THE INFLUENCE OF USING GLUCOXIDASE (GOX), ASCORBIC ACID IN PANIFICATION AND THE EFFECT OF REPLACING ASCORBIC ACID BY GOX

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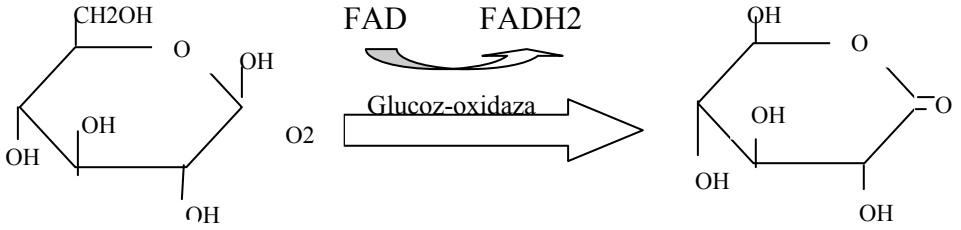
Abstract

The studies made have showed the fact that replacing ascorbic acid with gox leads to the improvement in dough rheology (stability, softening, strength) and leads to obtaining finished products with increased volume (BIMP 14 (2) II 2003, p.99). Our purpose is to notice what happens and how GOX, ascorbic acid, GOX and ascorbic acid replacing a part of it, influence dough features.

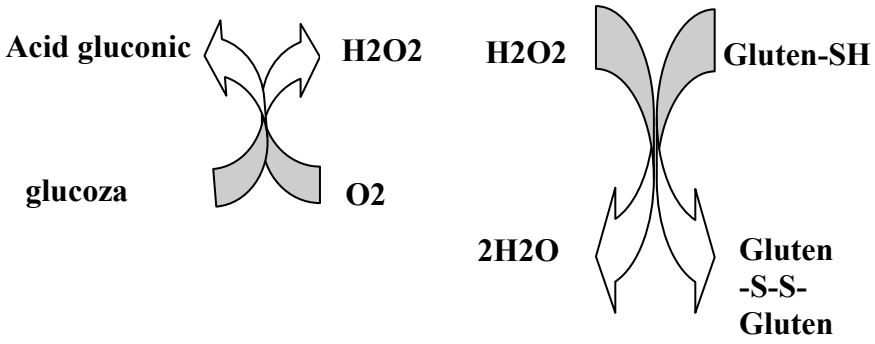
INTRODUCTION

GOX is a flavoenzyme containing 2 moles of Flavin Adenin Dinucleotid (FAD) as a prosthetic group at one mole of enzyme, by using flavones and molecular oxygen as a hydrogen acceptor.

FAD → $FADH_2$
(oxidized form) (reduced form)



β-Dglucoza



The resulted oxygenated water activates the flour catalases/peroxidase. The flour endogenous catalase acts as follows:

$$H_2O_2 \rightarrow \frac{1}{2} O_2 + H_2O$$

The oxygen released from the reaction participates in the oxidizing processes in the dough.
The oxygen resulted when disintegrating oxygenated water is continuously formed (its concentration increases), thus increasing the glycosidase speed of reaction and stability.
The improvement in dough rheological properties is due to –SH groups oxidation from the non-gluten proteins, that lead to their extraction from the sulphydrile –disulphide exchange reactions, thus favoring the forming of disulphide bridges between the gluten proteins and consequently dough strengthening occurs. The –SH groups of soluble proteins are the most reactive ones of the system.
The equilibrium of the sulphydrile –disulphide reactions changes in the sense of the reactions between the gluten proteins, leading to a more elastic and stretching resistance structure which can dilate without any breaks during final fermentation and of the first part of baking.

MATERIALS AND METHODS

The analyses results were obtained in the Moara Cibin SA Sibiu data analysis laboratory.
Wheat flour type 800 from 2005 production was used.
The samples analysis was done according to the EC Directives at the Alveograph NG Consistograph – Chopin apparatus. The results obtained have then been compared.
The samples were noted as follows:
M – approval sample, flour type 800 with no enzymes exogenous addition;
P1 – contains additive flour with 0,5 gr GOX;
P2 – contains additive flour with 4 gr ascorbic acid;

Flour endogenous peroxidases are thermo stable and catalyze the oxygenated water disintegration in the presence of one hydrogen donor, determining covalent reticulations of proteins and/or pentosans.
The enzyme also realizes a dough drying effect as the soluble pentosans form oxidized gels.
The best oxidizing system for oxidative jellification of pentosans is H2O2- peroxidase.
Peroxidase involvement in dough strengthening occurs by the proteins aggregation and by the crossed bindings of glucides between them and with proteins.
The formation of pentosans oxidizing gels can be done through two mechanisms. The first is based on the formation of dipheluric acid as a result of the binding of two rests of acid, which determines the binding of two chains of arabinoxilani and the latter –through the addition of protein radicals to the double activated binding of the esterified pheluric acid from arabiloxilani, having as a result the formation of bindings between proteins and pentosans.
The pentosans reticular reactions are favored by a PH of about 5 and by a 20...25 Celsius degrees temperature (Bordei, 2005)

P3 – contains additive flour with 2 gr ascorbic acid and 0,5 gr GOX;

RESULTS AND DISCUSSIONS

The results were measured or calculated from the five curves obtained with the Alveolink, considering that if one of the curves is too far from the other four ones, when the bubble is prematurely broken, it will not be taken into consideration when expressing the results.
The following results can be read from the alveogram:
P – viscosity or maximum pressure which is related to dough resistance to deformation;
L – extensibility (length of the curve starting from the origin up to the perpendicular point corresponding to the decrease in pressure due to the bubble break);

Table 1. The results of the values of the alveograms and of the falling number of approval samples and additive flour samples type 800:

	P (mm H2O)	L (mm)	G	W (10E-4J)	P/L	Ie(%)	FN (S)
M (F800)	71	41	14.3	96	1.73	23.4	342
P1 (0.5g GOX)	74	47	15.3	108	1.57	25.7	386
P2 (4g ascorbic acid)	81	50	15.7	134	1.62	33.7	372
P3 (2g ascorbic acid and 0.5g GOX)	86	52	16.1	142	1.65	32.6	395

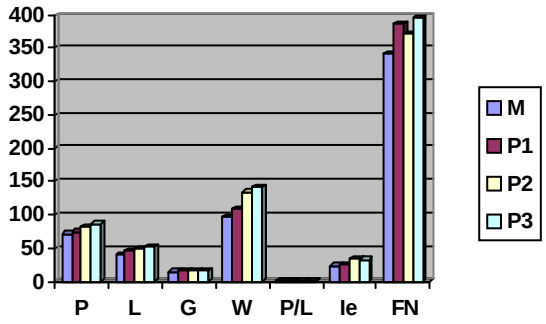


Fig.1: The variation diagram of alveograms and of falling number values for flour type 800 approval and additive samples

G – expansion index G is the average of the expansion indexes on the calculus graph and corresponds to the break of abscise L; G=2,226√L;

W – dough distortion action, based on one gram of dough evaluated at 10-4 joule, calculated as follows: W=1.32 x (V/L) x S, where V – air volume, in mm3; L – break average abscise, in mm; S – curve surface, in cm2;

P/L – curve configuration ratio;

Ie – elasticity index, representing the ratio between the measured pressures expressed in mm H2O under the form of bubbles after 200 cm3 of air is insufflated in the dough moulds, corresponding to a length L of 40 mm or to an expansion index G of 14,1 and P curve maximum: Ie % = P200/Pmax.

The Falling Number analysis (with the Perten-Hagberg device) was done, in order to determine the alpha-amylase activity of the 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 underlayer. The method is based on quickly jellification of flour suspensions using boiling water bath at and subsequent to the liquation of the sample starch. 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 distance in the gelatinous suspension.

CONCLUSIONS

One can observe that a better increase of dough resistance, a higher dough extensibility, a larger surface of the mechanical work and a higher elasticity index are obtained when 4 g of ascorbic acid is added than when adding 0,5 g glycosidase.
One can observe that replacing 2 g of ascorbic acid with 0,5 g of glycosidase is favourable to the rheological characteristics of the dough pleasant look, adequate volume and uniform pores can be obtained.

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