



DEVELOPMENT OF COMPLEX ACIDIFIERS AND ANALYSIS OF IMPACT ON BIOCHEMICAL PROCESSES IN DOUGH

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Abstract. Nowadays there are many different changes in all branches of human practice. This is engaged with runaway of science and technique and is dictated by consumer's demand. Similarity of products, low capacity to adaptation and changes may lead to a decrease of products' popularity with consumers. Nutrition technology, especially production of rye and rye-wheat bread, is also under great pressure from the point of view of growing rivalry. But this product apart from its popularity with consumers is not only an integral part of rational nutrition, but also a part of clinical nutrition. In modern conditions it is necessary to find ways to reduce the length of production of rye-wheat bread and to expand the range of products in restaurant enterprises and mini-productions. A formula of acidifiers, based on organic acids, dry milk whey, rye fermented malt and enzymes was developed in view of applying it in the technology of rye and rye-wheat bread. It contains organic acids and enzymes and provides significant shortening of dough fermentation and proper quality bread. The addition of supplements can reduce the duration of the process to 2,5-3 times and provide improvement of the structural and mechanical, physical and chemical properties of dough and bread. The influence of elaborated complex additives on biochemical processes in the dough and on bread quality was analyzed. A comparative study was made on the products obtained by traditional technology, using thick sourdough and those obtained by accelerated technology using of complex acidifiers. The changes in the balance of reducing sugars in the dough with complex acidifiers were analyzed as well. The addition of recently developed complex additives provides shortening of production process without quality loss of the finished products. These results allow the using of complex acidifiers in restaurant enterprises and mini-productions.

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

1. Introduction.

In recent years the development of restaurants and mini technology influenced significantly the 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 macro elements. A special taste and smell of rye bread increases its physiological value. These properties allow including 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 labor). On Ukrainian market acidifiers 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 acidifying additives and technological principles of their application. Therefore, the creation of complex acidifying 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].

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.

2. Materials and methods

Citric acid, dry milk whey, rye fermented malt, enzymes with different principles of action were used to create compositions of acidifiers. 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.

3. Results and discussion

Using methods of mathematical-statistical modeling and trial baking, three options of compositions by complex acidifiers 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 acidifiers "Effect Plus", "Optimal-1", "Optimal-2" respectively. There were established (Table. 1), that production of rye-wheat bread for accelerated technology with using developed acidifiers initial acidity of dough was greater than the control sample on 0.4 – 0.8 degrees. This is explained acidifiers' 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 acidifiers 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 acidifiers' 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.

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

Table 1

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

Figures	Control	With acidifiers		
		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			

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 acidifiers 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 acidifiers is 11% - 32% stronger than in the control sample. Compositions developed acidifiers 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 acidifiers' addition in dough intensifies the accumulation of carbon dioxide during the period of fermentation. Maximum of carbon dioxide's emission in samples with acidifiers 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 effects on gas production's ability of dough during fermentation. There were prepared four samples (1-control - thick rye sourdough, 2, 3, 4 – with developed acidifiers "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 was 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. The comparison between sugars formed in non-yeast dough, and the residual of sugars in dough after 1.5 hours of fermentation, helps to determine amount of sugars that were fermented (tab. 2).

Table 2

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 2 shows that in dough with acidifiers 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 acidifiers, leading to a deeper hydrolysis of starch and dextrins.

The number of fermented sugars in dough with acidifiers was by 26% higher than in the control due to the intensification of the process of fermentation. This creates conditions to reduce the period of fermentation of semi-finished products. Thus, intense accumulation and fermentation of sugars in dough samples with complex acidifiers is important foundation for intensifying the process of fermenting dough.

4. Conclusions

The development of integrated manufacturing new acidifiers for rye-wheat bread's manufacture is appropriate and relevant. Production of rye-wheat bread by accelerated technology with the addition of complex acidifiers promotes more intensive acids accumulation in dough. It 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 acidifiers, based on organic acids and enzymes provide

significant shortening of dough fermentation and proper quality bread.

The use of elaborated complex acidifiers is a perspective in the production of rye-wheat bread by accelerated technology in discrete modes of production in restaurant enterprises and mini-productions.

5. References

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