

COMPARATIVE EFFECTS OF THE INFLUENCE OF LIPASE, LIPOXYGENASE AND PROVAFLOR ON THE RHEOLOGICAL CHARACTERISTICS OF FLOUR

VASILE JASCANU*, ELENA DANIELA STEFOANE**¹

Abstract: Lipase acts on the dough rheological properties by oxydising it. in the sense of its oxidation. This additive can be used for the correction of flour with medium defects. The use of enzymatic soy flour at the supplementation of 650 type flour determines a peroxidation effect that is more pronounced than the action of lipase, as well as an economical advantage.

Keywords: lipase, glicerydes, additive action, oxidant, soy flour, lipoxigenase, provaflor.

INTRODUCTION

The action of lipase in dough will be realized depending on its quantity in flour. The flour of small extractions are the most poor in lipase (Mercier, 2001). Their effect will be manifested over the dough without addition of fats or with small addition.

The lipases hydrolyses lipids (phospholipases, glycolipases), in stages, breaking in the presence of water the connections between glycerin and fat acids. Monoglycerides action as emulsifiers, and fat acids poly non-saturated function as a substratum for the action of lipoxigenasis. The fat, poly non-saturated acids, in the presence of lipoxigenasis and the oxygen mixed while kneading, with be oxidized at hydroperoxydes that interfere in the oxidation of groups – SH, enforcing gluten and in the oxidation of carotenes bringing the whitening of the dough (Figure 1). The lipase acts as an oxidant, favoring the oxidation processes. Lipase is destroyed while baking. At kneading will be formed complex of the lipids (polar , non-polar) and glutenic proteins. Depending of the nature of lipids, the complex lipids – proteins influences the rheological properties of the dough. The polar lipids influence in a negative way the theological properties of the dough. The polar lipids

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influence in a positive manner the rheological characteristics of the dough, meanwhile non polar lipids influences them in a negative manner. The rheological properties of the dough depend on the rapport between polar and non-polar lipids. (Bordei, 2005).

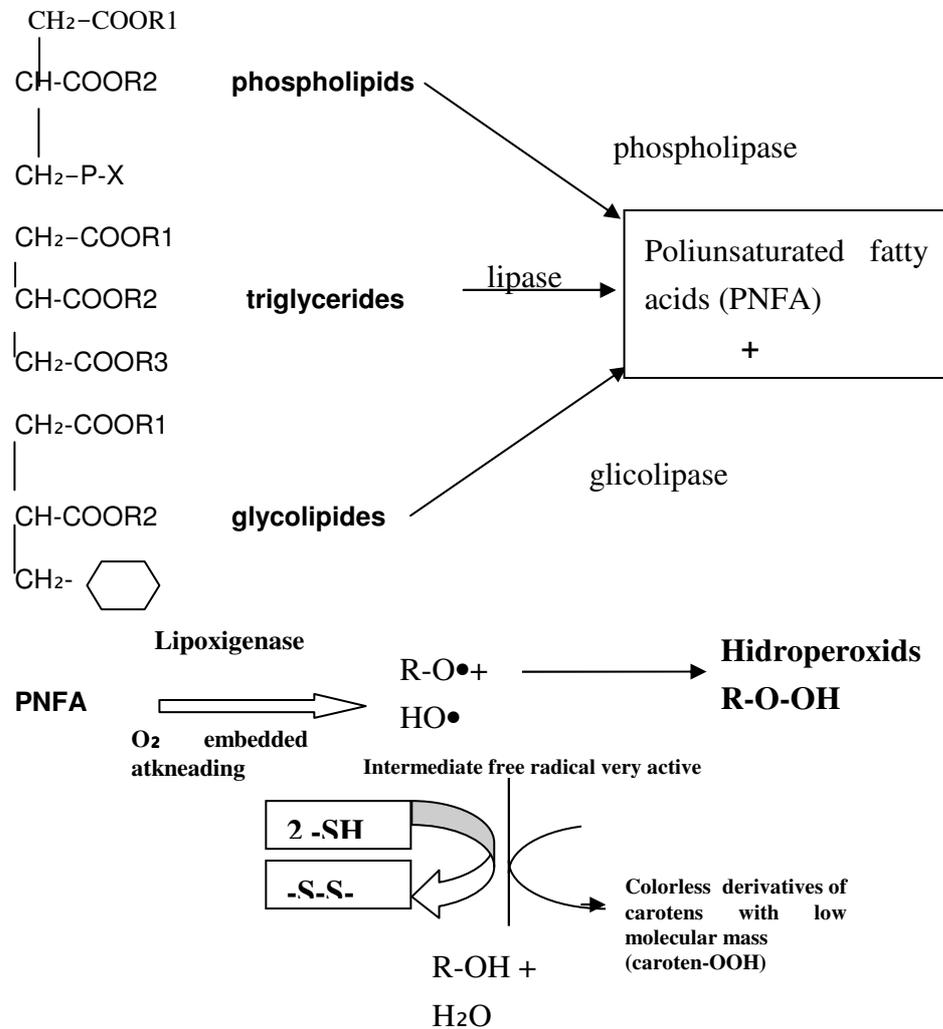


Figure 1: Lipase and lipoxigenase off biochemistry in bakery (Teodorescu, 2004)

The lipase, theoretically replacing emulsifiers, through the realization in dough of the emulsifiers using native lipids of the flour, have a medium effect depending on the composition in lipids of the flour, qualitative and quantitative, more difficult to be controlled than saccharide (Nelles, et al., 1998)

The emulsifiers, mono glycerides participate at the amelioration of the dough rheological properties through the interaction between gluten proteins and emulsifiers.

MATERIALS AND METHODS

Fungal lipase (LIPO B) from the microbial source *Rhizopus oryzae* and flour 650 type from the production of 2005 were used.

The experiments have been realized in the laboratory for quality flour analysis at SC BOROMIR PROD BUZAU. The rheological properties of flours were analysed using alveograms. For the obtaining of alveograms, the Alevograph apparatus NG Consistograph – CHOPIN was used. The tests were realized in conformity with the CE Directives. Typical alveograms are presented in Figure 2 and 3.

The indicators obtained from the alveogram are presented in a previous paper (Jascanu and Stefoane, 2005).

The enzymes activity was determined in flour samples with and without additives (blind sample).

Two tests were realized:

- **Test 1:** Analysis of the influence of lipase, compared with the action of ascorbic acid and of phospholipids on 650 flour type. Four samples were analysed:
 - Blind sample with flour F650 (M)
 - F650 supplemented with 2 g lipase /100g flour (P1)
 - F650 supplemented with 3 g ascorbic acid /100g flour (P2)
 - F650 supplemented with 0.5 g phospholipids /100g flour (P3)
- **Test 2:** the analysis of the effect of mixtures of enzymes alpha – amylase, hemicellulase, xylanase, combined with ascorbic acid on the rheological characteristics of flour 650. Three samples were analysed:
 - Blind sample with flour F650 (M)
 - F650 supplemented with 1 g ascorbic acid /100g flour (P1)
 - F650 supplemented with 80g provaflo and 1 g of ascorbic acid /100g flour (P2).

ALVEOLINK NG ALVEO CH CHOPIN

S.C. BOROMIR PROD. BUZAU STR. SANTIERULUI NR. 37 TEL. 0238436170 FAX 0238446705		
DATE: 11/02/2005 TIME: 09:33		SAMPLE IDENTIFICATION: MARTOR FILE NAME : 02110000A105
PARAMETERS LAB.TEMP.: 20.0 °C LAB.HYGROM.: FLOUR : 650 MILL : MOISTURE : 14.70 % FN VALUE : 265 s PROTEIN : 12.22 % W.A. : S.D. : ZELENY : ASH CONT.: 0.66 % EXTRAC.R.: GLUTEN : 26.2 DEF.4		RESULTS P = 53 mmH2O L = 118 mm G = 24.2 W = 205 10E-4J P/L = 0.45 Ie = 59.8 % W(0) = 0 10E-4J
COMMENTS		v:d2.7C +5.9

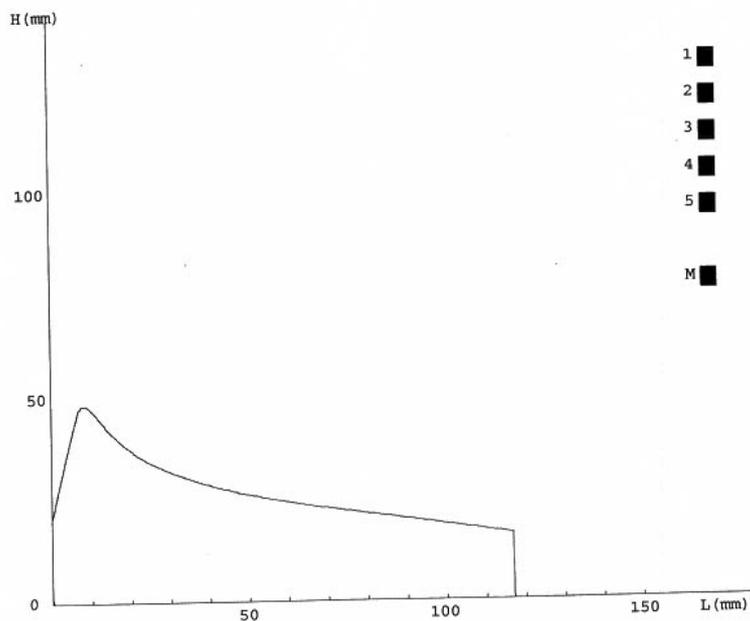


Figure 2: Alveogram for blind sample (M).

ALVEOLINK NG ALVEO CH		CHOPIN
S.C. BOROMIR PROD. BUZAU STR. SANTIERULUI NR. 37 TEL. 0238436170 FAX 0238446705		
DATE: 11/02/2005 TIME: 12:09		SAMPLE IDENTIFICATION: PROBA 1 FILE NAME : 02110002A105
PARAMETERS		RESULTS
LAB. TEMP. :	LAB. HYGROM. :	P = 56 mmH2O
FLOUR : 650	MILL :	L = 119 mm
MOISTURE : 14.70 %		G = 24.3
PROTEIN :	FN VALUE :	W = 211 10E-4J
S.D. :	W.A. :	P/L = 0.47
ZELNY :		Ie = 58.0 %
ASH CONT. :	EXTRAC.R. :	W(0) = 0 10E-4J
GLUTEN :		
COMMENTS 2G LIPO B		V:d2.7C +5.9

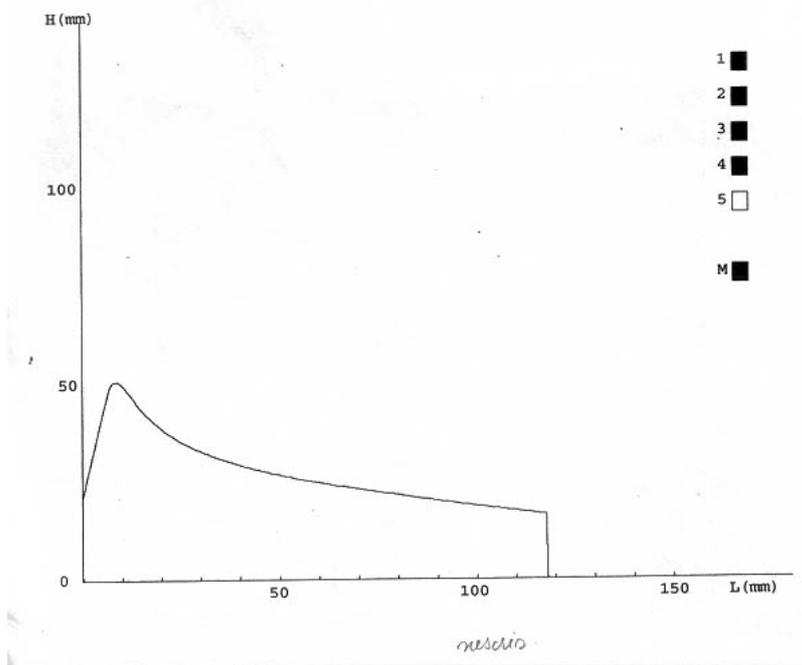


Figure 3: Alveogram for 650 flour supplemented with 2 g lipase.

PROVAFLOR product obtained from the company EDR Romania Neamt. This is the following composition: fat content 20%, proteins 38%. It contains 40 times more lipoxigenase than wheat, and the lipozidase enzyme contained here is 10 times more active than that from wheat. This can peroxide not only

fat acids poli non saturated that are free, and the ones situated in monoglyceride form, but also the ones from triglycerides.

RESULT AND DISCUSSIONS

The influence of lipase on the rheological properties of the dough.

In the first test (Test 1) the influence of lipase, ascorbic acid and phospholipids on 650 type flour was analysed. The variation of rheological characteristics are presented in Figures 4 and 5.

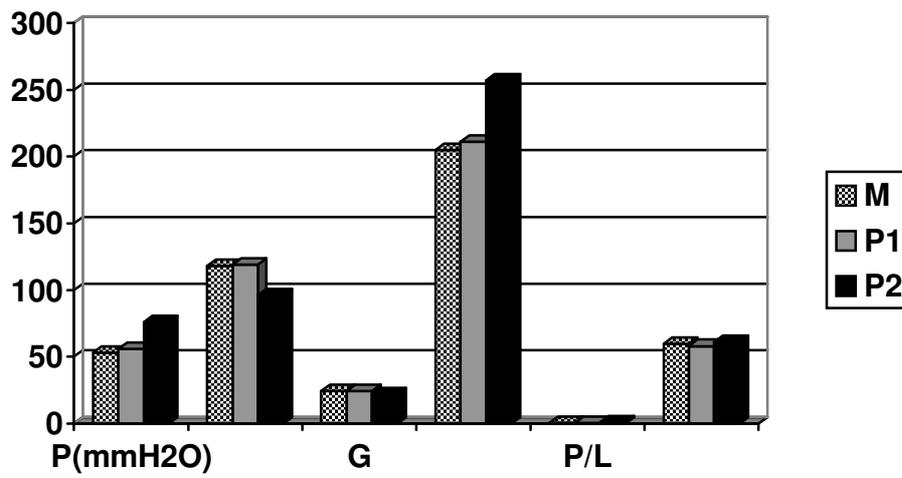


Figure 4: Variation diagram for test 1 of the characteristics of the alveogram (resistance, extensibility, energy for kneading, rapport of configuration of the curve, elasticity index) and the values of FN for blind sample (M) and samples additived with lipase (P1) and ascorbic acid (P2)

It can be observed that lipase actions on the dough strengthening, increasing the deformation resistance due to the oxygenation of the SH groups from the dough and their transformation in S-S. This will increase the deformation resistance, the dough becoming more powerful. The lipase determines an effect of a medium action, taking into account the connected values of the resistance of the dough and the rapport P/L/.

The rheological behaviour of flour supplemented with 0.5 g/100 g phospholipids is different, as Figure 5 reveals.

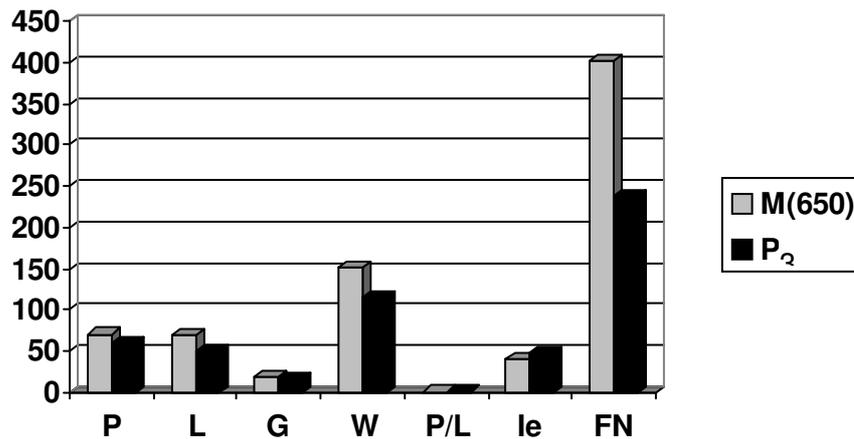


Figure 5: Variation diagram for test 1 of the characteristics of the alveogram (resistance, extensibility, energy for kneading, rapport of configuration of the curve, elasticity index) and the values of FN for blind sample (M) and sample supplemented with phospholipids (P₃)

It can be observed that lipases action on strengthening dough, increasing the resistance for deforming the dough due to the oxidation of the SH groups from the dough. It can be observed an improvement of the rheological characteristics of gluten, will be obtained powerful flour, with a better elasticity index in comparison with the witness.

The influence of using soy flour as well as the association with ascorbic acid on the qualitative characteristics of flour

In the second test (Test 2) the influence of ascorbic acid and soy flour (provaflor) on 650 type flour was analysed. The variation of rheological characteristics are presented in Figures 6 and 7.

As both figures reveals, an improvement of the rheological properties is obtained, generated by the presence of non – degreased soy flour. The soy flour increases the elasticity index and the deforming energy, giving more powerful flour. It can be observed an increased enzymatic activity that can have an effect more pronounced than the one realised from lipase.

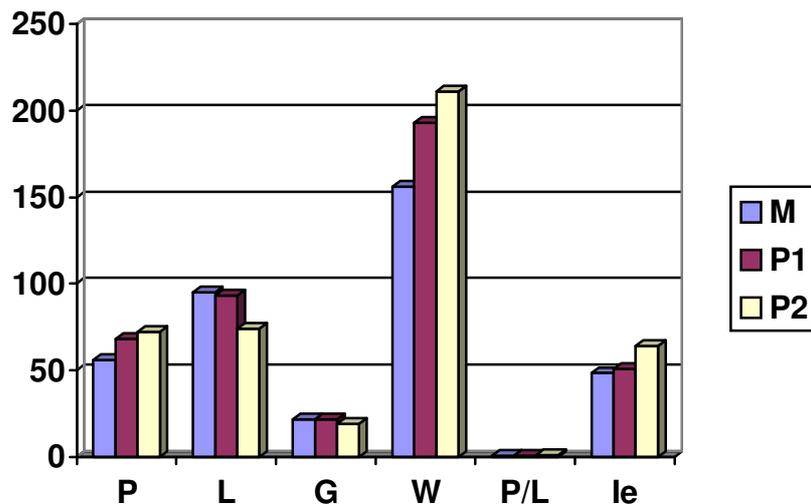


Figure 6: Variation diagram for test 2 of the characteristics of the alveogram (resistance, extensibility, energy for kneading, rapport of configuration of the curve, elasticity index) and the values of FN for blind sample (M) and sample supplemented with ascorbic acid (P1) and provaflo (P2)

So, the lipase can be replaced with soy flour to obtain supplementation of flour, this being a cheaper products than lipase. PROVAFLOR products present a fat layer that can fulfill the role of emulsifier (phospholipides), helping to cancel the negative action of the soy proteins that, once with the action of emulsifiers, proteins will be situated in in glutenic matrix, without being worsen the quality of gluten.

The results obtained at ALVEOLONK have been mentioned in figure 7.

CONCLUSIONS

Lipase acts on the dough rheological properties by oxydising it. in the sense of its oxidation. This additive can be used for the correction of flour with medium defects.

The use of enzymatic soy flour at the supplementation of 650 type flour determines a peroxidation effect that is more pronounced than the action of lipase, as well as an economical advantage.

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S.C. BOROMIR PROD. BUZAU STR. SANTIERULUI NR. 37 TEL. 0238436170 FAX 0238446705		
DATE: 18/01/2005 SAMPLE IDENTIFICATION: PROBA 2 FILE NAME : 01180003A105	DATE: 17/01/2005 COMPARISON SAMPLE : 17.01 SCH.I COMPARISON FILE : 01170003A105	
<p>RESULTS</p> <p>P = 72 mm H2O L = 74 mm G = 19.1 W = 211 10E-4J P/L = 0.97 Ie = 64.0 % W(0) = 0 10E-4J</p>	<p>RESULTS COMPARISON</p> <p>P = 56 mm H2O L = 95 mm G = 21.7 W = 156 10E-4J P/L = 0.59 Ie = 48.3 % W(0) = 0 10E-4J</p>	
<p>COMMENTS</p> <p>PROVAFLOR AC.ASCORBIC 80 1</p>		V:d2.7C +5.9

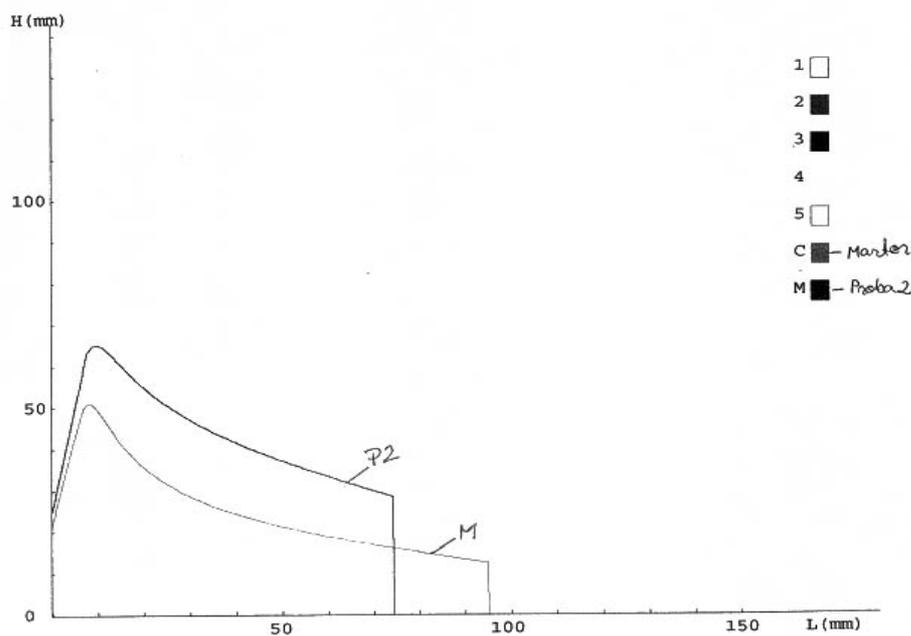


Figure 7: Alveograms for 650 flour (M) and flour supplemented with provaflor (P2)

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