ANALELE UNIVERSITATII DIN ORADEA
FASCICULA: ECOTOXICOLOGIE, ZOOTEHNIE SI TEHNOLOGII DE INDUSTRIE ALIMENTARA, VOL. VII, ANUL 7, 2008

THE INFLUENCE OF THE ADDITION OF XILANASE ON THE TOTAL GAS VOLUME FORMED IN THE PASTRY (ZIMOTACHYGRAFIC WITH LEAVEN EXCESS)

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Abstract

In this research there was determined the influence of the addition of xilanase on the total volume of gas formed in the pastry (zimotachygrafic) with excess of leaven. The pastry was obtained from the witness flour (M) and from the flour with addition of 3 different concentrations of xilanase (P1-8100U.FXU/100kg flour; P2-16200U.FXU/100kg flour; P3-24300U.FXU/100kg flour). The xilanase was used in these concentrations to establish which concentration is the most appropriate to be added in the flour in order to obtain superior quality features of the pastry and of the bread as follows: superior volume of the bread, the fine texture of the core, the extension of the bread freshness, the improvement of the colour and the fragrance of bread, the improvement of the cutting features of the bread. There was used the Zimotachygraph Chopin, a device that measures the gas flow released from a fermentation tank, and also measures the quantity of dioxide retained in the fermented flour patsry.

Key words: bread, xilanase, quality parameters, zimotachygraph.

INTRODUCTION

The objective of the bread manufacture is the conversion of flour, to whcih is added, eventually, other ingredients (leaven, salt, malt, milk, fats) in a processed and easy to preserve aliment, by operations of alcoholic fermentation and of baking. The alcoholic fermentation is a clear stage of the understanding process of the crucial role of the enzymes.

By fermentation it is described the complex of processes that take place in the panification pastry, in the time interval between the end of the kneading operation and the beginning of baking. The technological purpose of this operation is the biochemical maturation of the formed pastry.

The action of the xilanases in the pastry is not resumed only on the xilans and/or the arabinoxilans, but also on their complexes with other flour components, particularly with glutenic proteins. The positive action of the xilanase in the pastry can be assigned to the decrease of the content of insoluble pentosans and to the fact that the water released by the pentosans solubilized by hydrolyse becomes available to form the gluten.

MATERIAL AND METHOD

There were used 4 flours as witness samples whom features are the following, according to the table 1:

Table 1

Flour features

Feature	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
Moist gluten %	27,5	28,5	27,6	24,85
Bending of moist gluten, mm	13	5,5	4,5	5
Sedimentation index - Zeleny,ml	48	37	44	36
Gluten index, %	56,54	78,51	71,92	75,04
Acidity, %	2,5	2,6	2,4	2,3
Falling Number:				
-Falling index	451	394	296	270
Alveographe*:				
-Energy $W*10^{-4}J$	104	185	108	223
-Maximum pressure (P), mm	72	81	69	101
- Extensibility index, (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 index (Ie),%	27,4	44,6	30,7	48
Consistographe*:				
- Humidity of the sample (H_2O),%	14,60	13,80	14,10	14,40
- Maximum pressure (Pr max),mb	2807	3045	3072	3117
- Absorbed water (Wa),%b	56,4	57,4	57,6	57,8
- Water hydration rate (Hydha),%b	53,9	54,9	55,1	55,3
Farinographe*:				
-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
-Steeping rate, UF	90	65	65	80
-Flour potency,UC	61	61,2	63,5	61,4
Zimotachygraf*:				
-Total formed gas volume (V),cm^3	1347,6	1087,5	1406,1	1484,4

Leaven – Pakmaya (commerce), **Salt** – extrafine alimentary iodate salt (commerce), **Water** – drinkable water from the water network, **Enzyme: Belpan XILA L–** it is a standardized fungic xilanase of microbial origin obtained by the immersed fermentation of an *Aspergillusstem.* The enzyme contains pentosanases, endo- and exo-xilanases, hemicellulases which favour the hydrolyse reactions of the pentosans, transforming the insoluble pentosans in soluble pentosans, increasing in this way the elasticity module of the pastry, with enzymatic activity of 2700 FXU/g. FXU-units of fungic xilanase.

Then the enzyme was dosed as follows: for 99g flour was added 1g of enzyme and mixed for 20 minutes. The weighing of the enzyme quantities was performed on an electronic Sartorius balance. The use limits of each enzyme, separately, were determined by tests and there were chosen only the effective ranges, and from these were subsequently chosen the optimum doses.

The dosage of the enzyme was needed, because the quantity of enzyme taken in process for the determination was in very little quantities.

There were prepared 4 samples, where one was a witness one, without enzyme and 3 with the following xilanase levels: P1-8100 U. FXU/100 kg flour, P2-16200U.FXU/100 kg flour and P3-24300 U. FXU/100 kg flour. There were used in turn flour F1, F2, F3 and F4 and the enzymatic product **Belpan XILA L.**

The working process with the machine and the obtaining of the pastry: to prepare in a Petrin extractor a pastry at 26^0C made of: flour, salt, leaven and a proper quantity of water for a stronger consistency than the one usually used. The quantity of water that must be used may be given after the value of P obtained in the normal test with the Chopin alveographe according to a table, the adjustment to the normal consistency P=60 ml apă. After 6 minutes of kneading, the pastry is removed and it is carefully set into the container of the yimotacygraph, extending it on the bottom of the recipient. Than the cover of the recipient is properly placed and there will be progressively and alternatively tightened the four bolts of the cover, the zimotachigraph faucet being opened. After 12 minutes from the beginning of the kneeding, the devices barrel is turned clockwise, the tank is approached with the stylos to the barrel, on wich is monted the recording paper, bringing the stylos to the zero cypher of the hour gradation. The faucet of the device is closed and the synchronical engine is started. The recording is produced immediately and automatically under shape of parallel stripes, at each 2,5 minutes and their length gives the value of the gas flow at the moment. In a first part of the test, of variable duration, by the types of flours, the pastry retains the formed gas and rejects only the air. In this way there is not any dicrease of the gas volume, and when it passes in the devices vial, the extremity of the lines gives a continuous bend (winding bend). Then the pastry looses carbon dioxide on surface, the gas mixes with the air, which continues to eject from the pastry and it's percent increases gradually. From this results a diminution of the lines that correspond to the passage in to the absorbtion vial. It is estimated that after 2 hours and 30 minutes – 5 hours, the recording may be interrupted, that is the moment when the CO_2 presses the pastry on the bottom of the recipient (5) and the bends become asymptotes to the axis of the abscissae.

RESULTS AND DISCUSSIONS

The influence of the xilanase on the total gas volume formed in the pastry is presented in the table number 2 and the figures number 1 and 2;

Table 2

The influence of the xilanase addition on the total gas volume formed from the in the pastry (zimotachygrafic, with leaven exscess)

Flour sample	Total gas volume formed (V), cm^3, for an addition of xilanase (U. FXU /100 kg flour) of:			
	M	P1-8.100	P2-16.200	P3-24.300
F1	1347,6	1564,8	1490,7	1410,6
F2	1087,5	1189,2	1130,1	1361,7
F3	1406,1	1477,8	1764,3	1582,2
F4	1484,4	1582,8	1395,6	1467,3

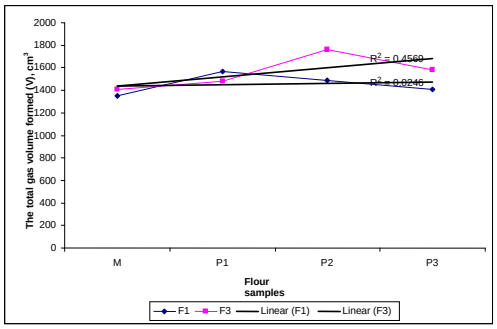

Figure 1. The influence of the xilanase addition on the total gas volume formed from the F1 and F3 flour

DISCUSSIONS

Comparing to the witness sample, at a dosage of 24.300uFXU/100kg flour for the F2 flour, the total gas volume increases by 25%. The same growth percent (compared to the witness sample) of the total gas volume is obtained for the F3 flour at a dosage of 16.200uFXU/100kg flour.

For the F1 F4 flours, the maximum influence of the xilanase addition,compared to the witness sample, is at an addition of 8100uFXU/100kg of flour. As the enzyme dosage increases, the total gas volume is in decrease, for these flours (F1 and F4).

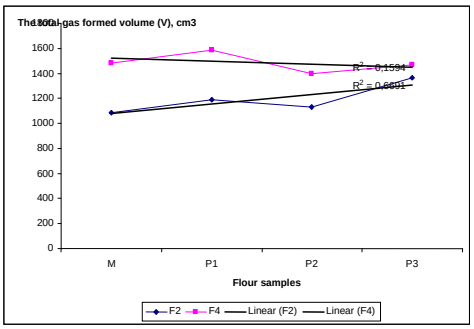

Figure 2. The influence of the xilanase addition on the total gas volume formed from the F2 and F4 flour

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CONCLUSIONS

From the data obtained, it is observed that the highest appears for the F2 and F3 flours, but for different xilanase doses, it is observed that these flours having different gluten qualities, for a maximum volume of gases, are needed different doses of enzymes.

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