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INFLUENCE OF THE ENZYME COMPLEX IN ADDITIVE COMPOSITION ON BREAD YIELD IN BREADMAKING PROCESS

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Abstract

The aim of bakery industry is meet the consumer's tastes and requirements, in order to produce high quality products at minimum costs. That is the reasons for constant tendency to increase bakery yield, in the process of bread production.

The research in this study is determining the effects of usage bread improvers with different enzyme composition on rising power of water absorption in the phase of kneading and forming dough.

Mixolab Chopin rheolological analyze is made on improver trials also in bread making process. Laboratory and process results correspond and show that different dosage of components in improvers have effect on water absorption.

By using improvers with different composition we provide the maximum effects in bread making production process by increasing bakery yield for 1,2%, decrease production cost by keeping quality of final product.

Key words: *Enzyme, water absorption, bakery yield, cost, quality*.

1. Introduction

The aim of this study is to show the opportunity that with a change of certain contents in the bakery additive, it is possible to increase the yield of bread.

Traditionally, ready-made improvers are used in the production of bakery products. The downside of using a ready-made improvers is that there cannot be any interventions in the content of the improver, depending on the quality of the flour. Thus, we have started researching an optimal composition of mixtures of additive which will increase the bakery yield and will not influence the final product.

In manufacture of bread the production of dough with unvarying consistencies is desirable so that process conditions and product quality can be optimized. Water absorption capacity is affected by the moisture content of the flour, protein and ash content, water soluble proteins, damage starch, enzyme activity.

There is an optimum water level for each of the flours used in bread dough-making. This is usually set according to the required dough viscosity and other rheological properties which yield the right product qualities. Optimum dough water level is set by bakers according to their ability to process the dough into its required sizes and shapes with a minimum of effort end damage to the dough properties (Stanley [1]).

Water most abundant ingredient is of great economic concern to both the manufacturer and to the consumer. Increasing the quantity of added water will increase the yield and this leads to profit for the manufacturer. The bread will also be a softer and have a better consumer appeal (September [2]).

Combinations of glucose oxidase and amylase have a synergistic effect on bread quality (Caballero *et al.* [3]).

Use glucose oxidase creates dry and strong dough. A high dosage of fungal α amylase gives dough extensibility. The combination of these two enzymes can therefore achieve a synergistic effect. When these two enzymes are used together with a smaller amount of ascorbic acid, the dough is not only very stabile but also absorbs 1-2% more water, resulting in a greater volume increase and a crispier crust (Si [4]).

2. Materials and Methods

The researches are made in Zito Polog AD, Laboratory and Bakery department.

For the preparation of 7 trial additive samples, the following components are used:

- Ascorbic acid 2.5-10 g/100 kg;

- Fungal α amylase, activity 60000 SKB (from *Aspergillus niger*) 1-4 g/100 kg flour;
- Bacillus xylanase (from *Aspergillus spp.*) 2-4 g/100 kg flour;
- Glucose oxidase, activity 2500 unit/g (from *Aspergillus niger*) 0,5-1 g/100 kg flour;
- Lipase, activity 10800 units/g (from *Aspergillus spp.*) 0,5-2 g/100 kg flour;
- Emulsifier 20-40 g/100 kg flour.

The limits of dosage of the components are given by the manufacturer of the components. All of the trial samples of additive are dosed with equal dosage of 0,5% in flour.

The laboratory analyses are made according to ICC Standard Method No. 110/1 determination of moisture content and ICC Standard Method No. 173 Mixolab, Chopin.

The test on Mixolab Chopin is based on preparing a constant hydrated dough mass so as to obtain a target consistency during the first test phase. Using the "Chopin+" protocol the flour is hydrated to reach a consistency of 1.1 Nm (±0,05 Nm). It measures, in 45 minutes, the torque (Nm) produced by the dough between two mixer arms with a rotating speed of 80 rpm. The Profiler converts the Mixolab curve into 6 indexes noted from 0 to 9 (Mixolab Index) which describes: water absorption potential, dough behavior during mixing, gluten strength, maximum hot viscosity, resistance to alpha amylase activity, starch retrogradation. Mixolab measures also these values: C1-used to calculate water absorption, C2-measures protein weakening as a function of mechanical work and temperature, C3-measures starch gelatinization, C4-measures the stability of the hot-formed gel, C5-measures starch retrogradation during the cooling period.

For the measurement of the additive components, a laboratory scale (Mettler AE 100) is used. A mixer type MBL-50-A is used for mixing the additive components with the flour. All seven improvers are tested at the industrial line for production of bread (manufacturer: Gostol-Gopan).

The process of production is performed by intensive processing of the dough (Ковачевиќ [5]) i. e. dough development and dough maturity can often be controlled without the use of time-consuming precursors (Ireks [6]).

All of the tests were performed at same processes conditions: temperature of water 23-24 ^{0}C, temperature of dough 29-30 ^{0}C, high speed mixer (1min slow and 2 min fast speed), resting dough 10 min, intermediate fermentation 12 minutes, fermentation 55 min at 37-38 ^{0}C and 74-75% RH and baking 25 minutes at temperature of 240-210 ^{0}C, in accordance with baking stage.

The improvers and their rheological characteristics, which are the subject of this research, are composed of same type of flour and additive with a different content, but equal dosage. The qualitative characteristics of the flour used for preparing the improvers as well as in the breadmaking process are given in Table 1.

Table 1 . The quality parameters of standard bakery flour

Parameters	Values
Moisture content %	14.87
Ash content %	0.498
Wet gluten content	23.6
Granularity (çm)	130-200
Mixolab Index	2-14-766
C1 (Nm)	1.15
C2 (Nm)	0.39
C3 (Nm)	1.88
C4 (Nm)	1.59
C5 (Nm)	2.40

3. Results and Discussion

In Table 2, seven trial samples of additive with different mass share of components in 100 kg of flour.

Table 2. Dosage of components in grams of additive on 100 kg flour

Additive sample	Ascorbic acid (g)	Amylase (g)	Bacillus xylanase (g)	Glucose oxidase (g)	Lipase (g)	Emulsifier (g)
1	7.5	0.5	4	0.8	1	20
2	5	1.5	4	0.8	1	20
3	5	0.5	2	0.8	1	20
4	5	0.5	4	0.8	1	20
5	5	0.5	4	0.5	1	20
6	5	0.5	4	0.8	0.3	20
7	5	0.5	4	0.8	1	0

In Table 3, the results of the rheological characteristics measured on Mixolab Device are given on 7 improver tests. Test 0 is consisted of flour with 0,5% dosage of a previously used ready-made improver.

Table 3: Mixolab results of flour and 0,5% improver

Mixolab tests of improvers	0	1	2	3	4	5	6	7
Index	5-12-463	4-13-675	3-12-543	3-12-654	6-13-685	3-13-755	3-13-755	2-14-776
C1 (Nm)	1.08	1.12	1.07	1.12	1.08	1.10	1.11	1.13
C2 (Nm)	0.28	0.34	0.30	0.33	0.35	0.37	0.34	0.43
C3 (Nm)	1.65	1.83	1.71	1.77	1.87	1.87	1.81	1.87
C4 (Nm)	1.47	1.59	1.33	1.40	1.77	1.58	1.50	1.67
C5 (Nm)	1.96	2.29	1.86	2.01	2.38	2.39	2.24	2.46

It is evident that the best result with highest water absorption of water has the improver number 4. By decreasing the share of components Bacillus xylanase, Glucose oxidase, Lipase and Emulsifier (mixtures 3, 5, 6 and 7) the ability for water absorption is decreased, but there is no influence on the volume of the bread (C2) and subsequently, a higher amylolytic activity (C4). The other values of the Mixolab curve indicate insignificant changes in relation to the rheological characteristics of the dough. The values of all parameters from C1 to C5 indicate higher values of improvers 4 in relation with ready-made improver. The Mixolab index of water absorption on improver 4 is higher for one unit compared to the same with the ready-made improver.

In Table 4, there is a comparison of the values for the index of water absorption of the ready-made and 7 mixtured trials of improvers made with the Mixolab device and the ability for water absorption dosed with 0,5% in 100 kg of flour in the breadmaking process.

Table 4. Comparison of Mixolab absorption index of the improvers and process water absorption of the improvers added in 100kg of flour

Mixtures (tests 0-7)	0	1	2	3	4	5	6	7
Mixolab absorption index	5	4	3	3	6	3	3	2
Water absorption in breadmaking process	61%	60.5	59%	59.5%	62.5%	59.5%	59.5%	58.5%

The results are graphically shown in Figure 1.

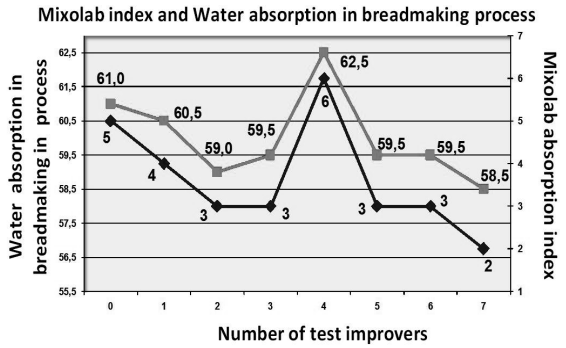

Figure 1. Comparison of Mixolab index and process water absorption of ready-made and 7 test improvers

It is evident that the index of water absorption of the improvers, determined in the laboratory with the Mixolab device, directly correspond with the ability of water absorption during phase of kneading the flour with the mixture in the process of production, i. e. the higher the Mixolab absorption index, the greater the ability for water absorption while kneading the dough.

The effect of increasing the water absorption index in improver 4 in relation to the other improvers in conditions of production, specifically in the process phase of kneading the dough, expressed through the number of pieces of baked product and bakery yield, is given in Table 5.

Table 5. Number of pieces bread and bakery yield from the ready-made and 7 test improvers

Improvers (0-7)	0	1	2	3	4	5	6	7
Number of bread pieces	269	268	265	266	271	266	266	264
Bakery yield	135.9	135.6	134.3	134.7	137.1	134.7	134.8	134.0

The use of improver from additive 4 provides a daily increase of the production of pieces of bread for 0.74% in relation to the ready-made additive previously used in production. The bakery yield is increased for 1.2%. Calculated at daily consumption of flour of 6000 kg and a market price of bread of 0.44 €, the profit from using the mixed additive number 4 in relation to the previously used ready-made additive is higher for 52.8 € a day.

4. Conclusions

– The choice of improver of additive with optimal content of components provides increase of two pieces for every kneading, i. e. an increase of the bakery yield 1,2%. This achieves decrease of production costs for 52,8 Euros a day, without increasing the acquisition price for improvers, nor violating the rest of the qualitative characteristics of the bread.

– The opportunity to implement own production of mixture for improvement of the quality of the bread, instead of the previous practice of using a ready-made additive, gives great opportunities for the Managers in the process of production of bakery products in relation to intervention according to the needs.

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