INFLUENCE OF THE ADDITION OF XYLANASE ON THE QUALITY OF WHEAT PREBAKED

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Abstract
Exogenous xylanases added in dough hydrolyze soluble and insoluble pentosanes in a greater or smaller measure and have a different influence on the rheological properties of dough and bread quality, depending on their origin. Together with α-amylase xylanases have a higher influence on dough structure. This paper aims were to present the role and influence of exogenous xylanase addition on quality prebaked bread flour obtained from wheat. It was established three distinct amounts of xylanase and analyzed the pharinograph and how they were influenced alveographic dough properties. There have been prebaked bread samples that were stored for different time intervals (10, 20, 30 and 45 days). Bread was stored frozen. After thawing and final baking bread has been baked and watched variation of physical-chemical indicators of the final product (volume, porosity, elasticity, and so on).
All samples were compared with a control sample. It was observed that increasing the amount of xylanase leads to an improvement of the volume but above a certain dose volume decreases. And if there was an improvement porosity values with increasing the amount. In the analysis volume, porosity, elasticity, shelf life it were observed that the storage time had no significant influence on them. All indicators followed that in case of prebaked and frozen bread was obtained worse results than witness who did not undergo this process.

Keywords*:* hydrolysis pentosani, freezing, thawing, xylanase, wheat

Submitted: 03.05.2013 Reviewed: 24.05.2013 Accepted: 10.06.2013

1. INTRODUCTION

Lately, bakery industry primary problem is to provide fresh bread at any time of day. A solution to this situation is prebaked bread. To work on stock prebaked bread can be subjected to a freezing process. This process updates the physicochemical properties (volume, porosity, elasticity, etc.). To improve the quality of products can use various additives and ingredients. Xylanase is an enzyme that is used successfully in the bakery industry. Its use leads to improved bread volume, porosity, elasticity bread. Good results are obtained when using α-amylase and mixed.

2. MATERIALS AND METHODS

In order to obtain some available experimental data, 650 wheat flour obtaining from market was used like control sample. The analytical flours' obtained quality (table 1) was determined in accordance with the international standard methods (ash content – ICC104/1, wet gluten – ICC105/2, protein content – ICC106/2, hydration capacity with Pharinograph - ICC115/1) (Table 1). The results obtained from tests conducted in the research laboratory of SC Pambac SA on dough rheological characteristics are presented in Table 2. For have a complete point of view regarding the quality of flour it were made baking test for each sample. It was used compacted fresh yeast (*Saccharomyces cerevisiae)* from S.C. ROMPAK, Pascani, with 32.5% dry matter and 46.54% protein content (N x 6.25). Also, it was used iodized salt produced by Tg. Ocna saline.
It was use also, an improver **Xylanase**-Pentopan Mono from the company Novozymes, Denmark, is an endo-beta -1, 4-xylanase from *Thermomyces lanuginosus* purified produced by submerged fermentation of a genetically modified *Aspergillus oryzae* microorganism (table.3.). Pentopan Mono improves bread dough machinability by its action on soluble and insoluble pentosane of flour. Enzyme preparation influence the

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stability dough, crumb structure becomes more uniform and smoother, improves bread loaf volume and crust is crisp. Pentopan Mono can be used as an alternative or in combination with emulsifiers in all kinds of bread. It is inactivated during the baking process. For best results it could be used with fungal α-amylase in bread making.

Table1 Physico-chemical and microbiological indices of wheat flour used in experiments

Indicators	Flour 650
Moisture [%] max	14,5
Acidity [degree] max	1,2
Wet gluten [%] min	29
Index deformity gluten [mm]	7
Ash [%] max	0,66
Protein content [%] min	11
Metallic impurities: - powder [mg/kg] max - in chips.	 no no
Yeast , Ufc.g^{-1}	<10
Fungus, Ufc.g^{-1}	$1x10^2$

Table 2 Dough rheological characteristics

Sample	Features alveograma					
	P [mm]	L [mm]	W [10^{-4}J]	P/L		
Flour 650	86	84	245	1,02		
	Features farinograma					
	Hidration capacity [%]	Development [min.]	Stability [min.]	Elasticity [U.B.]	Softening [U.B.]	Power
	55	1,30	3,30	100	70	49

Table 3 The physical properties of the enzyme preparation Mono Pentopan

Indicators	Value
Activity in units [FXU/g]	2500
Looks	Fine powder, light brown
Solubility	Soluble in water at all concentrations
pH optimum	4÷6
Optimum temperature [ºC]	≤75

2.1 Determination of rheological characteristics of dough

Chopin Alveoconsistograph was used to determine the strength and stability flour dough. The alveographic curve indicates the following characteristics:

- Height, P, measured in millimetres corresponds to the maximum bubble pressure of dough and is interpreted as resistance to deformation or stability of the dough
- Width, L, mm is interpreted as dough extensibility;
- Strain energy, W, in cm, is closely related to power flour flour hydration capacity. Action forming the dough is calculated in 10-4J.

Brabender Pharinograph it was use in order to determine the following indicators on the pfarinographic curve:

- Development dough in minutes, points are formed during the gluten network of the dough and read the pharinograph curve at point "0" to curve indicating the highest point of the track
- Stability dough in minutes, is represented by the pfariongrame that consistency is maintained on standard line (500 BU)
- Elasticity of dough, the UB curve is determined by the width of its widest part;
- Soaking of dough in UB, is determined after 12 or 20 minutes after start mixing and UB is the difference in consistency between standard line of 500 UB and middle of graphic
- Power of flour, value ruler reads the device and is dimensionless. It meets all the above indicators into a single number. The bigger the number is flour is stronger. With farinogramei alveogramei and technological characteristics of flours determine the influence of different additions of flour on these properties, to establish technological process to be applied.

2.2 Appreciation baking characteristics of flours by analyzing bakery baking test results

Bread volume Bread machine is determined by volumeter by measuring the volume of rapeseed displaced the product tested; refers to 100 g.

Core porosity Determine the total volume of voids in a given volume of core, knowing the density and mass. Porosity is expressed as a percentage and is calculated using the formula:

$$\text{Porosity}=\frac{V-\frac{m}{\rho}}{V}\times 100\ [\%]\quad (1)$$

where:
V = volume of core cylinder in cm3;
m = mass of the core cylinder in grams;
ρ = density of the compact core in grame/cm3:
ρ = 1.21 g / cm 3 for bread wheat flour black;
ρ = 1.26 g / cm 3 for the bread of milled wheat flour;
ρ = 1.31 g / cm 3 for bread from wheat flour and bakery specialties.

Elasticity core. Core elasticity is determined by pressing a piece of form core determined a given time and measuring return to its original position after removal of compression force and is given by:

$$\text{Elasticity}=\frac{B}{A}\times 100\ [\%]\ (2)$$

where:
A = height of the cylinder core before pressing, in mm;
B = height of core cylinder by pressing and return it to its original position, in mm.

Acidity

Acidity is expressed in degrees of acidity. A degree of acidity is the acidity of 100 g sample is neutralized with 1 cm3 of NaOH solution, 0.1 N. Acidity is calculated as:

$$\text{Acidity}=\frac{V\times 0{,}1}{m}\times 100\ \text{[degree of acidity at 100 g]}\ (3)$$

where:
V = volume of 0.1 N NaOH solution used in titration, in cm3;

Moisture

Determine the water content by mass loss by heating at 130 ± 2 ° C.
Water content is calculated by the formula:

$$\text{Moisture}=\frac{(m_1-m_2)}{(m_1-m_0)}\times 100\ [\%]\quad (4)$$

where:
m_1 = mass of the product vial before drying, g;
m_2 = mass of the product vial after drying, g;
m_0 = mass ampoule in g
The result is calculated to two decimal places and rounded to one decimal place.

3. RESULTS AND DISCUSSION

Xylanase added in dough hydrolyze soluble and insoluble pentosanes in a greater or smaller measure and have a different influence on the rheological properties of dough and bread quality, depending on their origin.
It was establish three different percents of xylanase which were added in the basic recipe: 4g/100kg flour 6g/100kg 10g/100kg flour and flour. After kneading, the homogeneous mixture obtaining was analyzed in the research laboratory. The results are presented in Table 4.
At Alveograph is observed that the addition of xylanase strain energy (W) decreases and the ratio P / L decrease. There is a decrease in pharinograph stability and an increase in the soaking. Prebaked bread samples were stored at different times 10, 20, 30 and 45 days (storage temperature -18 ° C). After each time interval bread was thawed slowly about 120 minutes at a temperature of 28 to 30 ° C and finally baked. After thawing the final product was baked. Samples were compared to a witness who was not subject to pre-baked process, freeze-thawing and final baking. The results were summarized in Table 5, 6 and 7.
In figure 1 it can be seen that addition of xylanase positively influence the volume of evidence obtained.
Not recommended increasing the amount of xylanase from 6g/100 kg flour at 10 g/100 kg flour, because the evidence falls to this value.
Storage duration does not affect the value of volume samples for the same amount of xylanase added.
Regarding the properties of bread core, it were made some observation starting the value indicated in figure 2. The analysis of data obtaining it could be observed that addition of enzyme improves both the control samples and the samples prebaked bread ¾ obtained by the process adopted. The porosity of samples is lower than for the same amount added to the witness. Also, shelf life does not affect porosity value added evidence for the same amount.

Table 4 Rheological behavior of dough with exogenous addition of xylanase

No. sample	Addition of xylanase [g/100kgflour]	Features alveograma			
		P [mm]	L [mm]	W [10^{-4}J]	P/L
1	4	83	86	243	0,97
2	6	68	88	215	0,77
3	10	63	79	189	0,8

Features farinograma							
No. sample	Addition of xylanase [g/100kgflour]	Hydration Capacity [%]	Development [min]	Stability [min]	Elasticity [U.B.]	Softening [U.B.]	Power
1	4	54	1,15	4,10	110	70	46
2	6	54,3	1,15	3,15	130	100	46
3	10	54,3	1,00	3,00	130	100	46

Table 5 Physico-chemical properties of prebaked bread with added 4g xylanase /100kg flour

Number of sample	Storage duration [days]	Physico-chemical indicators of bread samples – finished product				
		Volume [cm^3/100g]	Porosity [%]	Elasticity [%]	Moisture [%]	Acidity [degree]
1	10	292	76.8	77.6	44	1,2
2	20	296	77	78	44	1,3
3	30	294	76.6	77.6	43.8	1,3
4	45	295	77.09	78.4	43.6	1,2
Standard		326	78.6	82.2	42.9	1,2

Table 6 Physico-chemical properties of prebaked bread with added 6g xylanase /100kg flour

Number of sample	Storage duration [days]	Physico-chemical indicators of bread samples – finished product				
		Volume [cm^3/100g]	Porosity [%]	Elasticity [%]	Moisture [%]	Acidity [degree]
1	10	311	78	78.1	43.6	1,2
2	20	319	78.1	78.5	43.5	1,2
3	30	316	77.6	78.2	44	1,3
4	45	311	77.9	78.4	43.9	1,2
Standard		338	79.9	82.6	42.6	1,3

Table 7. Physico-chemical properties of prebaked bread with added 10 g xylanase /100kg flour

Number of sample	Storage duration [days]	Physico-chemical indicators of bread samples – finished product				
		Volume [cm^3/100g]	Porosity [%]	Elasticity [%]	Moisture [%]	Acidity [degree]
1	10	303	77.3	79.7	43.8	1,3
2	20	312	77.4	79.7	43.6	1,2
3	30	307	77	80	44	1,2
4	45	305	76.9	80.4	43.6	1,3
Standard		332	79.1	82.1	42.5	1,2

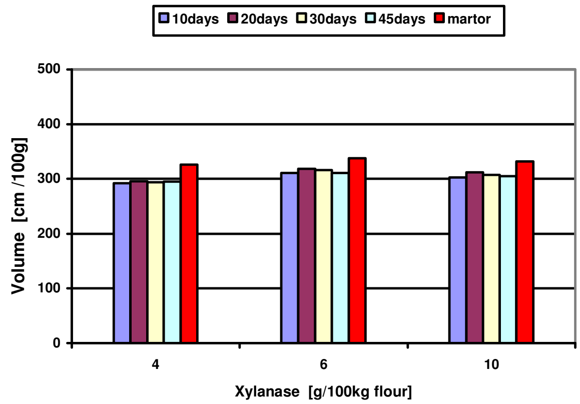
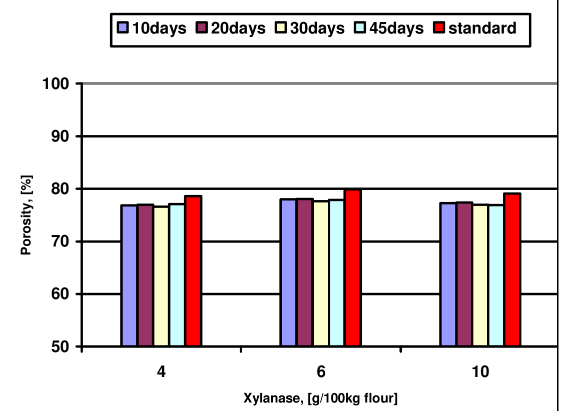
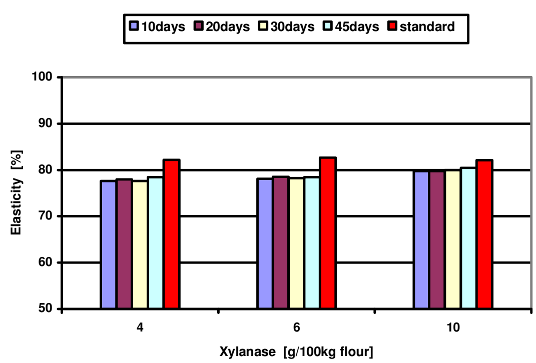


Fig.1. Influence of xylanase addition on loaf volume



a) Influence of xylanase addition to core porosity



b) Influence of xylanase addition on core elasticity

Fig. 2 Influence of xylanase addition to core properties

Addition of xylanase led to an improvement in the quality indicator so by increasing the amount of xylanase from 4g/100 kg flour to 10 g/100 kg flour, elasticity increased by 2.6%. Evidence elasticity value is lower than the witness for the same amount of xylanase added.

4. CONCLUSIONS

The analysis of data obtaining during the experiments showed from volume point of view, that the optimal amount of xylanase is 4 ÷ 6 g on 100kg flour indifferent of storage period.
The best result from porosity point of view was obtained in case of sample with is 6 ÷ 10g of xylanase on 100 kg flour indifferent of storage period.
It could be also observed that the core elasticity increases with the amount of xylanase added, the optimum being in case of 10g of xylanase on 100kg flour indifferent of storage period.
In conclusion it could be say that the addition 6 g of xylanase on 100 kg flour is the best options for quality of bread prebaked frozen.
Anyway, the rheological and technological characteristic of dough with exogenous xylanase added, were worse that in case of witness bread backed without improvers and in a traditional manner.

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