

PRODUCTION OF RYE BREAD USING DISCRETE TECHNOLOGY

J.J.Nurmatov, B.N. Amanov, Z.M.Amonova, A.A. Nodirov

Bukhara Engineering and Technology Institute

Bukhara, Uzbekistan

[Bobbi.0727@mail.ru](mailto:Bobbi.0727@mail.ru)

**Annotation.** For example, at the beginning of the twentieth century, over 1.2 kg of rye bread per day. But during the twentieth century, the consumption of rye bread gradually decreased and already in the years, the average person ate 600 g of bread per day, of which 450 g of rye.

The area under winter rye began to be reduced, since this crop was less productive compared to winter wheat.

**Key words:** rye bread; dry sourdough; accelerated method.

In our time, the total consumption of bread has sharply decreased and for the average resident it is about 200 g per day? mainly made from wheat flour. The first significant restructuring in the structure of bread consumption and its assortment. Due to a shortage of rye grain, the production of seeded and peeled rye flour was practically stopped and, as a result, peeled rye bread, previously its most popular variety, disappeared from store shelves [1,2,3].

The twentieth century led to an increase in the production of products from a mixture of rye and wheat flour. During that period, varieties such as Oryol, table, etc. appeared [1,4].

The second significant wave of changes in the technology and range of bakery products has been characteristic of the last 20 years and continues now.

These additives significantly facilitate technological processes and help level out deviations in the quality of the main raw material [5,6,7,8]. Traditional methods of preparing bread, based on long processes of alcoholic and lactic acid fermentation, are being replaced by accelerated methods that exclude lactic acid fermentation and intensify alcoholic fermentation through the use of a significant amount of yeast [9,10,11,12].

Wheat flour cannot be considered justified in rye flour, since, although both cereals are similar in nutritional value, rye flour has a higher yield and contains significantly more peripheral parts of the grain. The nutritional value of rye bread is higher and it contains significantly more dietary fiber. [13,14,15]

Rye bread, familiar to consumers, can only be obtained with the use of biological starters, which contribute to the formation of a characteristic taste and aroma. In this case, acid formation is of great importance for the complete swelling of rye proteins and for increasing the ability of the dough to better loosen. The resulting lactic acid prevents the development of other fermentation processes, and the acidic environment creates favorable conditions for the formation of flavor-forming compounds during the baking process [16,17,18].

With the development of small-scale bakery production, as well as the transition of enterprises to a one- or two-shift mode, the issue of promptly producing starter cultures or a method for preserving them becomes relevant.

Research has been carried out aimed at improving the technology for preparing sourdough rye bread, in relation to the conditions of low-power enterprises [19,20,21].

The breeding cycle is intended to obtain the main starter and is carried out from time to time, in the event that there is a need to refresh the production starter. The production starter is

used continuously for a long time, using part of it to knead a portion of dough, and the remaining part to renew the starter by adding flour and water to it [22,23,24,25].

You can obtain the main starter by using pure cultures of lactic acid bacteria using a special patented technology or use a starter delivered from another enterprise as a source of fermentation microflora.

An alternative to this solution may be to obtain the main starter at the enterprise itself through the breeding cycle due to spontaneous (spontaneous) fermentation. The use of hops, the bacteriostatic properties of which are well known, makes it possible to increase the efficiency of souring and ensure the necessary composition of the microflora of the sourdough [26,27,28].

Discrete technology for preparing rye bread paid special attention to spontaneous fermentation starters. Thick biological starters of spontaneous fermentation were chosen for the research (the ratio of peeled rye flour to liquid is 1:0.7, humidity 50-56%), since they contain more acid-forming bacteria and acids compared to liquid starters. Acids improve the structure of rye dough and slow down the dextrinization of starch. By using thick starters, it is easier to obtain bread with an elastic and dry crumb.

During the development of spontaneous fermentation starter, refreshment was carried out after 12 hours, using the accepted ratio of flour and liquid. A hop decoction with a hop concentration of 23 g per 1 liter of water was used as a liquid phase [29,30,31,32].

The activity of lactic acid bacteria in the starter stabilized at a high level on the fifth day and amounted to 30-35 minutes, subject to a temperature regime of 23...25 °C, the acidity reached 16 degrees.

Using starters of spontaneous fermentation, we baked plain rye bread GOST 2077-84 (Table 1).

Table 1

Index	Meaning
Specific volume, cm <sup>3</sup> /g	1,77
Humidity, %	49
Acidity, hail	9,5
Porosity, %	60
<b>Organoleptic evaluation</b>	
Appearance	The shape is correct, the color of the crust is dark brown, the surface is smooth
State of the crumb	Elastic, uniform porosity
Chewability	Chews well, does not crumble
Aroma	Expressed
Taste	Nice

Production baking showed that when kneading dough for rye varieties, the use of spontaneous fermentation as a source of fermentation microflora ensures the production of bread that meets the established requirements in terms of physical and chemical parameters and has a unique taste and aroma –vol.

To maintain the microflora of starter cultures in an active state, they must be constantly refreshed. For enterprises of small capacity, violations of the rhythm of selection and interruptions in work are characteristic, these factors worsen the quality of the starter - it becomes unsuitable for preparing dough [33,34,35,36].

Given the relevance of preserving the technological properties of the starter, it becomes necessary to preserve the starter with its subsequent activation. To this end, we have studied methods for preserving the starter of spontaneous fermentation.

Dry starter activation was carried out by reduction by adding water. Defrosting of the frozen starter was carried out at a temperature of 20.25 °C with further refreshment with a water-flour mixture. The chilled sourdough was brought to a temperature of 28 °C by introducing a water-flour mixture.

The fermentation properties of the reduced starter cultures were evaluated based on the results of trial baking of plain rye bread. In all cases, the leaven was introduced in the amount of 25% of the total amount of flour introduced.

The results of test baking are given in table. 2.

table 2

**Influence of sourdough preservation methods on the quality of plain rye bread weighing 0.3 kg**

Level of quality	The value of bread quality indicators		
	Dry sourdough	Frozen sourdough	Chilled sourdough
Humidity, %	50,0	51,2	50,8
Acidity, hail	11,0	8,0	11,2
Porosity, %	59	50	57
Volume, cm <sup>3</sup>	620	530	575

The analysis of the data obtained shows that simple rye bread with the use of dry sourdough was characterized by the best physical, chemical and organoleptic parameters compared to bread with chilled sourdough. Bread with the introduction of frozen and defrosted sourdough has low characteristics, probably because the microflora of the bred sourdough could not withstand the effects of negative temperatures [37,38,39].

In the production of bread from rye and a mixture of rye and wheat flour, one of the main trends in the development of bread baking has recently been associated with the development and practical implementation of accelerated methods of making bread, which make it possible to produce bread in enterprises with a discrete production cycle and small production vigilance. For bread made from rye and a mixture of rye and wheat flour, the preparation of which is based on the use of a continuously renewable sourdough phase, the implementation of this trend faces a number of difficulties [40,41,42].

To solve the problem of organizing the discrete production of rye bread, dry sourdoughs based on pure cultures of lactic acid bacteria and yeast, as well as acidifiers based on organic acids, have recently been used [43,44,45].

The use of dry starter cultures greatly facilitates and speeds up the process of making bread, since lactic acid bacteria and yeast are already in the optimal ratio, aromatic substances and acids

have been accumulated, and in conditions of small production, the problem of its continuity and limited production areas [46,47].

Studies on the production of dry rye sourdough have shown that it is expedient to use a sourdough of spontaneous fermentation using hop broth as a starting material. The dosage of dry sourdough is 5-10%. When using rye flour, fermentation is carried out to an acidity of no more than 14 degrees, when using a mixture of rye and wheat flour - to an acidity of no more than 12 degrees. It is possible to carry out a preliminary race of the rack of test pieces for 5-20 minutes. Then the dough pieces are sent to the final proofing, which is carried out until the dough pieces are ready for baking, and the bread is baked [48,49].

The low moisture content of dry sourdough allows for a long time to preserve its properties and transport it to any distance.

The use of dry rye biological sourdough makes it possible to produce bread identical in quality to that produced by continuous sourdough production [50].

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