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STUDY OF THE TECHNOLOGY OF FLOUR PRODUCTION FROM LOCAL VARIETIES OF THE WHEAT AND RYE AND IMPROVEMENT OF ITS BAKING QUALITIES

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Abstract

The article discusses the advantages of the production of wheat-rye bakery products by separating large fractions of intermediate grinding. A comparative analysis of experimental and control samples baked using traditional technology is given. Practical recommendations on the use of improvers for bread production are given.

Keywords: *technological process, acidity, porosity, baking properties, bread, pastries*

Introduction

The technology of producing flour, bread and bakery products belongs to an exceptional place in human nutrition, since these products provide a significant part of the physiological need of the human body for food substances.

High taste advantages and increased nutritional value of rye-wheat bread ensure a fairly high demand for this product and its expanded range.

The usual technology for preparing rye-wheat bread varieties provides for separate processing of rye and wheat grains, followed by mixing rye and wheat flour at bakeries. Varietal grinding of wheat is characterized by complexity, significant energy and labor costs, and also requires a sufficiently high quality of processed grain (Butkovsky B.A., Merko A.I., Melnikov E.M., 1999; Egorov G.A., 2005; Anninkova T. Yu., 2001; Auerman L. Ya., 1984; Polandova R.D., Guseva L.I., Maslikova N.H., 1984; Kovbasa V.N., Kobylinskaya E.V., Kovalev A.V., etc., 1998).

Due to these advantages, research on improving the technology of production of rye-wheat flour from grain mixtures is relevant and has important theoretical and practical

significance (Butkovsky V.A., 1989; Yakovleva O.V., 1995; Butkovsky B.A., Merko A.I., Melnikov E.M., 1999; Egorov G.A., 2005; Andreev A.N., 1999; Anninkova T. Yu., 2001).

In this regard, in this work, in addition to studies of certain stages of the technological process of processing rye-wheat mixtures, attention was paid to the problem of interaction of their components.

The rye and wheat standard provides for a restriction of the content of germinated grains to 3% (Kislukhina O.,1997; Yakovleva O.V.,1995; Auerman L. Ya., 1984; TU8–18–149–94; Matveeva I.V., Belyavskaya I.G., 1998).

In terms of grinding capacity, rye and wheat differ from each other due to the peculiarities of structural and mechanical properties. Also, the process of forming varietal rye-wheat flour from grain mixes by qualitative indices and percentage content of components is not studied, which is necessary for production of products with specified composition and properties (Butkovsky V.A.,1989; Kislukhina O., 1997; Butkovsky B.A., Merko A.I., Melnikov E.M., 1999; Egorov G.A., 2005; Kovbasa V.N., Kobylinskaya E.V., Kovalev A.V., etc., 1998).

However, the chemical composition of bakery wheat flour is characterized by a low content of essential amino acids, a low content of dietary fiber, which, in turn, requires enrichment of these products with micronutrients.

In this regard, rye grain processing products have an absolute advantage. Rye has worse flour-milling advantages compared to wheat grain, but it is significantly superior to wheat in amino acid composition (Kislukhina O.,1997; Egorov G.A.,2005; Bystrova A.I., Tokareva G.A.,1997; Matveeva I.V., Belyavskaya I.G.,1998; Poland R.D., Barkalova I.V., Podobedov A.V., etc. 1997).

To obtain rye flour with high yields and quality that meets the requirements and standards, it is necessary to improve grinding, but there are two problems:

1) rational use of grain mixture or flour;

2) obtaining high-quality finished products, a useful product for human health.

Due to the fact that rye grain has increased autolytic activity, the studies are devoted to the problem of improving the bakery advantages of rye grain, which are characterized by amylolytic activity.

An effective means of improving the bakery properties of flour, regulating the technological process and improving the quality of bread is the use of complex additives – improvers (Kislukhina O., 1997; Egorov G.A., 2005; Bystrova A.I., Tokareva G.A., 1997; Vorobyova I.S., 2002; TU8-18-149-94; Dremucheva G., Karchevskaya O., Polandova R., 2000; Matveeva I.V., Belyavskaya I.G., 1998; Polandova R.D., Guseva L.I., Maslikova N.H., 1984; Nechaev A.P., Dubtsova G.N., Dubtsov G.G., Bakulina O.N., 1990; Poland R.D., Barkalova I.V., Podobedov A.V., etc. 1997; Kovbasa V.N., Kobylinskaya E.V., Kovalev A.V., etc., 1998)

Currently, both in our country and abroad, the use of multi-component enhancers, the composition of which is specially selected taking into account the alleged focus of their action, has become the most widespread.

In this regard, research aimed at the development of bakery improvers from domestic, affordable and inexpensive raw materials is of particular relevance, since bread is a commodity of everyday demand and the increase in its cost will primarily affect the meager budget of socially unprotected segments of the population (Yakovleva O.V., Egorov G.A., 2005, Bystrova A.I., Tokareva G.A., 1997; 1995; TU8-18-149-94; Nechaev A.P., Dubtsova G.N., Dubtsov G.G., Bakulina O.N., 1990; Poland R.D., Barkalova I.V., Podobedov A.V., etc. 1997).

Aims and functions of scientific research.

– to development of technology for production of wheat-rye varieties of flour;

– to study of composite mixtures as improvers of wheat-rye bread varieties.

a study of the efficiency of using enzymes for wheat and rye flour;

– to make compositions of baking improvers for bread produced from wheat flour with “strong” or “weak” gluten;

– to determine the nutritional value of finished products and developed improvers;

– to conduct a comparative assessment of the effect of bakery improvers on the quality of bread and its preservation;

– to develop and approve technical documentation.

Methods of the study:

Technical analysis of grain and flour was carried out in accordance with GST 10839–64 " Grain. Test methods. "Nature was determined according to GST 10840-64; vitreous content – GST 10987-76; weight of 1000 grains – GST 10842-89; quantity and quality of gluten – GST 13586.1-68; ash content – GST 10847-74; content of weeds, grain impurities, fine grains and coarseness

– GST 13586.2–81; germination energy – GST 10968–88; acidity – GST 10844-74; humidity – GST 13586.5–85; protein – GST 10846-74; fall number – by the Hagberg-Perten method according to GST 27676-88. Autolytic activity of grain was determined by exspress baking. An organoleptic assessment of the appearance and state of the crumb of baked finished products was carried out.

Flour was analyzed for the following parameters: humidity determined according to GST 9404-88; ash content – GST 10847-74; acidity – GST 27493-87; size – GST 27560-87; whiteness – on RZ-BPL device as per GST 26361-84; number of fall – GST 27676-88.

Porosity determination procedure (as per GST 5669–96):

P = 100 · (V – m/p)/V, where

P – porosity,%;

V – total volume of bread cuts, cm^3;

m – mass of notches, g;

p – is the density of the non-porous mass of the crumb.

Determination of bread acidity (according to GST 5670–96):

Acidity of pulp X (deg) is calculated with accuracy to 0.5 deg. by the formula:

X = 2V · K, where

X – acidity, deg;

V – volume of sodium hydroxide solution with molar concentration 0.1; mol/dm_3 used for titration of the test solution, cm3;

K – correction factor of the solution used sodium hydroxide to a 0.1 mol/dm_3 solution.

Experimental part

This detail provides experimental learning of the baking properties and quality indicators of flour and bread made from wheat and rye.

Table 1. *Recipe of raw materials and baking process parameters*

Description of raw materials and process parameters	Quantities of raw materials and bread preparation parameters			
	control	1 sample	2 sample	3 sample
	Dough	Dough	Dough	Dough
First grade wheat flour, kg	100	95	90	80
Rye flour, kg	–	5	10	20
Fariman yeast, kg	1			
Table salt, kg	1.5			
Water	by calculation			
Humidity,%	48	47	46	46
Initial temperature,º C	26–30			
Fermentation duration	25–30			
Baking time, min	20–25			
Baking oven temperature, º C	220–240			

Bread baking was carried out in a laboratory electric oven of the company "MF GR Company" at a temperature of 230–240 °C for 35–40 minutes. The baked bread was stored in a laboratory cabinet. The analysis was carried out 12–18 h after baking.

As can be seen from table No. 2, the quality indicators of flour produced from wheat and rye grain utilise enzymes showed the best indicators on samples 3.

Table 2. *Quality indicators of obtained flour from wheat and rye grain (with addition of 0,5,10,20% of flour and 0,03 g of enzyme Alfa2 and LOU)*

Indicators	1 sample control grade 1	2 sample 5%	3 sample 10%	4 sample 20%
Humidity	14.8	15	14.5	14.8
Amount of raw gluten	34	32.4	30	28
Raw gluten quality (IDS)	73	76	80	78
Description of raw gluten (manual method)	Homogeneous, crumbles a little sticky	non-traditional, crumbles, sticky	unreported, uncooperative, sticky	non-traditional, crumbles, sticky
Number of falls per PChP-3	325	260	236	224
Ash content,%	0.77	0.86	1.10	1.21
Whiteness, unit of the device	48	46	46	44
Damaged starch index:	23.2 7.80			

Table 3. *Quality indices of wheat and rye flour by alveograph*

Temperature	Parameters	Results are standard	Temperature	Parameters	Results are standard
Water: 19,7 °C Kneader: 24.2 °C Spacer chamber: 25,2 °C Alveograph compartment: 20,7 °C	Air humidity: 53% Humidity: 15.6 Hydration: 50% Basic humidity: B15%H_2O Quantity of water: 122.35ml Mass of flour: 250g	P: 158 mmH_2O L: 55mm G: 16,5 W: 341 10–4J P/L: 2,87 Ie: 54,8%	Water: 19,8 °C Kneader: 23.8°C Spacer chamber: 25,2 °C Alveograph compartment: 20,6 °C	Air humidity: 64% Humidity: 14.5 Hydration: 50% Basic humidity: B15%H_2O Quantity of water: 127.21ml Mass of flour: 250g	P: 118 mm-H_2O L: 33mm G: 12.8 W: 163 10–4J P/L: 3,58 Ie: 0%

Figure 1. *Alveogaph curve*
a)

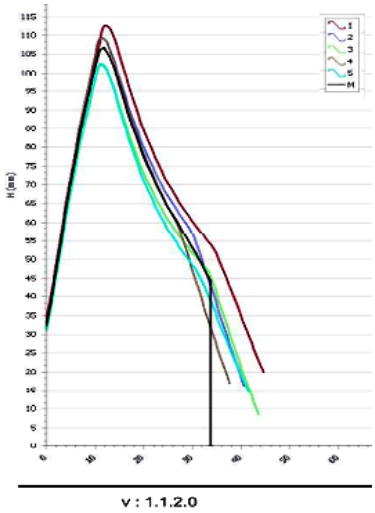

Figure 2. *Alveogaph curve*
b)

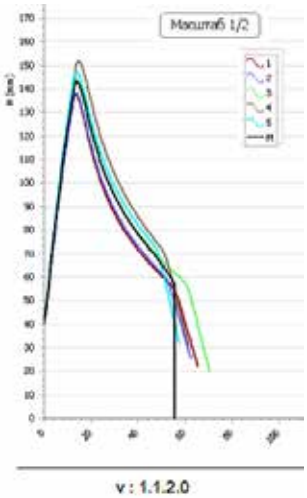

Figure 3. *Qualitative indices of porosity and acidity of bread from wheat and rye flour*

Table 4. *Organoleptic, physicochemical and technological properties of products*

Organoleptic qualities	Properties of indicators	
	1-grade	1-grade Wheat-rye flour mixture
Color	White and cream	Dark brown light
Taste	Non-cooked flavors, without hot	
Smell	Characteristic of the taste of wheat grains and rye	
Mineral mixtures	Absent	
Consistence	Same with dark shades	
Screening No. 38:	5 / 60	2 / 70

Table 5. *Physical and chemical qualities and technological properties*

Indicators	Quantities			
	From 1-grade wheat flour	Wheat and rye flour mixture (5%)	Wheat and rye flour mixture (10%)	Wheat and rye flour mixture (20%)
Humidity,%	14.6	14.9	14.92	14.89
Density, ρn, kg/m_3	704	706	708	707
Natural angle of inclination	38	35	36	33
Floatability	well	good	Very good	Satisfactorily speckled
Water pollution rate,%	62.0	60.2	58.1	57.8
Specific volume	2.4	2.5	2.76	2.71
Prowl	67	68	72	71

Table 6. *Indicators of bread quality and study of the effect of flour on baked goods*

Flour indicators	Bread Control	Bread (5%)	Bread (10%)	Bread (20%)
Humidity,%	48.4	46.4	44.2	45.1
Gaseous force, ml	1510	1480	1530	1490
Weight of bread, g	540	545	560	550
Crude gluten composition,%	26.6	28.0	24.4	21.5
Gluten elasticity, IDK-2	74	76	74	72
Prowl	66	68	72	74
Acidity, deg	6.2	5.8	5.4	5.6

Conclusions:

– Improvement and investigation of the possibility of separation of coarse fractions of intermediate wheat and rye grain grinding products by Q-factor.

– Comparative analysis of bread quality showed that physicochemical and organoleptic indices of test and control samples were beaten by close ones according to different criteria. In appearance, ground, specific volume, acidity, the test samples were better than the control.

– recommendations on application of improvers for bread production depending on its formulation and baking properties of used wheat and rye flour are given.

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