THE INFLUENCE OF CLARASE, OF ASCORBIC ACID, OF CLARASE AND ASCORBIC ACID, OF CLARASE AND HEMICELLULOSE OVER 800, 1250 SEVERAL TYPES OF FLOUR

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Abstract

Bakers request from millers a constant quality flour and consumers wish bread with pleasant look, crunchy crust, adequate volume, uniform pores, constant quality and also with minimum chemical additives and with less possible unfavourable effects on health.

But it is necessary that enzymes be properly chosen and that the operation of flour addition with enzymes meet those demands.

This paper shows a comparative analysis of the effects of clarase, ascorbic acid and of the mixtures of clarase and hemicellulosis enzymes over the 800, 1250 flour types, by monitoring the rheological characteristics by means of alveographic measurement parameters.

Keyword: *enzymes, quality flour*

INTRODUCTION

Consumers prefer bread where chemical additives have been replaced by natural additives, such as enzymes.

The influence of the addition of alpha-amylase

The addition of alpha-amylase leads to changes in rheological properties, to decrease in dough resistance, to increase in its extensibility. This is due to the fact that, in starch hydrolysis, maltose determining gluten's dehydration is formed, the quantity of free water in dough increases thus reducing its consistency.

Exogenous alpha-amylase is added to those types of flour having a reduced capacity of generating fermentable sugars and gases throughout the technological process.

Amylolysis is intensified when alpha-amylase acts over the starch components by hydrolysing 1-4 glycoside linkages within the poly-glucoside chains of amylopectin.

By adding alpha-amylase, the quantity of hydrolysed starch increases, the quantity of gelatinizing starch decreases and during baking a more complete gelatinization takes place than when alpha-amylase is missing, as a result of a larger quantity of available water (a slower degradation takes place). Breaking starch chains cannot create a continuous crystalline network, which stiffens the crumb. (Leonte, 2000)

When alpha-amylase is added, the quantity of carbon dioxide increases, the dough formation period decreases and the tolerance to fermentation of the semi-product is increased.

Alpha-amylase leads to dextrin formation by the degradation of the starch chains that suffered a no matter how weak degradation (Florea, 2003).

Dextrines in normal quantities have a favourable effect over the dough, water retaining capacity is increased, the look of the crumb is improved (soft and fluffy).

From the studies made it results that enzymes consume 5% starch for maltose and 3% starch for dextrines.

Starch contributes indirectly to dough consistency. Soluble pentosans make the liquid film that surrounds the gas bubbles and the dough, viscous. The more viscous is the dough, the more difficult is gases incorporation and the more difficult is gases retaining.

During the amylolysis process, when kneading, the quantities of maltose and dextrines in the dough are increased. The beta-dextrines created contribute to the increase of the dough viscosity.

The water linkage energy decreases with the increase in the proteins content and increases with the content of deteriorated starch and of soluble pentosans.

The viscosity of the flour-water suspension with addition of alpha-amylase of different origin is different in time for the same addition of alpha-amylase.

The dextrines content in the crumb increases the least for fungic alpha-amylase (1.25 times, resistant up to 70ºC, 1.5 times for the malt one (it is inactivated at 80ºC) and 7 times for the bacterial one (10% of its activity is preserved/maintained at 90ºC).

The decrease in the dough consistency by adding alpha-amylase leads to the dough's increase in extensibility and decrease in resistance. This is due to the fact that the maltose formed by starch hydrolysis determines the dehydrating of dough gluten. The free water quantity in the dough increases thus reducing the consistency (Bordei, 2005).

The addition of alpha-amylase is done when the gas forming capacity of the flour is low and the falling index is high (FN > 300), that is for strong flours.

The most frequently used oxidation agent in alpha-amylase improvers is the ascorbic acid.

The ascorbic agent is a good cyclical reduction-oxidation agent, which is not used up during the reactions in the dough. Its use is efficient as it changes/moves the alpha-amylase thermal optimum of activity towards low temperatures and inactivates the enzyme at the starch converting temperature, reducing the accumulation of dextrines during the bread baking process.

In the presence of the oxygen included at kneading, the ascorbic agent reduces the reactive –SH groups; during the first minutes of kneading, these groups are oxidised to –S-S-disulphide linkages. This fact leads to the improvement of the dough resistance and elasticity in the case of lean or medium flours; for strong flours the effects are not favourable.

The effects of hemicelluloses addition

The (fungic – Aspergillus oryzae) hemicelluloses are enzymes which hydrolyse the water insoluble and soluble pentosans, thus producing oligomers with a relatively large molecular mass. Their effect is to neutralize the negative effect of insoluble pentosans over bread volume and to improve dough stability and tolerance to fermentation, to improve the capacity of dough to retain fermentation gases.

Hemicellulose carries out the leaching of insoluble pentosans, by creating compounds with high water linking capacity, contributing to a better structure of gluten (extensibility) and to its formation. The hydrating capacity of pentosans was decreased and thus the gluten and the other flour components could absorb the respective water (Bordei, 2005).

From the determinations made optimum results are obtained when they are used together with alpha-amylase. It is known the synergetic effect of hemicelluloses when they are combined with alpha-amylases.

Materials and methods

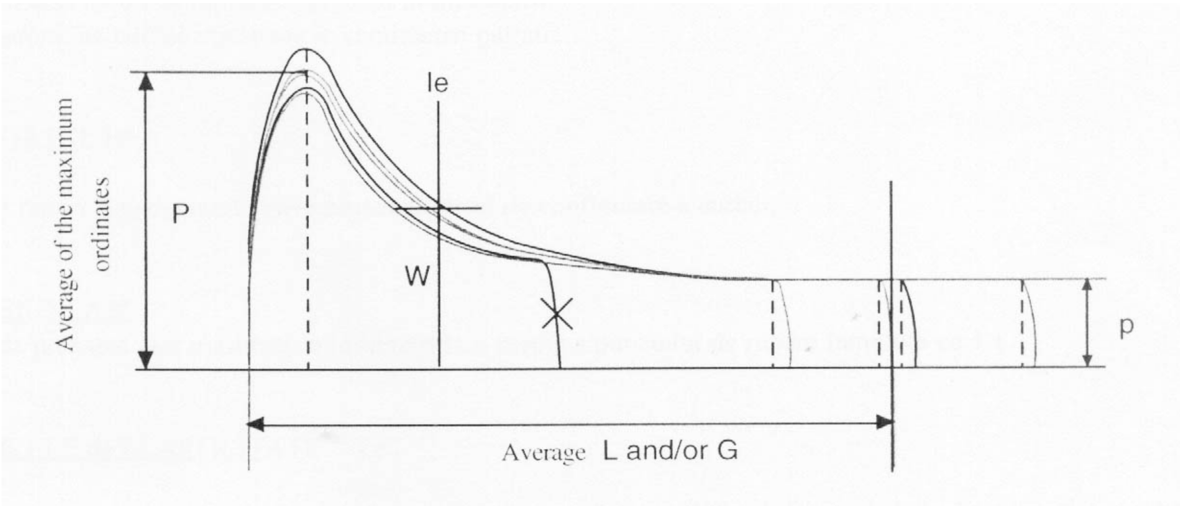
The experiments have been effected in the laboratory for flour quality analysis of SC MOARA CIBIN SA Sibiu.

Wheat flour of type 800, 1250 from 2005 production has been used.

The claraza used was fungic alpha-amylase (Aspergillus oryzae).

Sample analysis has been made according to EC Directives at the Alveograph NG Consistograph – CHOPIN apparatus. After that the results have been compared.

The following results can be read from the alveogram (fig.1)



P – viscosity or maximum pressure value, which is related to the dough resistance to deformation;
L – extensibility (length of the curve starting from origin up to the perpendicular point corresponding to the pressure decrease due to bubble break);
G – expansion index; G is the average of the expansion indexes from the calculus diagram and corresponds to the fracture of L abscissa; G=2,226√L; where L = air volume (cm^3) used for stretching the dough in the form of bubbles;
W – the dough deformation action, based on one gram of dough, evaluated at 10E -4Joule, calculated as follows: W = 1.32 x (V/L) x S, where V – air volume (mm^3); L – average break abscissa (mm); S – curve area (cm^2);
P/L – curve configuration ratio;
Ie – elasticity index; it represents the ratio between the measured pressures expressed in mm H2O at bubble formation after 200 cm3 of air are blown into the dough moulds, which correspond to a 40 mm length L or an expansion index G of 14,1 and a curve maximum P: Ie% = P200/Pmax.
The Falling Number analysis has been effected (using the PERTEN-HAGBERG device) determining the alpha amylase activity of approval samples and of additive flour samples.
The results of the analyses have been determined according to the ICC# 107/1(1995), to international standardized AACC 56-81B method for determining the alpha-amylase activity in grains, flours or other products containing starch (especially wheat and rye). The alpha-amylase activity is determined using the sample starch as a sublayer. The method is based on quickly gelification of flour suspensions using water bath at 100°C and subsequent to the liquation of the sample starch.
The falling number – FN - was determined with the Perten apparatus model 1310.
The falling number – FN – is the result of some complex mathematical functions where the argument is the quantity of alpha-amylase in the sample. These functions are also known under the name of Perten Liquation Equations.
FN is defined as the total duration, expressed in seconds, from the immersion of the tube in the water bath to the falling to a predetermined distancein the gelatinous suspension.
Results and discussions
For **flour type 800** the following materials have been used and for the samples the following notations have been used:
M – flour type 800 with no additives;
P1 – flour 800 additived with 3g-clarase/100 kg flour;
P2 – flour 800 additived with 3g-clarase, 10g hemicellulosis/100 kg flour;
P3 – flour 800 additived with 5g ascorbic acid/100 kg flour;

P4 – flour 800 additived with 5g ascorbic acid, 3g-claraza/100 kg flour.
The flour type 800 utilized has FN=347s, low amylase activity. Clarase used is fungic amylase from the Aspergillus oryzae strain.

The results obtained at ALVEOLINK are shown in Table 1.

Table 1. Average values of the characteristic parameters for analyzed samples

	P (mm H2O)	L (mm)	G	W (10E-4J)	P/L	Ie(%)
1) **Approval**	69	86	20.64	128	0.8	30.3
P1 (clarase 3g)	56	99	22.1	120	0.57	32.9
P2 (clarase 3g, hemicellulase 10g)	41	111	23.5	92	0.37	33
P3 (ascorbic acid 5g)	74	94	21.6	190	0.79	43.7
P4 (ascorbic acid 5g, clarase 3g)	53	120	24.4	174	0.44	49.3

The variation The variation diagram of these values is shown in Fig.2.

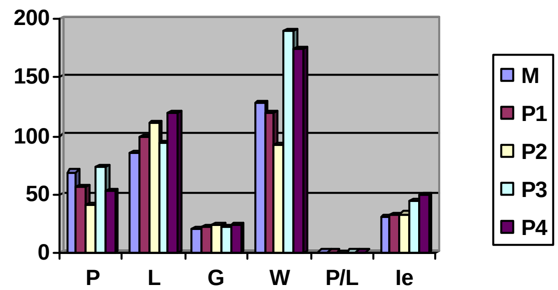


Fig. 2: The variation diagram of alveogram characteristics (resistance, extensibility, kneading energy, curve configuration ratio, elasticity index).elasticity index).

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The effect of clarase is to increase the extensibility and to decrease the resistance of gluten, which can be compensated by using ascorbic acid.
From the determinations made claraza increases mechanical work and changes P/L ratio.
The addition of ascorbic acid is favourable to the bread manufacture properties of flour, as a

- Studies are done also over strong **flour type 1250**, with low alpha-amylase activity, where the decrease of resistance and increase of extensibility
- yield and the improvement of the amylase activity also take place.

Flour type 1250 very strong is additived with clarase respectively with clarase and ascorbic

flour with high mechanical work is obtained. The flour obtained has a good deformation resistance, a lower extensibility, thus being necessary to add an enzyme to increase extensibility that is to use clarase.
One can observe that the best results from the viewpoint of elasticity index are obtained when alpha-amylase (clarase) and ascorbic acid are added.

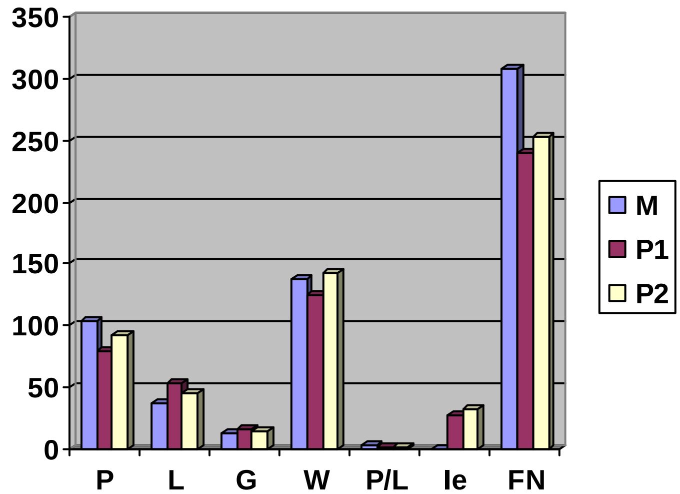
of dough are necessary by adding claraza, a better elasticity index being also obtained. The decreases of the falling number, the increase of the

acid. The following results are obtained, according to Table 2.

Table 2. Average values of flour type 1250 and of flours additived with clarase respectively clarase and ascorbic acid:

	P (mm H2O)	**L (mm)**	**G**	**W (10E-4J)**	**P/L**	**Ie(%)**	**FN (S)**
M (F1250)	104	38	13.7	138	2.74	0	308
P1 (claraza 3g)	79	53	16.2	125	1.49	27.7	240
P1 (claraza 3g, ascorbic acid 3g)	92	45	14.9	143	2.04	32.2	252

Figure 3: The Variation diagram of alveograms parameters and of FN for 1250 flours and for additived ones.



CONCLUSIONS

One can observe that the addition of claraza and ascorbic acid has favourable effects over dough rheological characteristics as a better elasticity and a higher deformation energy of dough are obtained and the falling number decreases, being a little higher then in the case when only clarase is added. In this case the oxidant action of ascorbic acid over the dough occurs.

As a conclusion, the addition of the analysed flours, strong (types 800, 1250) with low amylase activity, with high resistance to deformation and low extensibility, that was demonstrated by the ratio between those sizes (almost a unit and sometimes even greater than 1) is optimised by using complex additives, mixtures of additives formed of clarase, hemicellulase and ascorbic acid.

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