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INFLUENCE OF LIPASE PRODUCTS ON TECHNOLOGICAL PROPERTIES OF THE BREAD FLOUR

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Abstract

The usage of enzymes like bread making improvers instead of chemical ones is more convenient from healthy point of view. They are inactivated into oven and their improved effects during bread making have been already registered. Depending on the flours' quality (referring biochemical composition and functional properties) and estimated effects in relationship with range and quality of end products, a suitable choosing of enzymes and doses is mandatory. The purpose of this study have been verifying the exogenous lipase effect accordingly with different doses of lipase products in bread making, using flour with an average quality, like starting material.

***Keywords**: lipase, improvers, bread making, and rheology*

Introduction

As it's known, the lipids in flour (around 1% content) influence the dough and end products properties. These properties are generally related with the ratio and nature of lipids. The role of lipids on rheological behaviour of dough and their effect in bread making was explained on basis of those interactions in which are also involved the main compounds of flour - gluten proteins and starch.

Pyler (1988) underlined that the lipids could be involved in gluten proteins links through both hydrophobic and hydrophilic bonds. Concerning the interactions between starch and lipids, some researchers mentioned either lipid constituents could appear like amylose-inclusion complexes, or could be esterified to the carbohydrate substances. Consequently, all the interactions between lipid compounds and gluten and starch complexes depend on fatty acids content and HLB.

By action of lipolytic enzymes, such as lipase, natural lipids from flour undergo hydrolytic changes. Lipase catalyses the hydrolysis of triglycerides into di- and monoglycerides, and ultimately into glycerol and free fatty acids. The di- and monoglycerides, as well as glycerol have stabilising function of oil-water emulsions, such as emulsifiers (Banu, 2000). Glycerol possesses like attribute hygroscopicity in terms of capacity for attracting and retaining moisture, so that shelf life of loaves is extended. Free fatty acids, unsaturated ones become substratum for oxidoreductases, like lipoxygenase with effect on crumb loaf properties.

During mixing, fermentation, and baking process dough background, because of their functionality lipids seem to act in many ways, as following:

- ✓ Glyco-lipids aid the gluten forming proteins in retaining the carbon dioxide gas produced in fermentation;
- ✓ The formed thin lipid layer contribute to plasticity of dough;
- ✓ They increase ovenspring;
- ✓ Lipids seem to be sealing the burst gas cells during baking, preserving volume;
- ✓ They help in preserving freshness in the baked bread;
- ✓ Some free unsaturated fatty acids are enzymatic natural oxidised during mixing with effects on crumb brightening (Amendola, 2003).

For these reasons the lipase have started to be used such as dough conditioner in bakery area. Anyway the usage of lipase products like bread-making improvers seems to be controversial, because of occurred fatty acid with fewer than 14 carbon atoms, which flavours deterioration produce by hydrolytic rancidity (Pyler, 1988). In these conditions it is preferable to used exogenous lipases like bread making improvers only for doughs without added fats (Bordei, 2004). On the other hand on prolonged storage flours and flours with moisture content higher than 15% the lipolytic activity increases, and rancidity lipase-induced occur, too.

In conclusion, in certain conditions bread-making core, lipase products can be used such as emulsifier substitutes for. The aim of this paper was check the effect of different doses of exogenous lipase in view of optimum one in bread making, using flour with an average quality, like start material.

Experimental

The study was carried out on flours for bread making average quality. Commercial white flour 650 type, obtained from the last (2004) crops' milling was used. Enzyme supplementation into dough formulation meant Belpan LIPO B using in different doses, like flour improver. Belpan LIPO B product is a fungal lipase from *Rhizopus oryzae*. Enzymes & Derivates Romania Co supplied the commercial product, like a cream power, enzyme that had 10,800 lipase units per gram. The samples were noted as it is shown below:

- ✓ M – blank sample (white flour 650 type, without exogenous enzymes)
- ✓ P_1 –sample, which comprised flour added Belpan LIPO B correspondent to 0.2 g/100kg flour
- ✓ P_2 –sample, which comprised flour added Belpan LIPO B correspondent to 0.4 g/100kg flour
- ✓ P_3 –sample, which comprised flour added Belpan LIPO B correspondent to 0.6 g/100kg flour
- ✓ P_4 –sample, which comprised flour added Belpan LIPO B correspondent to 0.8 g/100kg flour

The quality assessment of the samples was performed by Romanian standards, using physical, chemical, rheological, and technological methods. Moisture content, ash, and wet gluten content were performed by STAS 6124-73, STAS 90-88, and STAS 6283-83. Falling number values were determined according to SR ISO 3093:1997. The rheological properties of the flours were made on 300g – Brabender farinograph, as well as using a Chopin alveograph. Using of established dough formulation baking tests performed, and the bread indicators were compared (STAS 91-83 ref.).

Results and Discussions

The physical-chemical properties of blank and improved flours, by using previous scheme were assessed. The results are indicated in table

1. For analysed samples moisture content attained values lower than 15%, which means a lower probability that flours to develop a high endogenous lipolytic activity. Wet gluten, as well as gluten deformation had the same values for blank and improved flour samples. The falling number's values varied between 296 s and 316 s. About 20 seconds, the difference between falling number values, as well as the upper-lower range variation, indicate certain changes in enzymatic action into flours samples, without can explain the mechanism of reactions. Anyway the falling number figures indicate that all samples had a weak amylase activity.

The rheological behaviour of flour's doughs, which were investigated, is shown in figures 1, and 2. The values of certain characteristics are indicated in table 2, and 3, too.

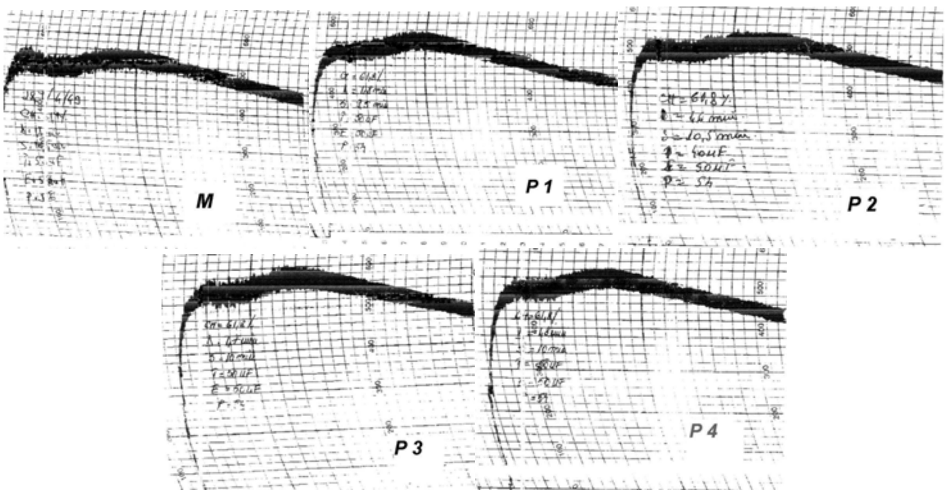


Fig. 1. Farinograms of analyzed samples

Table 1. Values of physical-chemical properties of samples

Samples	Ash, %	Moisture, %	Wet Gluten, %	Gluten Deformation, mm	Falling Number, s
M	0.65	14.6	28.4	4	307
P_1	0.65	14.7	28.4	4	309
P_2	0.65	14.7	28.4	4	296
P_3	0.65	14.7	28.4	4	305
P_4	0.65	14.7	28.4	4	316

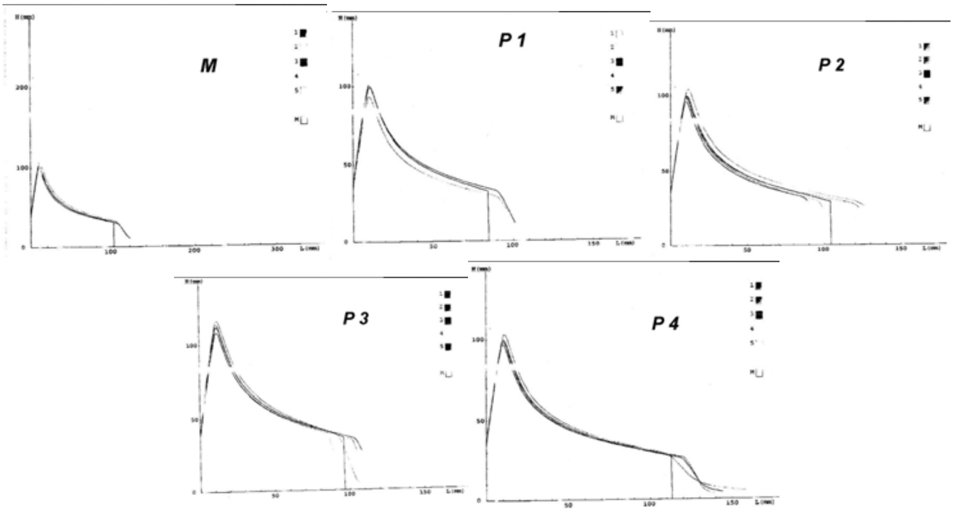


Fig. 2. Alveograms of analyzed samples

Table 2. Farinograph values

Samples	WA, %	DDT, min	DST, min	WD, BU	FS, BU
M	61.4	1.2	9.5	50	56
P_1	61.8	1.8	9.5	60	54
P_2	61.8	1.6	8.5	40	54
P_3	61.8	1.3	11	60	54
P_4	61.8	1.6	8	60	54

Legend: WA-water absorption, DDT-dough development time, DST-dough stability time, WD-weakening of dough, FS- flour strength

Table 3. Alveograph values

Samples	P, mm H_2O	L, mm	G	W, 10E-4J	P/L
M	115	101	22.4	358	1.13
P_1	110	85	20.5	302	1.29
P_2	110	104	22.7	351	1.06
P_3	124	97	21.9	386	1.28
P_4	110	114	23.7	361	0.97

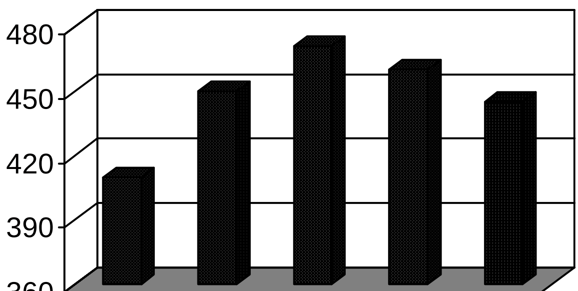
Legend: P-tenacity, L-extensibility, G-index of swelling, W-baking strength, P/L-configuration ratio of the curve

The figures established on basis of the farinograms show a weak development, a higher stability, and an average weakening of all doughs, which means an average to a good quality of samples for bread making from this point of view.

Regarding alveograms' values, the figures indicate that the doughs tenacity was very high, and that behaviour affected the whole curves configuration, even the samples' extensibility could be correspondent. Concerning the extensibility, only for samples P_2 and P_4 were registered a slight increase, but insufficient to equaliser the tenacity of dough in view to accomplish a suitable curve configuration. The baking strength values more than $300 \cdot 10^{-4}$ J was registered, too.

On basis of physical-chemical and rheological data, all the samples had an average quality for bread making, with a stronger rheological behaviour of flours. Better relationships between samples' properties of elasticity and plasticity could be established only for samples P_2 and P_4. Because the blank sample was higher tenacity and strength, expressed by gluten deformation, as well as both rheological indicators DST, and P, the effect of lipase improver was light insensible. Because of an insufficient developing of active enzymatic equipment, on this rheological behaviour of flours contributes the lower amylolitic activity, too. Only for sample P_3 was registered a difference, but the effect was not really in order to improve the bread making quality. Maybe lipase uses in a complex formulation, with amylolitic enzyme adding the results could be convenient.

Cogent results were obtained by baking test assessment. The loaf volume figures are shown in figure 3.



	M	P1	P2	P3	P4
■ Loaf Volume, cm3/100g	410	450	471	460	445

Fig. 3. Loaf volume values of analyzed samples

All data indicate an increasing ratio between 8.5% for sample P_4 and 14.9% for the P_2 one. That confirms the hypothesis according to the effect of lipase on dough transformation during baking processes, but accurate assessment of pathways in spirits of improving action it is difficult. It is possible that the effect of lipase and lipids' bounds with the other compounds to became obviously ovenspring, through new functional links and biochemical changes, which were occurred during dough temperature increase.

Also it is interesting that better results were obtained for samples P_2 and P_4, which had better relationships between elasticity-plasticity specific features.

Regarding the freshness preserving of baked loaves, that was registered at 24 hours. Also suitable results were obtain for breads, which were baked using modified recipe, with a lower water quantity for the same water absorption of flour.

The effect of crumb brightening was evident for loaves, which were baked from improved flours with lipase product.

Conclusions

The aim of this study was checking the effect of exogenous lipase, which was added in different doses into flour with an average quality, referring its improving potential.

Accordingly this study, the best dose of Belpan LIPO B (10,800 LU/g) was 0.4g lipase/100kg wheat flour, correspondent sample P_2. The dose is not representative like optimum level in aim of flour improvement for all types of flours or even for an average quality of them. The optimum dose might be changed according to the variation of the functional properties of the flours.

By using exogenous lipase, such as Belpan LIPO B product on bread making, the effects on baked products were visible in terms of loaf volume increasing, the freshness preserving, as well as the crumb properties improvement. In this way the results related rheological improving of dough properties could be argumentation in view of lipids significance and linkages with the main compounds, gluten protein and starch.

An interesting feature is important to highline, in sense that the better results in baking by flour improving with lipase product were registered for samples with meliorated rheological properties concerning elasticity and plasticity ratio.

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