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Flour Mixture with the Introduction of Biologically Active Phyto Raw Materials for Acid-forming Liquid Ferments

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Running title: **Technology of Acid-forming Liquid Ferments for the Production of Bread in a Discrete Mode**

Abstract
The selection and analysis of biologically active phyto raw materials that can be used in the technology of acid-forming liquid ferments, the peculiarities of the chemical composition of the phyto raw materials and their methods of preparation were studied. The effect of the proposed phyto raw materials on the organoleptic, physico-chemical, microbiological parameters and baking properties of rye flour were investigated. Samples of mixtures of rye flour with the introduction of phyto raw materials for use in acid-forming liquid ferments were prepared.

Practical applications
The powder of Cortex Quercus, Echinaceae purpurea herba, Folia Salviae, Artemisia absinthium herba may be a component in flour mixtures, using in particular rye flour. It contributes to the improvement of microbiological parameters of flour mixtures, prevents insect pests, extends the storage time and improves baking quality of flour. Mixtures of rye flour with the introduction of phyto raw materials can be produced at bakeries, flour mills and other enterprises. This will greatly expand the number of producers, provide employment and reduce losses due to spoilage of flour.

Key words: powders of phyto raw materials, acid-forming liquid ferments, bread from rye flour and mixture of rye and wheat flour, discrete mode of production

Introduction

Production of bread from rye flour and mixture of rye and wheat flour (short – bread) is associated with acid-forming liquid ferments. The dynamics of the development of yeast and lactic acid bacteria in these foods is crucial in the formation of their biotechnological properties, which determine the flow of the process and the production of bread with highly approached be consumer properties (taste, aroma, structure, etc.). The semi-finished products are prepared traditionally in a continuous mode.

New approaches are required to obtain acid-forming liquid ferments in such circumstances with the necessary quantitative and qualitative composition of microorganisms. These include focused modification of flour nutrient mixtures that are used for cultivation of yeast and lactic acid bacteria. This will provide the necessary structure and composition of nutrient mixture, that will provide directional growth of microorganisms, improvement of the properties of acid-forming liquid ferments and finished product. Modification of flour mixtures can be carried out by making local biologically active phyto raw materials (Cortex Quercus, Echinaceae purpurea herba, Folia Salviae, Artemisia absinthium herba). This phyto raw material contains chemical compounds that ensure the growth and the development of cultivated microorganisms.

Materials and Methods

The work was funded by the Belarusian Republican Foundation for fundamental research. The research was conducted in the laboratories of the Department of technology of bread products of the Mogilev State University of Food Technologies. Experiments were repeated 3–5 times. The results were processed by statistical methods with the probability of 0,95. Error experience of 5,0 %. The article presents the arithmetic means of the values obtained.

Materials

Raw materials

Rye flour and samples of the following types of phyto raw materials were used for this research: Cortex Quercus, Echinaceae purpurea herba, Folia Salviae and Artemisia absinthium herba. Phyto raw materials were harvested and packaged by the 3 most major manufacturers of the Republic of Belarus (the company «BIOTEST» of Grodno, «PADIS'S» of Minsk, «Kalina» of village Pischalovo of Vitebsk region). Were studied 4 samples of phyto raw materials for 5 years from every manufacturer. The total number of samples of each phyto raw material for testing was 60.

Methods

Conventional and special methods used in the food industry of the Republic of Belarus were used in this study.

Sampling of phyto raw materials was carried out by a conventional method for medicinal vegetative materials [1]. Authenticity, contamination by insect pests, particle size and impurity content in phyto raw materials were identified by methods for medicinal vegetative materials [2]. Moisture content, ash content, extractives and tannins of phyto raw materials were also determined by methods adopted for medicinal vegetative materials [3]. Fiber was identified by the method of Kushner and Ganec and pectin substances – by pectate of calcium [4]. Antioxidant activity of phyto raw materials was determined using the permanganate method [5]. Active acidity was determined according to the methods presented in the literature [4]. Microbiological characteristics of flour with the introduction of phyto raw materials were determined using the method that is presented in the literature [6].

Results

Earlier in the technology of baking production studies have been conducted on the use of different types of phyto raw materials (hops, ginseng, green tea, pomegranate powder, etc.) to adjust the properties of the main raw materials (flour) and the simultaneous stabilization of biotechnological properties of acid-forming liquid ferments, dough and consumer properties of bread. However, the use of these types has a number of disadvantages:

1) requires long preparation of phyto raw materials (extraction, infusion, etc.);
2) precise dosing of highly concentrated extracts;
3) in the Republic of Belarus most kinds of phyto raw materials do not grow or are cultivated in limited quantities.

All this requires additional monetary costs on businesses, affects the properties of semi-finished and finished products, is reflected in the cost of bread, and consequently, in the economic efficiency of enterprises.

At the same time different kinds of phyto raw materials grow on the territory of the Republic of Belarus. They have full chemical composition, ensure the microbiological purity of raw materials, acid-forming liquid ferments and finished products,

help to regulate microbial processes in obtaining bread. In addition, phyto raw materials have anti-microbial, fungicidal properties, high antioxidant activity, may participate in the formation of flavor substances of finished products, help to extend shelf life and prevent the occurrence of oxidative processes. In general, these properties are due to the presence in the composition of phyto raw materials of the compounds of polyphenolic nature of different classes.

As low-cost import-substituting phyto raw materials grown and processed in the Republic of Belarus and used in other sectors of the food industry it was proposed to use powder of Cortex Quercus, Echinaceae purpurea herba, Folia Salviae, Artemisia absinthium herba. They have not yet found application in the production of acid-forming liquid ferments in a discrete mode of production of bread.

In the first stage the peculiarities of the chemical composition and quality parameters of the proposed phyto raw materials were studied. The results are shown in table 1 and 2 respectively.

The results of the studies (table 1 and 2) showed that samples of phyto raw materials contain a variety of substances that can influence microorganisms activity. The presence of sugars in phyto raw materials would be an additional source of nutrition for yeast and lactic acid bacteria cultured in acid-forming liquid ferments. High fiber (from 12,1±0,5 to 24,5±0,5 % d.m.) will increase water absorption ability of rye flour with the introduction of phyto raw materials and improve the rheological properties of the intermediate products. Tannins have antimicrobial and fungicidal properties that will prevent the development of pathogenic microorganisms in the semi-baking. Phyto raw materials have high antioxidant activity from 450±10 to 720±10 mg / 100 g in terms of quercetin.

During the preliminary research, milling to a powdery mass, and sieving to particle size of not more than 240–260 microns was chosen as the optimal method of preparation of phyto raw materials (Cortex Quercus and Echinaceae purpurea herba). This method is the most efficient in the production of flour food products, and eliminates the problem of disposal of phyto raw materials used, for example, in making extracts, infusions, etc. [8].

In a similar way Folia Salviae and Artemisia absinthium herba were prepared. The fraction of extractive substances of the phyto raw materials was evaluated, depending on the size of its particles. The results showed that, with decreasing particle size, the samples of phyto raw materials had increased content of extractives. For samples of phyto raw materials with a particle size of 240–260 microns and less, the change of the mass fraction of extractives was located at the level of accuracy experience. This led to conclusion about inexpediency of further more intensive shredding of phyto raw materials and, accordingly, about the possibility of reducing energy and labor costs for the operation of the process. For the separation of phyto raw materials with the required particle size, it was proposed to use the passage of a special sieve.

Samples of flour with the introduction of the proposed type of phyto raw materials in the amount of up to 2,0 % with an interval of 0,4 % by weight of rye flour were studied. Samples of rye flour without the introduction phyto raw materials and with the introduction of phyto raw materials were stored 12 months.

According to the organoleptic characteristics, all the samples of flour with the introduction of phyto raw materials meet the requirements of the rye flour. The maximum amount of phyto raw materials, in particular crushed Cortex Quercus, increases the acidity of the flour on average, by 1,0 degree. Echinaceae purpurea herba, Folia Salviae and Artemisia absinthium herba in different amounts did not changed significantly the acidity of the flour. Baking properties of rye flour were improved with the introduction of phyto raw materials into rye flour. The growth rate of microorganisms was reduced several times in samples of rye flour with the introduction of phyto raw materials during the storage of the flour. Insects were not detected in the samples of rye flour with the introduction of phyto raw materials during the storage of the flour. Projects of new normative documents for the rye flour with the introduction of phyto raw materials as the basis for modified flour mixtures for acid-forming liquid ferments were developed.

Conclusions

Was studied the characteristics of quality indicators and chemical composition of Cortex Quercus, Echinaceae purpurea herba, Folia Salviae, Artemisia absinthium herba as unconventional raw materials in the technology of acid-forming liquid ferments. The particle size of phyto raw materials (no more than 240–260 microns) was identified. The possibility of the introduction phyto raw materials into the flour mixture was installed. The

possibility of maintaining the microbiological purity of the rye flour with the introduction of phyto raw materials during the storage of the flour was ascertained. Projects of new normative documents were developed.

References

Raw medicinal plant. Acceptance rules and sampling methods [Text]: GOST 24027.0–80. – Introduced 01.01.81. – Moscow: USSR State Committee on management of quality and standards, 1981. – 5 pages.

Raw medicinal plant. Methods of determining the authenticity, granary pest infestation, grinding and impurity content [Text]: GOST 24027.1–80. – Introduced 01.01.81. – Moscow: USSR State Committee on management of quality and standards, 1981. – 7 pages.

Raw medicinal plant. Methods of determination of humidity, ash content, extractive and tannin, essential oils [Text]: GOST 24027.2–80. – Introduced 01.01.81. – Moscow: USSR State Committee on management of quality and standards, 1981. – 8 pages.

Laboratory workshop on the General technology of food production [Text]: textbook / A. A. Vinogradova [et al.]; under editorship of L. P. Kowalskaya. – Moscow: Agropromizdat, 1991. – 336 pages.

Method for determination of antioxidant activity [Text]: patent 2170930 Russian Federation MPK 7 G 01 N 33/50 G 01 N 33/52 / T. V. Maksimova, I. N. Nikulin, V. P. Pakhomov, E. I. Shkarina, Z. V. Chumakova, A. P. Arzamastsev; the applicant of the Moscow medical Academy. I. M. Sechenov. No 2000111126/14, stated 05.05.2000; published 20.07.2001 // Official Bulletin. Of the invention. The utility model / the Federal service for intellectual property. – 2001.

Grain, cereals, flour, oatmeal for children's food. Methods of microbiological analysis [Text]: GOST 26972–86. – Introduced 01.07.87. – Moscow: USSR State Committee on management of quality and standards, 1986. – 22 pages.

Theoretical justification of production technology and the development of import-substituting of food products of functional purpose on the basis of dry composite mixtures [Text]: report about scientific research work (final) / Establishment of education «Mogilev State University of Food Technologies»; head T. Samuylenko. – Mogilev, 2015. – 161 p. – № of state registration 20131943.

Table 1. Chemical composition of phyto raw materials

Name of the indicator	Cortex Quercus	Echinaceae purpurea herba	Folia Salviae	Artemisia absinthium herba
Protein, % d.m.	4,7±0,2	11,3±0,2	9,3±0,2	7,5±0,2
Sugars, % d.m.	2,5±0,5	24,4±0,5	12,7±0,5	14,7±0,5
Fiber, % d.m.	19,4±0,5	12,1±0,5	22,5±0,5	24,5±0,5
Ash, % d.m.	6,6±0,5	10,2±0,5	8,3±0,5	6,5±0,5
Tannins, % d.m.	17,4±0,5	3,2±0,5	8,0±0,5	3,4±0,5

Table 2. Indicators of quality of phyto raw materials

Name of the indicator	Cortex Quercus	Echinaceae purpurea herba	Folia Salviae	Artemisia absinthium herba
Appearance	particles with small weight, different shape and size	mixture of pieces of stems, leaves and other parts of phyto raw materials	particles with small weight, different shape and size	mixture of pieces of stems, leaves and other parts of phyto raw materials
Color	light brown	green	light green	green with a gray tint
Smell	weak, kind, aggravated by wetting with water	weak	sharp	kind
Taste	astringent	grassy	grassy	bitter
The infestation of granary insects	missing			
Moisture, %	10,0±0,5	11,5±0,5	10,5±0,5	10,8±0,5
Active acidity (pH), units	4,8±0,2	6,2±0,2	5,9±0,2	5,8±0,2
Antioxidant activity in terms of quercetin, mg / 100 g	720±10	610±10	450±10	680±10
Extractives (extractant – water), % in terms of dry substance	24,6±0,5	23,7±0,5	35,2±0,5	21,0±0,5