

IMPROVING SENSORY INDICATORS OF BREAD QUALITY USING VEGETABLE-FAT MIXTURES BASED ON WHEAT GERM PRODUCT

Djuraeva Nafisa Radjabovna, Bukhara engineering-technological institute, assistant professor, faculty of food technology, e-mail: nafis101@mail.ru

Isabaev Ismail Babadjanovich, Bukhara engineering-technological institute, professor, faculty of food technology, e-mail: isabayev_63@mail.ru

Abstract. In article is considered the problem of expediency of use of the germinal product of wheat as flour fraction of fat-flour mixes. Efficiency of application of these mixes for improvement of sensor indicators of quality of bread is determined.

Keywords: fat-flour mix, fat, flour of the germinal product, bread, sensor indicators.

УЛУЧШЕНИЕ СЕНСОРНЫХ ПОКАЗАТЕЛЕЙ КАЧЕСТВА ХЛЕБА С ИСПОЛЬЗОВАНИЕМ ОВОЩНО-ЖИРНЫХ СМЕСЕЙ НА ОСНОВЕ ПРОДУКТОВ ПШЕНИЦЫ

Джураева Нафиса Раджабовна, доцент, кафедры «Пищевая технология», Бухарский инженерно-технологический институт, Республика Узбекистан, e-mail: nafis101@mail.ru

Исабаев Исмаил Бабаджанович, профессор, кафедры «Пищевая технология», Бухарский инженерно-технологический институт, Республика Узбекистан, e-mail: isabayev_63@mail.ru

Аннотация. В статье рассматривается проблема целесообразности использования проростков пшеницы в качестве мучной фракции жирно-мучных смесей. Определена эффективность применения этих смесей для улучшения сенсорных показателей качества хлеба.

Ключевые слова: жирумучная смесь, жир, мука из зародышевого продукта, хлеб, сенсорные индикаторы.

In the baking industry as a part of compounding of the majority of bakeries and rich products from the wheaten flour are widely used the high-quality margarine, animal and vegetable oils, baking fats, shortening agents, compounds various on structure and properties. Their addition in the dough improves quality of finished goods: the volume increases, porosity of a crumb improves, the freshness of bread remains longer [1].

However, besides the traditional fats, nowadays raised demand of consumers and manufacturers has the production corresponding to the concept of a positive food, and that demands expansion of fundamental and applied researches to this group of products which should become the basic diet [2].

One of key directions of the decision of the given problem in baking industry is development of fatty composite mixes with functions of modifiers, allowing purposefully coordinate rheological properties of the dough and quality of bread in the set direction. Search of economically effective technologies of reception of fatty products of the functional purpose has shown expediency of application of the germinal product of wheat for preparation of the various mixes. The germinal product accumulates in itself the significant amount of biologically active substances, is characterized by integrated approach of a chemical compound and is biologically and technologically effective in making of fat-flour mixes [3].

Objective of the research was development of fat-flour mixes with the crushed germinal product further called as the flour (flour from the germinal product of wheat), for use as receipt component at bread production.

For achievement of goal of the research following problems have been solved: selection and optimization of structure of fat-flour mixes; an estimation of influence of the offered semi-finished product on sensor indicators of quality of bread.

As objects of research have been used samples of fat-flour mixes and ready bakery products with additives.

The technology developed by us provides application of composite mixes from emulsion fatty products (margarine type) and waterless fats with flour from the germinal product of wheat. For preparation of a waterless mix as a fatty component can be used any firm, plastic or buttery (for prevention of the process of sedimentation of particles with the mixed flour) food waterless fats or the fatty mixes of various structure intended for a batch.

For an estimation of influence of various on structures fat-flour mixes quality of bread from wheat flour of 1st grade we carried out a series of trial laboratory batches by the standard technique with entering of respective alterations in the receipt in compliance with a matrix of mathematical planning of experiment. As samples of comparison were used the products prepared on above-stated margarine and the waterless fat without addition of flour from the germinal product of wheat. Quality of products analyzed in 3 hours after the batch.

With the account of conservatism of tastes of consumers, that is the settled stereotypes to quality of food products, especially to bread and bakery products as socially significant, sensor indicators are the most important. Therefore at use of the various additives positioned as modifiers of quality of products, it is necessary to predetermine their influence on the above-stated indicators.

For construction of the mathematical model adequately describing dependence of target parameters from investigated factors, active experiment on system of the factorial plan 2^3 has been realized.

In a general view required under the composite plan the mathematical model is reliably enough approximated by the equation (1):

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + b_{123}x_1x_2x_3 \quad (1)$$

As major factors are accepted: x_1 – receipt quantity of fat-flour mixes, in % to the receipt quantity of the flour; x_2 – mass fraction of flour from the germinal product of wheat, in % to total quantity of the mix; x_3 – humidity of the dough, in %. For each factor were defined the center, an

interval of a variation and dependence of coded variable X_i from natural x_i . Target parameter (y) was the complex factor of sensor indicators of quality, a point.

Complex factor of sensor indicators of quality of bread (y) represents the sum of products of individual indicators of quality on corresponding factors of weightiness. For the characteristic of the given indicators used the 20-point scale with the account of factors of the importance of indicators [5].

For definition of degree of a coordination of experts used the method of aprioristic ranging [6]. Experts were offered to make ranged number on the sum of organoleptic indicators of the quality of investigated samples of bread for the purpose of allocation of the most qualitative samples. Then by experts the samples-leaders having the minimum total rank (table) have been allocated.

The normalized columns of ranks of individual indicators of the quality of bread

Number of the sample	Experts (n=7)							The sum of ranks $\sum_{j=1}^{m=7} x_{ij}$	Deviation of the sum of ranks from average d	Squares of deviations d^2
	1	2	3	4	5	6	7			
1	6	7	6	6	6	6	6	43	11.5	132.25
2	8	8	8	8	8	8	8	56	24.5	600.25
3	7	6	7	7	7	7	7	48	16.5	272.25
4	5	5	5	5	5	5	5	35	3.5	12.25
5	2	2	2	1	2	2	2	13	-18.5	342.25
6	1	1	1	2	1	1	1	8	-23.5	552.25
7	4	4	4	3	3	4	4	26	-5.5	30.25
8	3	3	3	4	4	3	3	23	-8.5	72.25
	-	-	-	-	-	-	-	-	-	2014.00

The sums of ranks on each indicator were defined:

$$\sum_{j=1}^{m=7} x_{ij} = x_{i1} + x_{i2} + \dots + x_{i7} \quad i = 1 \div 8, \quad (2)$$

Where x_{ij} - a rank of i - indicator of j - expert; m - number of experts ($m=7$).

Deviation of the sum of ranks of each indicator from an average arithmetic for the whole matrix was determined under the formula (3):

$$d_{ij} = \sum_{j=1}^{m=7} x_{ij} - a, \quad (3)$$

Where $a = \frac{1}{2}m(n + 1)$ - Average arithmetic value from the whole matrix, n - number of indicators (8).

The sum of squares of deviations is defined by dependence (4):

$$\sum_{i=1}^8 d^2 = \sum_{i=1}^8 (\sum_{j=1}^{m=7} x_{ij} - a)^2 \quad (4)$$

Degree of a coordination of opinions of experts defined on Kendall's concordance factor, defined under the formula (5):

$$W = \frac{\sum_{i=1}^8 d^2}{\frac{1}{12}m^2(n^3 - n) - m \sum_{i=1}^7 T_j} = 0.98 \quad (5)$$

Where m - number of experts; n - quantity of variants, piece; T_i - an estimation of the connected ranks (it is defined in case the expert does not specify an order of decrease of two or several indicators and appropriates to each of them an identical average rank. In our case $T_i = 0$).

The coordination of opinions of experts confirmed with the concordance factor $W=0.98$ (at completely coordinated ranks $W=1.0$).

Statistical processing of experimental data has been executed with the help of correlation-regression analysis in MicrosoftExcel 2013, and adequate mathematical models are derived as a result.

On the basis of the received dependences optimum dosages of fat-flour mixes and

maintenances in them flour from the germinal product of wheat for a baking are defined. It is determined that for reception of qualitative production the receipt quantity of fat-flour mixes on margarine makes 2 ... 3 % to weight of a flour at maintenance of flour from the germinal product of wheat no more than 15 % to weight of margarine, on waterless fat – not more than 5 % with maintenance of flour from the germinal product of wheat no more than 50% to the mass of waterless fat. Pre-production models on waterless fat with flour from the germinal product of wheat have received most an appreciation of tasters concerning control tests with margarine

We have to notice that because of rather high maintenance of flour from the germinal product of wheat, possessing raised water absorbing ability, at use of fat-flour mixes on waterless fat it is recommended to increase humidity of the dough on 0.5 ... 1.0 % concerning settlement value, and that will allow to increase an output of production of demanded quality and to lower its cost price.

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