

DEVELOPMENT OF COMPLEX ACIDULANTS AND ANALYSIS OF IMPACT ON BIOCHEMICAL PROCESSES IN THE DOUGHT

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In modern conditions there is necessary to find ways to abbreviate the length of production of rye-wheat bread to expand their range of products in restaurant enterprises and mini-productions.

There was developed a formula of acidulants, which are based on organic acids and enzymes, for their application in the technology of rye and rye-wheat bread, which contain organic acids and enzymes and provide significant shortening dough fermentation and proper quality bread.

There was analyzed influence of elaborated complex additives on biochemical processes in the dough and on bread quality. There was leaded comparative appreciations of products obtained by traditional and accelerated technology. There was analyzed changes in balance of sugars in the dough with acidulants.

The addition of recently developed additives provides shortening of production process without quality loss of finished products. These results allow to recommend using of complex acidulants restaurant enterprises and mini-productions.

Keywords: *rye-wheat bread, accelerated technology, biochemical properties, complex acidulants.*

Introduction.

In recent years the development of restaurants and mini technology influenced significantly on production of bakery products. Previously bakery was produced mainly on industrial bakeries, which are equipped with specialized equipment. Now a part of the bakery products are producing at mini bakeries or in restaurant industry. This makes it possible to produce a wide range of bakery products and sell them in their outlets being hot during the day.

Nowadays bread from rye flour (rye bread) is in demand among the people and has high nutritional value, thanks to the flour in essential amino acids, vitamins, micro- and macroelements. A special taste and smell of rye bread increases its physiological value. These properties allow to include the bread from rye flour to category of healthy nutrition products. Taking into account the characteristics of carbohydrate and amylase complex, protein and proteinase complex of rye flour, technology of making bread is very sophisticated and labor-intensive (demanding intensive labour). On Ukrainian market acidulants supplying additives are imported, but there are problems of economical and resource availability of these additives, the lack of scientific evidence of their use. These reasons make necessary to develop new acidulants additives and technological principles of their application. Therefore, the creation of complex acidulants additives with a substantiate structure for the rapid

production of rye-wheat bread and a study their impact on basic dough processes is actual and up-to-date [1-4, 6].

Setting objectives.

To create the proper conditions of biochemical processes in the dough and shortening manufacturing rye-wheat bread it is necessary to provide proper acidity of dough and fermentation activity of yeast. For this purpose it is necessary to develop the complex Acidifiers and explore their effects on biochemical processes in dough and bread quality.

Materials and methods.

Citric acid, dry milk whey, rye fermented malt, enzymes with different principles of action were used to create compositions of acidulants. All components are selected taking into account the features of rye-wheat dough and products of it. Dough was prepared from a mixture of wheat flour first grade and peeling rye flour in proportion 50:50(1:1). The humidity of dough was 47%. There were prepared dough on traditional technology on thick rye sourdough as a control sample .

The quality of semi-finished product and bread was evaluated by organoleptic and physico-chemical parameters with standard methods [5]. The intensity of fermentation of dough was determined by its ability gasification, sugar content research was carried out by Shorly's iodometric method.

The results.

Using methods of mathematical-statistical modeling and trial baking, three options of compositions by complex acidulants were developed: "Effect Plus", "Optimal-1" and "Optimal-2". There were defined their influence on technological process and the quality of bread [7,8].

There were investigated 4 samples of dough: 1 – control on thick rye sourdough, 2, 3, 4 – developed acidulants "Effect Plus", "Optimal-1", "Optimal-2" respectively. There were established (Table. 1), that production of rye-wheat bread for accelerated technology with using developed acidulants initial acidity of dough was greater than the control sample on 0.4 – 0.8 degrees. This is explained acidulants' great acidity, which composed of organic acids.

During fermentation acidity of dough is increasing due to the intensification of the fermentation of dough. Thus, in samples of dough with the established acidulants process of acids accumulation occurred more intensively. For less time of fermentation there were accumulated more acids respondent substances as in control sample. This fact can be explained by more optimal pH and the presence of pressed yeast in dough's samples with acidulants addition. The intensive of fermentation promotes to cut down the length of maturation products that are relevant in the accelerated technologies of rye-wheat bread.

Table 1

Effect of acidulants on figures of technologic process and rye-wheat bread's quality

Figures	Control	With acidulants		
		Effect Plus	Optimal-1	Optimal-2
Dough				

Initial acidity , grad.	6,6	7,4	6,8	7,0
Duration of fermentation, min.	90	30	30	30
Duration of maturation, min.	50	40	40	35
Final acidity, grad.	7,4	8,6	7,7	8,0
Bread				
Specific volume , cm ³ /g	2,4	2,2	2,2	2,3
Porosity, %	66	64	65	66
Acidity, grad.	6,0	6,6	6,4	6,8
Look	Right shape, smooth			
Crumb quality	Non-rigid			
Porosity	Equable			
Taste and flavor	Natural for rye-wheat bread			

Bread, which was made with accelerating technology, satisfied to requirements of regulatory documents, had good organoleptic properties, pleasant taste and flavor.

One of the features, which indicators the intensity of fermented dough, is its ability of gasification property. This figures images activity of yeast cells and the availability of sugars and nitrogen-containing substances. Since compositions of acidulants contain significant amount of these substances, there was conducted determination of number of selected carbon dioxide during 300 minutes of fermentation. There was found that gas production in the dough with acidulants is 11% - 32% stronger than in the control sample. Compositions developed acidulants provide more intensive gas production. There is associated with more accumulated sugars under the influence of enzymes in dough's fermentation. The dynamic of gas production in the rye-wheat dough shows that acidulants' addition in dough intensifies the accumulation of carbon dioxide during the period of fermentation. Maximum of carbon dioxide's emission in samples with acidulants is observed much earlier than in the control sample.

It is known that the biochemical processes in dough can be characterized by changes in the balance of sugars in semi-finished product. The depth of their changes affects on gas production's ability of dough during fermentation.

There were prepared four samples (1-control - thick rye sourdough, 2, 3, 4 – with developed acidulants "Effect Plus", "Optimal-1", "Optimal-2" respectively) to determining the balance of sugars of rye-wheat dough. To avoid the influence of yeast's enzymes and fermentation on content of sugars, yeasts are not made in dough. Similarly, there were prepared four samples of dough but with addition of 3% of yeast. Accumulation of sugars were determined immediately after mixing and after 1,5 hours of dough's fermentation at temperature of 32° C.

In the dough after mixing and after 1,5 hours of fermentation sugars' content were determined by Shorly's iodometric method. The accumulation of sugars was determined by the difference between their content in the dough after mixing and after 1,5 hours of fermentation. Comparison of sugars formed in non-yeast dough, and the residual of sugars in dough after 1,5 hours of fermentation, help to determine amount of sugars that were fermented (tab. 2).

Table 2

Content of reducing sugars in rye-wheat dough

Subject	Reducing sugars							
	Samples without yeast				Samples with yeast			
	1	2	3	4	1	2	3	4
Dough after mixing	3,62	4,46	5,1	4,67	3,59	4,58	5,2	4,8
Dough after 1,5 hours of fermentation	6,0	7,06	7,8	8,0	4,28	5,4	5,9	6,0
Accumulated sugars	2,38	2,6	2,7	3,33	0,69	0,82	0,7	1,2
Fermented sugars	-	-	-	-	1,69	1,78	2,0	2,13

The table shows that in dough with acidulants accumulation of sugars and their fermentation exceed the level of control in all dough samples. After 1,5 hours of fermentation there were formed in samples of dough with the addition of 10-40% more reducing sugars than in control sample. This can be explained by increased activity of enzymes by reduction the pH of dough acidulants, which leading to a deeper hydrolysis of starch and dextrins.

Number of fermented sugars in dough with acidulants was on 26% higher than in the control, thanks to intensification the process of fermentation. This creates conditions for shortening period of fermentation and proofing semi-finished products.

So, intense accumulation and fermentation of sugars in dough samples with complex acidulants is important foundation for intensifying the process of fermenting dough.

Conclusions:

Development of integrated manufacturing new acidulants for rye-wheat bread's manufacture is appropriate and relevant. Production of rye-wheat bread for accelerated technology with the addition of complex acidulants promotes more intensive acids accumulation in dough, increases the gas production process and accelerates ripening dough reduces the duration of proofing dough pieces and has positive effect on the taste qualities of bread.

Developed acidulants, which are based on organic acids and enzymes, provide significant shortening dough fermentation and proper quality bread.

Using elaborated complex acidulants is perspective in the production of rye-wheat bread for accelerated technology in discrete modes of production in restaurant enterprises and mini-productions.

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