STUDY ON STRUCTURAL CHANGES AND THE BREAD DOUGH AFTER ADDING ENZYMES

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Abstract

In this paperwork it has been determined the bread quality resulted from the witness flour(M) and the bread quality resulted from the flour with enzymes mixture in three different concentrations In these concentrations it has been used fugal α-Amylase and xylanase in order to establish which concentration is the most appropriate to be added into the flour so that we could get higher quality characteristics of the bread such as: higher volume of the bread, soft texture of the crumb, longer lasting bread freshness, colour and flavour's improvement, improvement of the cutting property of the bread.

Key words: bread, α- amylase, xylanase, quality parameter.

INTRODUCTION

The enzymes have more functions in the technology of bread manufacture, from catalyzing the starch and proteins decomposition to the whitening of the dark coloured pigments in flour. (Banu et. al, 1999)

For the past few years it has been made much progress in the enzymology field regarding their applicability in food industry science and technology.

The use of exogenetic enzymes in gristmill and bread manufacture prevent a deficiency of the enzymes which can be found naturally in wheat and flour. (Banu et. al, 2000)

Although the acting mechanisms of the enzymes are complex and unknown in few cases, the reason of using them in manufacturing bread can be established because of the decisive importance in controlling the dough properties. (Răcaru, 1999)

In this paperwork we have determined the quality of the bread (volume, porosity, elasticity) (Anderson et al, 2002). It has been determined the quality of bread resulted from the witness flour (M) and the bread's quality resulted from the flour with 3 different concentrations of α- amylase and xylanase as mentioned in the abstract.

MATERIAL AND METHOD

It has been used 4 witness tests of flour whose characteristics are the following, according to the table 1:

Table 1

Flour's Characteristics

Characteristic	F1	F2	F3	F4
Humidity, %	14,60	13,77	14,08	14,42
Ash, %	0,64	0,48	0,55	0,38
Protein content, %	13,25	13,44	13,37	10,60
Humid gluten , %	27,5	28,5	27,6	24,85
Humid gluten deformation, mm	13	5,5	4,5	5
Sedimentation value- Zeleny,ml	48	37	44	36
Acidity, %	2,5	2,6	2,4	2,3
Falling Number:				
- Falling value	451	394	296	270
Cell graph*:				
-Energy $W*10^{-4}J$	104	185	108	223
- Maximum pressure(P), mm	72	81	69	101
-Extensibility value, (G)	15	19,1	15,8	18
-Extensibility (L), mm	46	74	50	65
- P/L ratio	1,58	1,09	1,39	1,55
-Elasticity value (Ie),%	27,4	44,6	30,7	48
Consistency graph*:				
- Test's humidity (H_2O),%	14,60	13,80	14,10	14,40
- Maximum pressure (Pr max),mb	2807	3045	3072	3117
- Water absorbed(Wa),%b	56,4	57,4	57,6	57,8
-Hydration degree (Hydha),%b	53,9	54,9	55,1	55,3
Farinograph*:				
-Hydration capacity, %	64,4	60,9	61,9	62,0
-Development, min	2	1,5	2	2
-Stability, min	6	5,5	6,5	6,5
-Elasticity, UF	75	70	80	80
-Dip degree, UF	90	65	65	80
-Flour's power, UC	61	61,2	63,5	61,4
Zimotachygraph*:				
-Total volume of resulted gases (V),cm^3	1347,6	1087,5	1406,1	1484,4

Yeast– Pakmaya (commerce), **Salt** – extra soft table salt (commerce), **Water**-drinking water from the water supply, **Enzymes: Clarase G Plus** – it is a preparation of fugal α-amylase, extracted out of *Aspergillus oryzae*, with a minimum enzymatic activity of 140.000 SKB/g and **Belpan XILA L–**which is a standardized fugal xylanase of microbial origin obtained through dip fermentation of an *Aspergillus* stem. The enzyme contains pentosanase, endo-and exo-xylanase, hemicellulosis which support the hydrolysis reactions of the pentosans, turning the insoluble pentosans into soluble pentosans thus increasing the elasticity modulus of the dough, with enzymatic activity of 2700 FXU/g.

Then the enzymes were dosed as follows: to 99g flour it was added 1g of enzyme, and it was mixed for 20 minutes. The enzymes weighing was done using an electronic Sartorius balance. The limits for using each enzyme were determined by trials and there were chosen only the periods which had results and subsequently, out of these being chosen only the optimal doses.

Dosing the enzymes was necessary because the enzyme quantity taken for determination was in very small quantities.

There were prepared four tests, one of them as a witness test, without enzyme and 3 of them with the following levels of α-amylase and xylanase: for

F1and F2 the enzymes mixture is P1-840000U.SKB/100kg flour+8100U.FXU/100k flour,P2-840000U.SKB/100kg flour+16200U.FXU/100kg flour, P3-840000U.SKB/100kg flour+24300U.FXU/100kg flour; and for **F3 and F4** the enzymes mixtureis P1-2800000U.SKB/100kg flour+8100U.FXU/100kg flour, P2-280000U.SKB/100kg flour+16200U.FXU/100kg flour, P3-280000U.SKB/100kg flour+24300U.FXU/100kg flour.

The procedure for making bread: The 900g bread tests were prepared using the direct procedure, following the next recipe: 675g flour, 13.5g yeast, 13.5g salt, 365 g water. The yeast was dispersed into 50 ml water, the salt was dissolved into 50 ml of water and the enzyme was added in different ratios according to the flour quantity from the recipe.

Operational programme: slow mixing for 12 minutes into the laboratory blender; fast mixing for 4 minutes; fermentation 20 for minutes; 25-30^{0}C, re-kneading for 20 s; manual division – 1,000 g; manual rounding; pre fermentation – 20 minutes (rest); shaping – long format; final fermentation for 60 minute, 33^{0}C into an automatic fermenting machine, relative humidity 80%; baking for 35 minutes, 250^{0}C into a cyclothermic oven; cooling at 20^{0}C.

In order to estimate bread quality there were established the following parameters: volume, porosity, elasticity.

RESULTS AND DISCUSSIONS

The influence of the α-amylase and xylanase (associated) on the bread volume made from F1 and F2 flour is presented in table 2:

Table 2

The influence of the α-amylase and xylanase (associated) on the bread volume made from F1 and F2 flour

Flour test	**Specific volume of bread, cm^{3}for 100g bread for an addition of α-amylase and xylanase (associated) of:**			
	M	P1-840000U.SKB/100kg flour +8100 U.FXU /100kg flour	P2-840000U.SKB/100kg flour+16200U.FXU /100kg flour	P3-840000U.SKB/100kg flour+24300U.FXU /100kg flour
F1	261	284	298	298
F2	235	284	279	276

Both for the F1 flour and F2 flour have been registered an increasing of the specific volume, compared to the witness test volume with 9% respectively with 21% for a dosage of associated enzymes corresponding to test P1.

For the doses corresponding to tests P2 and P3, the specific volume in F1 flour increases compared to the specific volume of the witness test with 14%.

In F2 flour case, for the doses of associated enzymes corresponding to tests P2 and P3, the specific volume decreases compared to the specific volume of the test, but it is higher than the specific volume of the witness test with 19%, respectively with 17%.

The influence of the α-amylase and xylanase (associated) on the bread volume made from F3 and F4 flour is presented in table 3:

Table 3

The influence of the α-amylase and xylanase (associated) upon the bread volume made from F3 and F4 flour

Flour test	**Specific volume of bread, $cm^3$for 100g bread for an addition of α-amylase and xylanase(associated) of:**			
	M	P1- 280000U.SKB/100kg flour +8100 U.FXU /100kg flour	P2- 280000U.SKB/100kg flour+16200U.FXU /100kg flour	P3- 280000U.SKB/100kg flour+24300U.FXU /100kg flour
F3	269	296	270	260
F4	238	273	260	246

For both types of flour there is an increasing of the specific volume compared to the specific volume of the witness test, but only for the associated enzymes dose, corresponding to test P1.

For the next doses of enzymes corresponding to tests P2 and P3 there has been registered a decrease of the specific volume compared to the specific volume of test P1.

The influence of the α-amylase and xylanase (associated) on the bread porosity made from F1 and F2 flour is presented in figure 1:

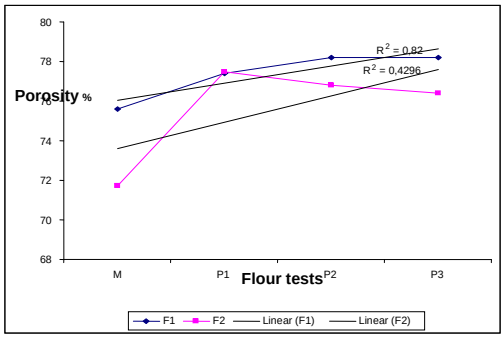

Figure.1. The influence of the α-amylase and xylanase (associated) on the bread porosity made from F1 and F2 flour

Porosity of the bread made from F1and F2 flour treated with associated enzymes in the dose corresponding to test P1, has registered an increasing of 2% respectively 8%.

For the next doses of associated enzymes, corresponding to tests P2 and P3, the porosity is increasing for F1 flour, compared to porosity of the witness test and test P1.

In F2 flour case, for the doses of associated enzymes corresponding to tests P2 and P3 there has been registered a small decrease of the porosity compared to the porosity of test P1, porosity which is higher than the porosity of the witness test.

The influence of the α-amylase and xylanase (associated) on the bread porosity made from F3 and F4 flour is presented in figure 2:

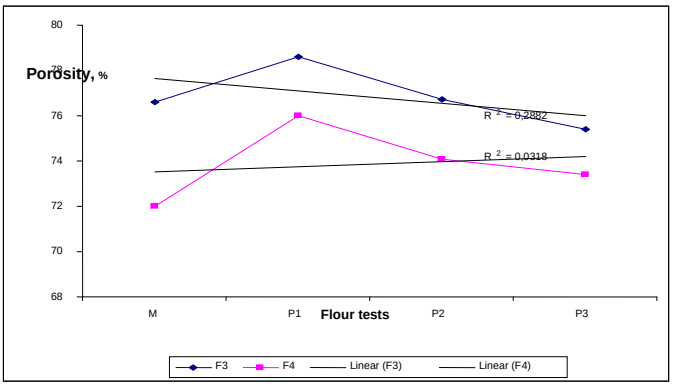

Figure.2. The influence of the α-amylase and xylanase (associated) on the bread porosity made from F3 and F4 flour

For both types of flour, there is an increasing of the porosity with 3% for F1 flour and 6% for F2 flour compared to the porosity of the witness test, in case of these flour treated with associated enzymes, corresponding to test P1.

While the doses of associated enzymes are being modified, the porosity registers a slight decrease compared to the porosity of test P1, getting to register lower values than the porosity of the witness test in case corresponding to test P3 for F3 flour.

In case of F4 flour, for the doses of associated enzymes corresponding to tests P2 and P3, the porosity is decreasing, compared to test P1 porosity, but higher than the porosity of the witness test.

The influence of the α-amylase and xylanase (associated) on the bread elasticity made from F1 and F2 flour is presented in table 4:

Table 4

The influence of the α-amylase and xylanase (associated) upon the bread elasticity made from F1 and F2 flour

Flour test	**Crumb elasticity, % for an addition of α-amylase and xylanase (associated) of:**			
	M	P1- 840000U.SKB/100kg flour +8100 U.FXU /100kg flour	P2- 840000U.SKB/100kg flour+16200U.FXU /100kg flour	P3- 840000U.SKB/100kg flour+24300U.FXU /100kg flour
F1	97	98	98	98
F2	96	98	97	97

In case of F1flour, the crumb elasticity registers a slight increasing compared to the elasticity of the witness test, increasing which stays constant for all the doses of associated enzymes (P1, P2, P3).

The crumb elasticity of the bread made from F2 flour, registers an increasing in the first stage corresponding to test P1, after which for the next doses corresponding to tests P2 and P3 the crumb elasticity decreases compared to the elasticity of test P1, but it is higher than the elasticity of the witness test.

The influence of the α-amylase and xylanase (associated) upon the bread elasticity made from F3 and F4 flour is presented in table 5:

Table 5

The influence of the α-amylase and xylanase (associated) upon the bread elasticity made from F3 and F4 flour

Flour test	**Crumb elasticity, % for an addition of α-amylase and xylanase(associated) of:**			
	M	P1- 280000U.SKB/100kg flour +8100 U.FXU /100kg flour	P2- 280000U.SKB/100kg flour+16200U.FXU /100kg flour	P3- 280000U.SKB/100kg flour+24300U.FXU /100kg flour
F3	98	98	98	98
F4	97	98	98	98

By treating flour F3 with the addition associated enzymes, the crumb elasticity of the obtained bread stays at the same level for all the enzymes doses, level equal to the elasticity of the witness test.

By treating flour F4 with the addition associated enzymes, the crumb elasticity increases compared to the elasticity of the witness test with 1%, percentage which stays constant for all the doses of addition associated enzymes (P1, P2, P3).

CONCLUSIONS

The addition of α-amylase and xylanase improved the bread volume, the porosity and elasticity of the crumb, to a certain dose of added enzymes mixture, the more the enzymes dose was bigger and better the flour, which positively influenced the retention of gases.

In case of flour F2, for the doses of associated enzymes corresponding to tests P2 and P3 there has been a slight decrease of the porosity compared to the porosity of test P1, porosity which is higher than the porosity of the witness test.

While the associated enzymes doses are being modified, the porosity registers a slight decrease compared to porosity of test P1, getting to register lower values than the porosity of the witness test for the dose corresponding to tests P3 for flour F3.

In case of flour F4 for the doses of associated enzymes corresponding to tests P2 and P3, the porosity is decreasing, compared to the porosity of test P1, but higher than the porosity of the witness test.

The elasticity of the bread crumb made from flour F2, registers an increasing for the first stage corresponding to test P1, after which for the next doses

corresponding to tests P2 and P3 the elasticity of the crumb decreases compared to the elasticity of the test P1, but it is higher than the elasticity of the witness test.

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