9,6
Titrateable acidity, ml NaOH	2,5	2,2	2,0	2,8	2,6
Water absorption, %	200	170	163	215	205
Density, g/cm ³	0,46	0,51	0,54	0,39	0,45
Firmness, kg/m ² ×10 ⁸	5,5	6,5	7,0	4,5	5,0

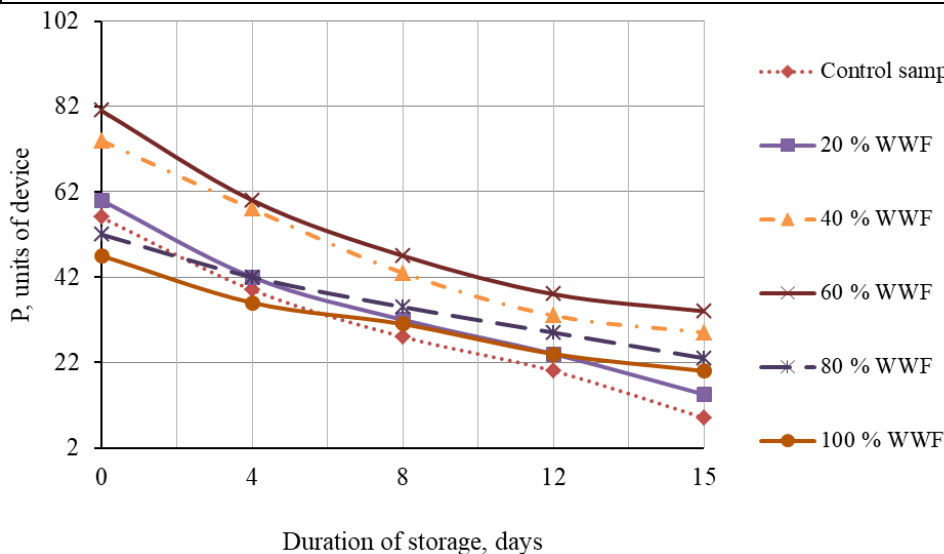


Fig 6 - Changes in the structural-mechanical properties of yeast-based cake crumb during storage

For many flour-based products, the crispy and crunchy characteristics are important for sensory acceptance on which consumer base their appreciation, as it was shown in study [19]. Usually, when storing flour products, a rapid increase in their hardness is observed, which is due to the processes of drying, staleness and crystallization. Staling is a consequence of the loss of moisture as a result of starch retrogradation. During storage, crystallization of sucrose and solid fats occurs, which increases the hardness of the products. It is important to note that the degree of crystallization for cakes crumb, which contain non-amylose wheat flour is lower compared to the control, which indicates less in-

tensive retrogradation of waxy wheat starch granules. Yeast-containing cakes with waxy wheat flour were stored for 15 days per piece packed in polyethylene packaging at temperature of 18 ± 2 °C at a relative humidity of 60-65 % (fig. 6). The changes in the structural and mechanical properties of the cake crumb were reduced, but the use of waxy wheat flour in the recipe of the yeast-containing cakes was accompanied by smaller changes in the structure of their crumb as we can see

It has been established that with an increase in the dosage of waxy wheat flour, the structural and mechanical properties of the crumb of pastry products improve.

Conclusions

Thus, based on the results of the research, it can be concluded that the replacement of bread wheat flour for the various types of flour with specific characteristics leads to the stabilization of the quality during the shelf-life of wide pastry assortment groups (cakes, sugar-free hardtacks, wafers and waffles). The experimental results have shown that waxy wheat flour characterised with higher gassing power and water absorption compare with control. Flour of extra-soft wheat Oksana is characterized by low water absorption and weak gluten. Using Biscuit Oksana wheat flour instead of bakery flour was accompanied by obtaining batter with lower viscosity, which leads to batter's better distribution over the surface of wafer plates and ensured obtaining homogeneous density and thicknesses of wafer sheets. Wafers and waffles were characterized by a more porous loosened texture, which is due to the better loosening of products during baking. The use of waxy wheat flour in the production of

hardtacks with Jerusalem artichoke powder and maltose syrup instead of sugar in the recipe leads to an increase of alcohol and lactic acid fermentation and an product's porosity improvement. It was found that yeast-based cake's with 60 % waxy wheat flour was characterized with the highest porosity compared to the control. Obtained results can be the basic of a novel technological solution to provide the technological process intensification, the quality stabilization of cakes and hardtacks with reduced sugar content based on WWF and to prolong their shelf-life without synthetic improving agents usage.



REFERENCES

1. Ofitsiyinyi Internet-sayt derzhavnogo komitetu statistiki Ukraina. URL: <http://www.ukrstat.gov.ua>
2. Estruch R. et al. Reformulation of Pastry Products to Improve Effects on Health // *Nutrients*. 2020. T. 12. №. 6. 1709.
3. Types of wheat flour // *Berkeley Wellness*, University of California. 2016. URL: <http://www.berkeleywellness.com/healthy-eating/food/article/types-wheat-flour>
4. Zhigunov, D.A. Analiz kachestva pshenichnoy muki tselevogo naznacheniya. *Hranenie i pererabotka zerna*. 2013. 3. 41-43.
5. Manley D. *Manley's Technology of Biscuits, Crackers and Cookies*. Woodhead Publishing Limited. Cambridge, 2011. 632 p.
6. Iorgachova K., Makarova O., Khvostenko K. (2016). The rationale of selecting pastries to be made with waxy wheat flour / *Eastern-European Journal of Enterprise Technologies*. – 2016. – № 2/11 (80) – P. 12–19.
7. Martínez-Monzó J., García-Segovia P., Albors-Garrigós J. Trends and innovations in bread, bakery, and pastry // *Journal of culinary science & technology*. – 2013. – T. 11. – №. 1. – C. 56-65.
8. Voinea L., Popescu D. V., Negrea M. T. Good practices in educating and informing the new generation of consumers on organic foodstuffs // *Amfiteatru Economic Journal*. – 2015. – T. 17. – №. 38. – C. 488-506.
9. Noorfarahzilah M. et al. Applications of composite flour in development of food products // *International Food Research Journal*. – 2014. – T. 21. – №. 6. – C. 2061.
10. Catterall P., Cauvain S. P. *Flour milling // Technology of breadmaking*. – Springer, Boston, MA, 2007. – C. 333-369.
11. Ribalka, O.I. *Yakist pshenitsi ta yiyi pollpshennya / Logos*. Kyiv, 2011. 496
12. Duyvejonck A. E. et al. Relative contribution of wheat flour constituents to solvent retention capacity profiles of European wheats // *Journal of Cereal Science*. – 2011. – T. 53. – №. 3. – C. 312-318.
13. Prabhasankar P., Rao P. H. Effect of different milling methods on chemical composition of whole wheat flour // *European Food Research and Technology*. – 2001. – T. 213. – №. 6. – C. 465-469.
14. Yu, X.R., Zhou, L., Zhang, J., Yu, H., Gao, D.R., Zhang, B.Q. et. al. (2015). Comparison of Structural Development and Biochemical Accumulation of Waxy and Non-waxy Wheat Caryopses. *Cereal Research Communications*. 2015. Vol. 43 (2). P. 307–317.
15. Xurun, Y., Heng, Y., Zhang, J., Shao, S., Zhou, L., Xiong, F. & Wang, Z. Comparison of endosperm starch granule development and physicochemical properties of starches from waxy and non-waxy wheat. *International Journal of Food Properties*. 2015. Vol. 18. P. 2409–2421.
16. Lebedenko, T. E. *Tehnologiya hlibopekarskogo virobnitstva. Praktikum / OsvIta Ukrayini*. Odessa, 2014. 392 s.
17. Iorgachova K.G., Makarova O.V., Gordienko L.V., Korkach G.V. *Praktikum po tehnologiyi konditerskih virobiv / za red. K.G.Iorgachovoyi*. Odessa. 2011. 208 s.
18. Iorgachova K., Makarova O., Khvostenko K. (2018). Prospect of the new types of wheat flour usage in the production of the refined sugar-free hardtacks. Vol. 24 (5). P. 225-235.
19. Luyten, H., Plijter, J.J., Vliet, T.V., 2004. Crisp/crunchy crusts of cellular foods: a literature review with discussion. *Journal of Texture Studies* 35 (5), 445–492

УДК 664.665.761

О.В. Макарова, канд. техн. наук, доцент, E-mail: olga-odes@ukr.net
 К. Хвостенко, канд. техн. наук, доцент, E-mail: epinchuk@ukr.net
 Н.Ю. Соколова, канд. техн. наук, доцент, E-mail: techinstoffood@gmail.com
 А. Фатеева, асистент, E-mail: fateeva.a.s.26@gmail.com
 К. Аветисян, канд. техн. наук, доцент, E-mail: karkush@ukr.net

ТІСТО НА ОСНОВІ БОРОШНА ЗІ СПЕЦИФІЧНИМИ ХАРАКТЕРИСТИКАМИ

Анотація

Основним фактором конкурентоспроможності борошняних кондитерських виробів є забезпечення високої якості та збереження її протягом усього терміну зберігання продукції при використанні для виробництва лише натуральних інгредієнтів. Одним із ефективних способів вирішення цього завдання є використання пшеничного борошна із специфічними характеристиками. Диференціальний підхід до технологічних характеристик борошна залежно від виду виробів дає змогу забезпечити стабільність технологічного процесу та якість виробленої продукції без використання неорганічних поліпшувачів. Особливий інтерес серед видів пшеничного борошна цільового призначення викликає борошно з пшениці ваксі, крохмаль якого не містить амілози, яка відіграє важливу роль в черствінні борошняних продуктів. Дослідженнями було встановлено, що борошно з ваксі-пшениці характеризується більш високою газоутворювальною та водопоглинальною здатністю порівняно з хлібопекарським борошном. Відповідно до його технологічних характеристик пропонується використовувати дане борошно в технології кексів на дріжджах, галет зі зниженою цукроємністю. Борошно з екстра-м'якої зерної пшениці сорту Оксана характеризується низькою водопоглинальною здатністю та слабкою за якістю клейковиною, що є бажаними технологічними властивостями для виробництва більшості видів виробів з кондитерського тіста. Встановлено, що листові та м'які вафлі на основі борошна з пшениці Оксана відрізнялися від виробів на хлібопекарському борошні меншою густиною та кращою пористістю і текстурою. Показано, що використання борошна з пшениці ваксі та м'якої зерної пшениці в технології зазначених видів борошняних кондитерських виробів призводить до інтенсифікації технологічного процесу, стабілізації реологічних характеристик напівфабрикатів, якості та свіжості продукції без додавання поліпшувачів.



Ключові слова: борошно пшеничне, пшениця ваксі, екстра-м'якозерної пшениці, борошняні кондитерські вироби, якість, зберігання.

ЛІТЕРАТУРА

1. Офіційний Internet-сайт державного комітету статистики України. URL: <http://www.ukrstat.gov.ua>
2. Estruch R. et al. Reformulation of Pastry Products to Improve Effects on Health // *Nutrients*. – 2020. – Т. 12. – №. 6. – С. 1709.
3. Types of wheat flour // Berkeley Wellness, University of California. 2016. URL: <http://www.berkeleywellness.com/healthy-eating/food/article/types-wheat-flour>
4. Жигунов Д.А. Анализ качества пшеничной муки целевого назначения. *Хранение и переработка зерна*. 2013. № 3. 41-43.
5. Manley D. *Manley's Technology of Biscuits, Crackers and Cookies*. Woodhead Publishing Limited. Cambridge, 2011. 632 p.
6. Iorgachova K., Makarova O., Khvostenko K. (2016). The rationale of selecting pastries to be made with waxy wheat flour / *Eastern-European Journal of Enterprise Technologies*. – 2016. – № 2/11 (80) – P. 12–19.
7. Martínez-Monzó J., García-Segovia P., Albors-Garrigos J. Trends and innovations in bread, bakery, and pastry // *Journal of culinary science & technology*. – 2013. – Т. 11. – №. 1. – С. 56-65.
8. Voinea L., Popescu D. V., Negrea M. T. Good practices in educating and informing the new generation of consumers on organic foodstuffs // *Amfiteatru Economic Journal*. – 2015. – Т. 17. – №. 38. – С. 488-506.
9. Noorfarahzilah M. et al. Applications of composite flour in development of food products // *International Food Research Journal*. – 2014. – Т. 21. – №. 6. – С. 2061.
10. Catterall P., Cauvain S. P. *Flour milling // Technology of breadmaking*. – Springer, Boston, MA, 2007. – С. 333-369.
11. Рибалка О.І. Якість пшениці та її поліпшення / *Логос*. Київ, 2011. 496
12. Duyvejonck A. E. et al. Relative contribution of wheat flour constituents to solvent retention capacity profiles of European wheats // *Journal of Cereal Science*. – 2011. – Т. 53. – №. 3. – С. 312-318.
13. Prabhasankar P., Rao P. H. Effect of different milling methods on chemical composition of whole wheat flour // *European Food Research and Technology*. – 2001. – Т. 213. – №. 6. – С. 465-469.
14. Yu, X. R., Zhou, L., Zhang, J., Yu, H., Gao, D. R., Zhang, B. Q. et. al. (2015). Comparison of Structural Development and Biochemical Accumulation of Waxy and Non-waxy Wheat Caryopses. *Cereal Research Communications*. 2015. Vol. 43 (2). P. 307–317.
15. Xurun, Y., Heng, Y., Zhang, J., Shao, S., Zhou, L., Xiong, F. & Wang, Z. Comparison of endosperm starch granule development and physicochemical properties of starches from waxy and non-waxy wheat. *International Journal of Food Properties*. 2015. Vol. 18. P. 2409–2421.
16. Лебеденко, Т. Е. *Технологія хлібопекарського виробництва. Практикум / Освіта України*. Одеса, 2014. 392 с.
17. Іоргачова К.Г., Макарова О.В., Гордієнко Л.В., Коркач Г.В. *Практикум по технології кондитерських виробів / за ред. К.Г. Іоргачової*. Одеса. 2011. 208.
18. Iorgachova K., Makarova O., Khvostenko K. (2018). Prospect of the new types of wheat flour usage in the production of the refined sugar-free hardtacks. Vol. 24 (5). P. 225-235.
19. Luyten, H., Plijter, J.J., Vliet, T.V., 2004. Crisp/crunchy crusts of cellular foods: a literature review with discussion. *Journal of Texture Studies* 35 (5), 445–492

Received 14.07.2021

Reviewed 02.08.2021

Revised 15.09.2021

Approved 24.09.2021



Cite as Vancouver Citation Style

Makarova O., Khvostenko K., Sokolova N., Fateeva A., Avetisian K. Pastry based on flour with specific characteristics. *Grain products and mixed fodder's*, 2021; 21 (3, 83): 21-28. DOI <https://doi.org/10.15673/gpmf.v21i3.2230>

Cite as State Standard of Ukraine 8302:2015

Pastry based on flour with specific characteristics. / Makarova O. et al. // *Grain Products and Mixed Fodder's*. 2021. Vol. 21, Issue 3 (83). P. 21-28. DOI <https://doi.org/10.15673/gpmf.v21i3.2230>

