

THE IMPROVEMENT OF THE QUALITY OF WHEAT FLOUR WITH A LOWER CONTENT OF α - AMYLASE THROUGH THE ADDITION OF DIFFERENT ENZYMATIC PRODUCTS

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*This paper aims to outline the opportunities of use and the tendencies of improving the rheological properties of the dough obtained from flours with a low content of α -amylase induced by the addition of some enzymatic products provided by S.C. Enzymes & Derivates, Romania. The low level of α -amylase in the wheat especially supposes a supplementation of flour with this enzyme, which has two functions in the process of bread making: on the one hand, it continually provides fermentable sugars for yeast and at the same time it produces carbon dioxide, and on the other hand, it contributes to the improvement of dough properties and leads to a higher bread quality. Therefore, this paper has used four different enzymatic products, which contain α -amylase from different sources, such as malt flour and moulds such as *Aspergillus oryzae*. The effect of the addition induced through adding various improvers was analyzed through the value of the falling number index of the sample flour but also through the evolution of the dough rheological properties measured with the lab device Promylograph T3. As a result of the experiments carried on, it was noticed that the falling number decreases up to the optimum value of 250 seconds starting with doses of about 100g/100kg added enzymatic product. A stronger effect of optimizing the falling number was seen in the case of improvers which contain enzymes from malt flour (cereals).*

Key words: promylograph, falling number, α -amylase, malt flour

The supplementation with amylase, which is found in insufficient quantities in flour, has a great practical importance. It is known that, in general, the flour obtained from the grain harvested mechanical or from the drought period has almost none or a very weak α -amylase activity. This kind of flours have a reduced capacity of forming fermentescibile carbohydrate and therefore of forming gas. These flours have a low maltose index (1.5-2%) and a high falling number value (over 300s) [1]. The supplementation of flour with α -amylase intensifies the amylose and increases the quantity of fermentescibile carbohydrates from the dough, through maltose formation, capable of ensuring the formation of gas on the entire duration of the technological process, including in its the final phase, at a level which guaranties the obtaining of a quality bread.

The supplementation with amilolitic preparations can be realized during the grinding of the wheat, further in the flour or during the preparation of the dough. It is realized through the addition of α -amylase or of products from malt, the preparations of fungal α -amylase and preparations of bacterial α -amylase [2, 3, 4]. It was considered useful to use a series of enzymatic preparations which don't contain only pure α -amylase, but a mixture of enzymes and additives used in bakery in order to ensure an optimal improvement of the rheological characteristics of the dough prepared from wheat flour because in the experiments it was used a flour with high fall value, but a low deformation value. Also it was used a comparative study between the enzymatic preparations which contain more ingredients in the mixture and the malt flour which present a high α -amylase activity, and important quantities of reducing sugars, specially maltose and proteolytic activity.

MATERIAL AND METHOD

Commercial wheat flour (harvest 2008) were milled on an experimental Buhler mill from Mopan S.A. (Suceava, Romania). Deionised water was used in all experiments. Enzyme supplementation into dough formulation meant Belpan As, Belpan MOPA and Belpan Malt using in differnt doses, like flour improver. Enzymes@Derivates Romania Co supplied this commercial products which contain the following composition:

- Belpan AS contains malt diastase flour, stearoil 2 lactilat sodium, ascorbic acid, cysteine, fungal alpha amylase, fungal hemicelulază, xilanază;
- Belpan MOPA contains diastase malt flour, non-degreased soy flour with enzymatic activity, mono-and digliceride of fatty acids-E471, steoil-2-lactilat sodium, ascorbic acid, cysteine;
- Belpan Malt contains pure malt flour.

Control flour was analyzed by performing Romanian standards methods: SR ISO 712:1999, SR EN ISO 21415-2/2008, SR EN ISO 21415-2/2008, SR 90/2007, SR ISO 3093:1997. In experiments was used a flour with 14.4% moisture, 0.64% ash content, 28.7% wet gluten content, 5 mm gluten deformation, and falling number 429 s. Data acknowledge that the control flour has a average potential for bread-making from that point of view.

The rheological properties of the flours were made on promylograph device for doses of 50, 100, 150 and 200 g/100kg of flour with commercial added products. The promylographical method of determination of rheological characteristics of the dough is similar with the pharinographical method of the determination of the same parameters: hydration capacity, stability, formation time, the soaking degree etc. The using of established dough formulation, the falling number performed and the α -amylase indicators where compared.

RESULTS AND DISCUSSIONS

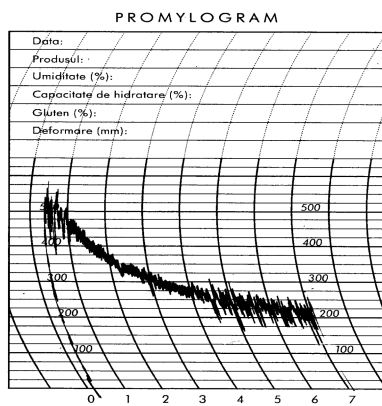
1. The characterization of comercial products used in the improvement of white flour with a low content of α -amylase.

Belpan AS contains components which improve the capacity of the dough of forming gas (malt diastasis flour, fungal alpha amylase), components which weaken the rheological properties of gluten (cysteine), components which increase the freshness of the bread (stearoil 2 lactilat of sodium), oxidation agents (ascorbic acid), components which act on the poly-carbohydrate and non starch fraction from the wheat flour (fungal hemicelulaza, xilaniza).

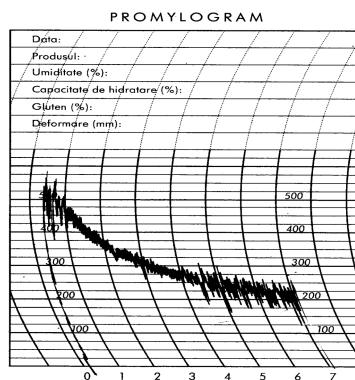
Belpan MOPA contains components which improve the capacity of the dough of forming gas (diastasis malt flour), components which weaken the rheological properties of gluten (cysteine), components which increase the freshness of the bread (non degreased soy flour with enzymatic activity, mono and di-glycerides of fat acids – E471, steroil-2 lactilat of sodium), oxidation acids (ascorbic acids).

Belpan Malt is malt flour obtained from germinated cereals in conditions which protect the enzymes. Therefore, this product contains besides α -amylase in large quantities and proteolytic enzymes, and other active at germination enzymes, products of hydrolysis of the components of the seed: maltose, dextrin, amino acids, polypeptides. Because of its content of proteolytic enzymes, it is appropriate the use of it in the analyzed flour with a low formation index for the bakery.

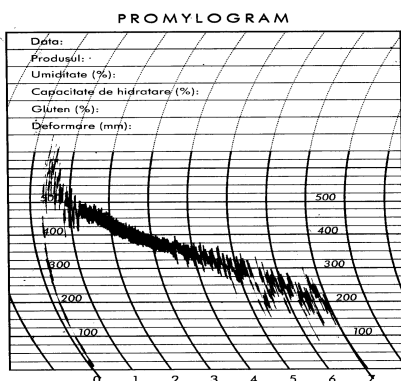
2. Rheological characteristics for promylograph. The data obtained at the promylograph T3 device through the addition of Belpan As, Belpan MOPA and Belpan Malt is shown in the figures 1, 2 and 3.



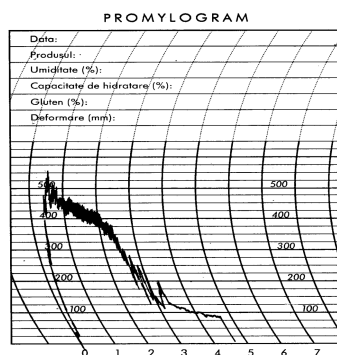
50g /100 kg flour



100g /100 kg flour

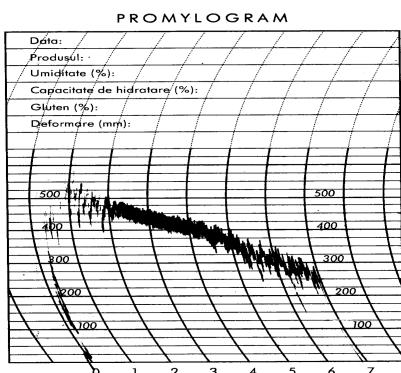


150g /100 kg flour

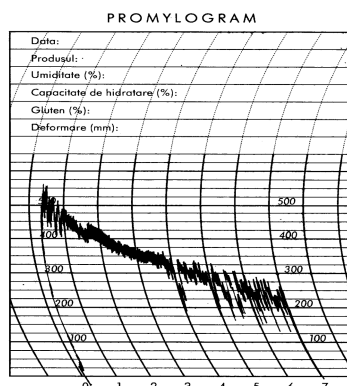


200g /100 kg flour

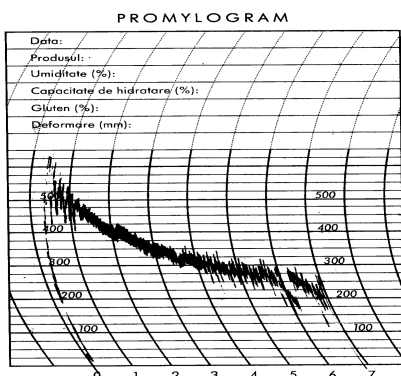
Figure 1 The curves obtained at the promylograph T3 through the addition of Belpan As



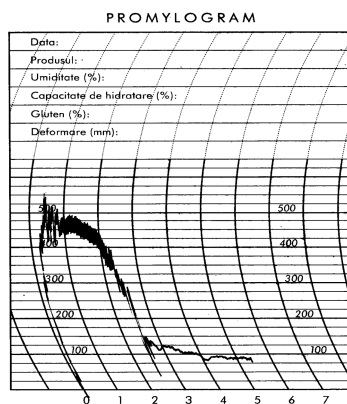
50g /100 kg flour



100g /100 kg flour

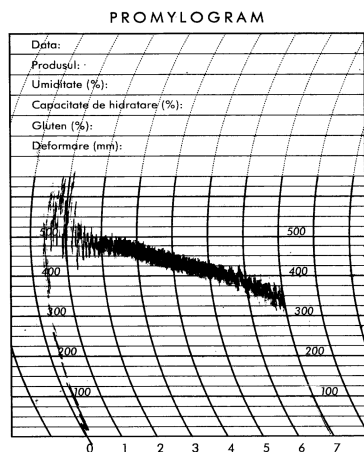


150g /100 kg flour

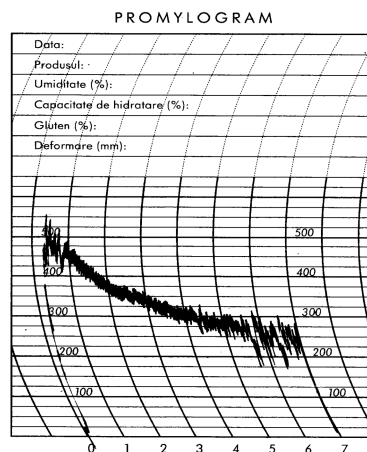


200g /100 kg flour

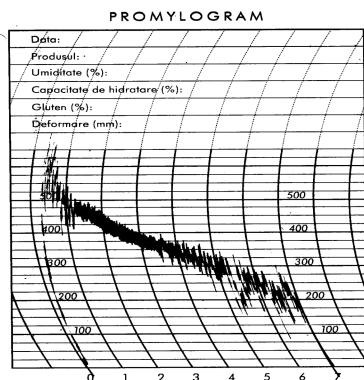
Figure 2 The curves obtained at the promylograph T3 device through the addition of Belpan MOPA



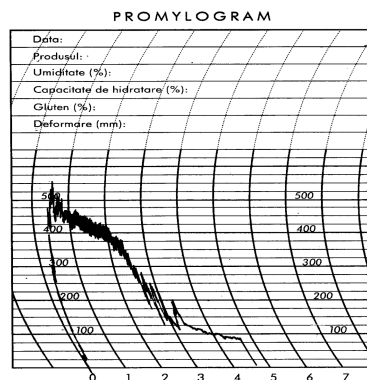
50g /100 kg flour



100g /100 kg flour



150g /100 kg flour



200g /100 kg flour

Figure 3 The curves obtained at the promylograph T3 device through the addition of Belpan Malt

From the graphics obtained at the T3 promylograph it can be observed that the optimal results are obtained at a doses of 50-100g/100kg flour for Belpan As, 150g/100kg flour for Belpan MOPA and 100 g/100 kg flour for Belpan Malt. The addition of these ameliorators reduce the consistence of the dough and modify its the rheological properties. The extensibility of the dough increases and the resistance of the dough decreases the more as the addition of this commercial preparations is bigger. This is due to the proteolytical activity generated by the cysteine and the proteolytical enzymes from the malt flour, the degradation of non-starch poly-carbohydrates generated by the xilanaza and fungal hemicelulaza (in the case of the addition of Belpan As), and the quantity of maltose formed through the hydrolysis of the starch which carry on the gluten from the dough a dehydration activity. In this way, the quantity of free water from the dough is increased, fact

which reduces the consistence and worsens its rheological properties at a too high doses of added ameliorator in the dough system.

From the point of view of the value of the fall index, it was obtained an optimal result at a dose of 100-150 g Belpan AS/100kg flour, 400 g Belpan MOPA/100kg flour and 100 g Belpan Malt/100 kg flour according to the data from *table 1*.

Table 1

The influence of the addition of Belpan As, Belpan MOPA, Belpan Malt on the falling number index

Fall number, s	Doses of ameliorator g/100 kg flour		
	Belpan AS	Belpan MOPA	Belpan Malt
302	50	-	-
260	100	-	-
231	150	-	-
209	200	-	-
192	250	-	-
360	-	50	-
340	-	100	-
324	-	150	-
314	-	200	-
275	-	400	-
279	-	-	50
250	-	-	100
240	-	-	150

The rheological data obtained at the promylograph T3 device and the α -amylase activity obtained at the falling number device through the addition of different commercial preparations which contain in a form or another α -amylase, led to the conclusion that for the Belpan As ameliorator, the optimal doses that should be added for the analyzed sample is 100 g at 100 kg of flour, and for the Belpan Malt ameliorator is 50-100 g at 100 kg flour. For the Belpan MOPA ameliorator, the optimal doses from the rheological point of view are not compatible with the doses needed for the achievement of the value of 240-260 s at the falling number device, which makes us think that this ameliorator is not suitable for the flour taken in consideration.

CONCLUSIONS

The experimental data showed that the falling number decreases around the optimal value of 250 seconds beginning with doses about 100g/100kg flour. The strongest effect of the optimization of the falling number was observed at the Belpan Malt ameliorator. From the rheological point of view, it can be concluded that, although there are no significant differences between the control sample, the addition of Belpan Malt offers a superior stability to the dough, while the addition of Belpan MOPA and Belpan AS gives a superior elasticity. Both from the rheological point of view and from the value of the fall number point of view, it can be claimed that the best results were obtained by the Belpan Malt ameliorator.

BIBLIOGRAPHY

1. Bordei, D., 2005 – *Modern technology of breadmaking*, Ed. Agir, Bucharest, pp. 343-344.
2. Bordei, D., 2000 – *The science and technology of baking industry*, Ed. Agir, Bucharest, pp. 199-206
3. Leahu, A., Codina, G.G., 2008 – *The effect of the malt flour on the rheological properties of the dough and the bread quality*, Annals of the Suceava University, Food Engineering, VII (1): p 126-131.