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THE EFFECT OF STARTER CULTURES ON THE QUALITY OF WHEAT DOUGH BREAD

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Abstract

In the present paper, we have tried to define the effect of starter cultures over the rheological properties of dough and bread crumb. The rheological properties of dough have been determined with the Brabender farinograph and their effect over the bread quality has been established through baking tests. By adding starter cultures, we have obtained doughs with superior rheological properties and finite properties with better qualitative characteristics.
***Key words:** rheology, dough, farinograph, bread quality*

Introduction

Using starter cultures in bread industry has achieved a high popularity in the last few years due to the increasing request of consumers that prefer natural, good and healthy products. The advantageous effect of these cultures over the finite product has been recognized worldwide: over loaf volume (Clarke and his co-workers 2002), flavour (Theile and his co-workers 2002), nutritional value (Salovaara and Goransson 1983; Larson and Sandberg 1991; Lilijeberg and Bjorck 1994), bread freshness (Laver-Micocca and co-workers 2000, 2003, Mangusson and Schnures 2001 quoted by Clarke and His co-workers, 2004).

It seems that the favourable action the lactic bacteria has upon the quality characteristics of the finite product is due to metabolism products that are brought in the dough, especially the lactic acid that has a higher acidity as a result.

Modifying the pH leads to modified protein solubility, some of the fragments become soluble and are don't take any more part to the gluten structure while other fragments are precipitate and would interact with the glutenic chain. Proteins' structure is to be modified and the gluten becomes stronger and less felxible (Wherle 1997).

At the same time, modifying the pH leads as well to changes in the activity of some enzymes like amylases, pentosanases, cellulases (that act at a 3.6-5.6 pH), proteases (best pH 4.0-4.1) and the reaction products obtained.

Modifying the proteolytic activity in the dough leads to a growth of the quantity of free amino acids in the dough and at the same time of the quantity of flavour substances accumulated (Thiele and co-workers, 2002). It seems that this growth was due not only to changes in the pH but also to the proteases synthesis by the lactic bacteria used.

The proteolytic system of *Lactobacillus sanfranciscensis* species shows aminopeptasic, dipeptasic, tripeptasic and iminopeptasic activities (Gobetti and al. 1996 quoted by Thiele and co-workers 2002 as well).

Regarding the nature of flavour components resulted, these depend on the type of starter culture that has been used. The diacetyl is produced especially by the homofermentative bacteria and the etylacetat by the heterofermentative bacteria. If we also add yeasts in the culture dough, the number and quantity of flavour components will grow.

In the dough fermented with mixed cultures of yeasts and lactic bacteria there have been found larger quantities of methyl-1-butanol, 2-methyl-propanoic acid, 3-methyl-butanoic acid and 2-fenil-ethanol. They have also found a growth of volatile components' concentration in the dough fermented by yeasts in the presence of lactic bacteria, having as a result the following fermentation products: 1-propanol, 2-methyl-1-propanol, 3-methyl-1-buthanol.

Experimental

The study was carried out on commercial white flour 650 type, obtained from the last (2006) crops' milling. Starter culture supplementation into dough formulation meant DI-PROX M 207 using in different doses, like flour improver. DI-PROX M 207 product is a starter culture that contains *Lactobacillus plantarum* and *Lactobacillus brevis.*

Enzymes&Derivates Romania Co supplied the commercial product, like a cram power, culture starter that had an optimum activity to 26-30 °C temperature. The producer recommends using a dose of 1-3U/100kg flour.

The quality assessment of the samples was performed by Romanian standards, using physical, chemical, rheological and technological methods: STAS 90-88, STAS 6124-73, STAS 6283-83 and SR ISO 3093:1997.

The physical and chemical properties have been set as following: ash cntent 0.65%, humidity 14.2%, wet gluten content 24.2%, gluten deformation index 5 mm, falling number 278s.

The rheological properties of the flours were made on Brabender farinograph in conformity with SR ISO 5530-1:1998. Using of established dough formulation baking tests performed, and the bread indicators were compared (STAS 91-83 ref.).

The culture dough (figure 1) was made of flour and water in a ratio of 1:2 (culture environment) in which starter culture DI-PROX M 207 was introduced. After inoculation, the suspension resulted was fermented at the temperature of 28°C for 12 hours until it reached the pH 3.5.

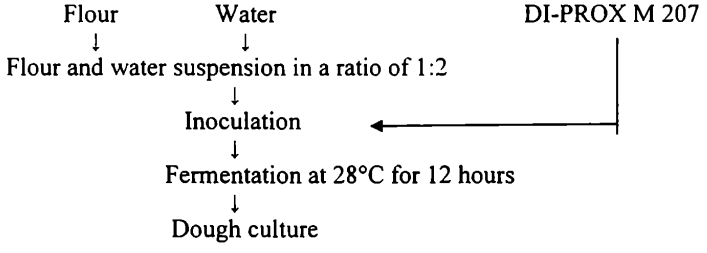

Fig. 1: Procedure for culture dough

Starting from the flour chosen for analysis, different doses of DI-PROX M 207 have been used as following:

- M – blank (white flour 650 type, without exogenous sample, starter culture);
- P_1 – sample, with addition of 1U/100kg flour;
- P_2 - sample, with addition of 2U/100kg flour DI-PROX M 207;
- P_3 – sample, with addition of 3U/100kg flour DI-PROX M 207;
- P_4 – sample, with addition of 4U/100kg flour DI-PROX M 207;
- P_5 – sample, with addition of 5U/100kg flour DI-PROX M 207;

Results and Discussion

The rheological behaviour of the dough, prepared according to procedure above has been appreciated according to the determinations made

by the Brabender farinograph as shown in figure 2. The values of certain characteristics are indicated in table 2 and 3.

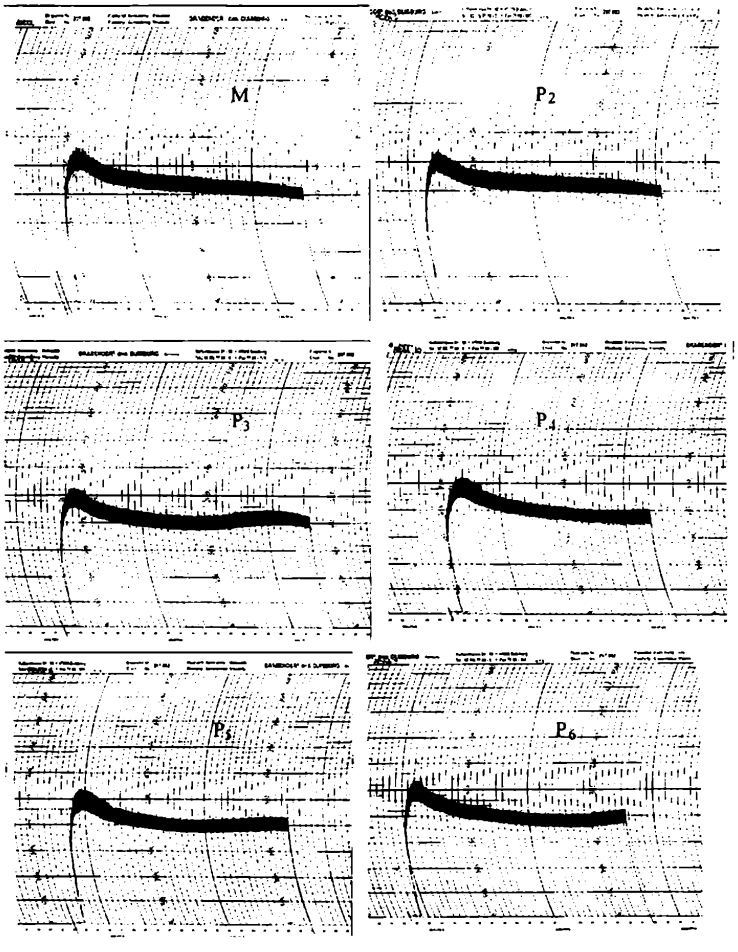

Fig.2: Pharinograms of analyzes samples

Table 1: Pharinograph values

Samples	M	P_1	P_2	P_3	P_4	P_5
WA, %	59.6	59.6	59.6	59.6	59.6	58.8
DDT, min	3	3.40	3.40	3.40	3	2.30
DST, min	4.30	4.50	4.50	5	5.30	6.30
WD, U.B.	110	115	120	120	125	130
Elasticity, U.B.	90	100	110	110	100	95
FS	46	48	48	50	52	52

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

Based on the farinographic analysis it was ascertained that by adding DI-PROX M 207, dough with rheological properties superior to those of the witness have been obtained. By adding starter culture, the time of forming dough, its stability and the dough's tempering will be higher. The technological effects of the analyzed samples have been appreciated through the baking samples – table 2

Table 2: The quality index of the breads obtained through experiments

Index/Sample	M	P_1	P_2	P_3	P_4	P_5
Nominal Weight, g	508	504	504	499	496	493
Moisture, %	45.4	45.9	45.7	46.0	45.2	45
Acidity, degrees	1.0	1.6	1.4	1.6	1.8	1.8
Porosity, %	81	83	83	84	84	84
Elasticity, %	95	95	97	95	96	93
Loaf volume, $cm^3/100g$	333	359	359	366	381	375

According to the samples shown in table 2, all the improved flour samples (except for P_5) led to obtaining bread that has a bigger volume than

that of the witness (fig.2). Furthermore, all the improved samples (except P_5) have better characteristics regarding the crust, crumb, porosity, flexibility and freshness.

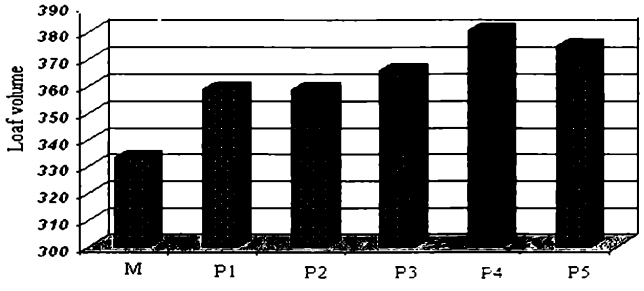

Fig. 2: Loaf volume values of analyzed samples

From the point of view of the sensorial properties, the consumers have rather appreciated the samples treated with DI- PROX M 207 than the witness.

Conclusion

According to the general conclusions that the samples treated with DI-PROX M 207 provided, an improvement of the rheological properties of the dough with a growth of starter culture added is to be noticed as well as better characteristics of the finite product (volume, freshness, flexibility, porosity) and bread flavor. On the other hand, an overdose of starter culture (P_5) would lead to bad properties of the finite product.

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