

PERSPECTIVES OF USAGE SPONTANEOUS FERMENTATION STARTERS OF CEREAL CROPS CULTURES IN BREAD TECHNOLOGIES

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Bread products are products of regular consumption of all segments of the population and account for about 40 % of calories, thus producers must provide the high nutritional value of the products to define them as the source of microcontrollants needed to ensure the optimal life of each person. It is known that high-quality wheat flour, which is the basis of the production of most groups of bread products, is deprived of important grain compounds. Therefore, the addition to the chemical composition of the bread of biologically active substances of other supplementary materials can help to solve the problem of providing healthcare qualities of the bread.

Today, in both European and Ukrainian markets, the popularity of bread products based on the flour of crops cultures is rising. The most promising in terms of nutritional value and dietary qualities are oatmeal, barley, rice, and green buckwheat flour.

Oatmeal flour, compared to wheat one, is characterized by low starch content and increased fat content. It also contains all essential amino acids, vitamins E, A, H, group B, micro- and macroelements (K, Mg, and Fe).

Barley flour contains 8 – 15 % protein. Compared with high-grade wheat flour, barley flour has more minerals, in particular K, Ca, P, vitamins B1, B2, PP.

The specialty of the carbohydrate composition of oat and barley flour is the availability of soluble polysaccharides: pentosans, levulezan, as well as prebiotics and β -glucan immunizers, which is the most of the hemicellulose of the flour.

The absence of heat processing in the production of green buckwheat flour allows to preserve the full range of vitamins, macro-, and micronutrients. It has a high protein content (13 – 15 %) and higher, compared to other crops, the content of calcium, and iron. In addition, flour contains vitamins B₁, B₂, PP, and E. Buckwheat flour contains 1,5 – 2 times more fiber than the oat.

Rice flour is a source of vegetable protein, complete in amino acid composition, that is close to the protein of breast milk, with a small amount of fat – about 0,6 %. It is a source of Na, K, Mg, P, Si is also present; among vitamins – B₁, B₂, B₇, PP.

Rice and buckwheat flours are widely used in the recipes of gluten-free products because they do not contain components of fibrin proteins (gluten).

In addition, the flour of crop cultures has a reduced glycemic index, which is very important in the production of healthcare and therapeutic products [1].

Along with enlarging the range of healthcare products, the issue of the development and implementation of advanced resource-saving technologies for the preparation of various types of bread, as well as new biotechnological processes that enhance the production processes is also relevant. This problem can be solved with the usage of starters.

In the conditions of bakeries, it is impossible to conduct a sourdough breeding cycle, due to the lack of special laboratories and the necessary equipment. One of the effective ways to solve this problem may be the usage of spontaneous fermentation starters.

Biological starters of spontaneous fermentation have several advantages:

- simplification of the starter production process;
- saving of yeasts and pure cultures of lactic acid bacteria (LAB);
- saving of production space;
- prompt response to the consumer market, increase or decrease of production volumes and variety [2].

Like yeasts and LAB based starters spontaneous starters can have antimicrobial properties in wheat flour bread technology (inhibit the development of "potato disease"), reduce amylase activity in bread technology with rye flour, enhance storage time and digestibility of mineral substances of flour due to the content of phytase enzyme.

Peculiarities of chemical composition, especially, of the state of biopolymers of the researched types of flour of crop culture create preconditions for its use as a nutrient medium for sourdoughs. It should be noted that the behavior of crop cultures flour as a medium is also determined by the technological parameters of the starter production.

During the research of the technological properties of flour, it was found that the flour of crops is characterized by lower values of total gas formation and lower activity of amylolytic enzymes compared to wheat flour, but their use in excess of no more than 20 % by weight of wheat flour does not impair the quality of finished products [3].

The next stage was the process of preparation of spontaneous fermentation starters from oat, barley, rice, and buckwheat flour, which consists of the cycle of cultivation and production cycle. Each of the developed schemes had its features depending on the flour properties and the necessary parameters. The indicators of quality of prepared starters during the production cycle and microbiological structure were investigated.

The study suggests that under the condition of clearly regulated optimal parameters and schemes of management it is possible obtaining a high-quality starter, with the performance closed to the traditional rye and wheat.

To increase the nutritional value, accelerate the technological process and improve organoleptic characteristics, the influence of spontaneous fermentation of the studied types of crop flours on the technological process and quality indicators of bread products of the following range were studied: from popular types-wheat and wheat-rye; from the dietary types gluten-free was chosen.

The results of the research show that barley, oat, buckwheat sourdoughs should be used in the technology of wheat bread; oat and buckwheat - in the technology of wheat and rye bread; buckwheat and rice - in the technology of gluten-free bread.

We recommend the following dosages of starters:

- in the technology of wheat bread – 10 – 15 % by weight of flour (5 – 12 % of the flour is added with sourdough);
- in the technology of wheat and rye bread – 25 – 30 % by weight of flour (12 – 16 % of the flour is added with sourdough, thus the corresponding amount of wheat flour is replaced by crop flour);
- in the technology of gluten-free bread – 25 – 30 % by weight of flour (12 – 16 % of the flour is added with sourdough) [4,5].

In the case of adding a specified amount of starter, the duration of dough ripening is reduced, the studied samples of bread on physicochemical quality indicators meet the requirements of regulatory documentation, and organoleptic parameters are more expressed, which may be due to fermentation products of sourdough microflora which is involved in the formation of taste and aroma. The use of sourdough in the technology of gluten-free bread helps to improve the taste and aroma, as well as increases the volume and porosity of products.

The use of sourdough of spontaneous fermentation from crop cultures flour in the conditions of discrete production of different kinds of bread products is a topical issue these days because several tasks are solved complexly: the production process is intensified, the nutritional value of products is improved, the range of healthcare products is expanded, and risk of infection of products is reduced.

References

1. Hetman I.A., Mikhonik L.A., Naumenko O.V. (2019). Boroshno krupianykh kultur yak perspektyvna netradytsiina syrovyna v khlibopechenni. [Cereal flour as a promising non-traditional raw material in baking]. Materialy Mizhnarodnoi naukovo-praktychnoi konferentsii: Innovatsiyni rozvytok kharchovoi industrii. [Proceedings of the International Scientific and Practical Conference: Innovative development of the food industry]. Kyiv, P. 23-25. [in Ukrainian]
2. Drobot V.I., Sylchuk T.A. (2016). Vykorystannia zakvasky spontannoho brodinnia pry vyrobnytstvi zhytno-pshenychnoho khliba. [The use of spontaneous fermentation in the production of rye-wheat bread]. Naukovi pratsi NUKhT. [Scientific works of the National University of Food Technologies]. Vol.22, №1. P.180-184. [in Ukrainian]
3. Hetman I.A., Mykhonik L.A., Kukharenko I.O. (2020). Doslidzhennia vuhlevodno-amilaznoho kompleksu boroshna krupianykh kultur i yoho sumishei z pshenychnym. [Investigation of carbohydrate-amylase complex of cereal flour and its mixtures with wheat]. Kharchova promyslovist. [Food industry]. №27. P. 46-52. DOI: 10.24263/2225-2916-2020-27-7. [in Ukrainian]

4. Hetman I.A., Mykhonik L.A., Drobot V.I., Semenova A.B., Pysarets O.P. (2017). Doslidzhennia pokaznykiv yakosti zakvasok spontannoho brodinnia z boroshna krupianykh kultur. [Research of quality indicators of spontaneous fermentation ferments from cereal flour]. Zberihannia ta pererobka zerna. [Grain storage and processing]. №10 (218). P. 45-48. [in Ukrainian]

5. Hetman I.A., Mykhonik L.A., Pysarets O.P. (2017). Vykorystannia zakvasok spontannoho brodinnia z boroshna krupianykh kultur v tekhnolohii khliba. [The use of spontaneous fermentation of cereal flour in bread technology]. Materialy Mizhnarodnoi naukovop-praktychnoi konferentsii: Innovatsiinyi rozvytok kharchovoi industrii. [Proceedings of the International Scientific and Practical Conference: Innovative development of the food industry]. Kyiv, P. 55-56. [in Ukrainian]

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