

## Shelf-life and sensory evaluation of pan breads produced with transglutaminase, bacterial xylanase and maltogenic alpha-amylase

Letícia Cappuccelli Pinto\*, José Ricardo Ganancio, Caroline Joy Steel

### Abstract

The baking industry still has much to expand in the use of enzymes in its formulations but, to obtain the best results, it is necessary to increase the knowledge on how these processing aids affect the final product. Therefore, this study observed the effect of transglutaminase (TG), bacterial xylanase (XYL) and bacterial maltogenic alpha-amylase (AM) on pan bread. A 2<sup>3</sup> Central Composite Rotatable Design was used and the bread quality parameters (dependent variables) were observed on the 1st, 5th and 9th days of shelf-life. The Response Surfaces obtained showed that, on day 1, all the enzymes affected the moisture and AM and XYL affected the water activity. On day 5 XYL affected the texture. Sensory analysis was carried out to evaluate the acceptance of the consumers. Differences between the samples were observed for "appearance", "color" and "texture" ( $\alpha < 0,05$ ). It is possible to conclude that enzymes can replace additives in "clean label" pan breads.

### Key words:

pan bread, shelf-life, enzymes

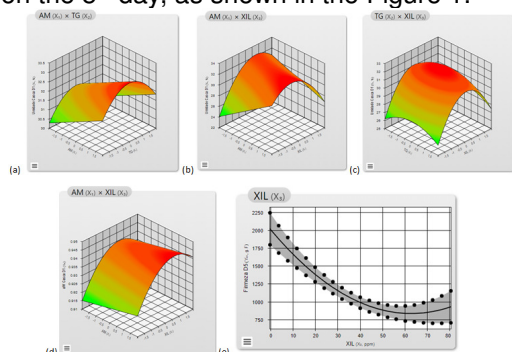
### Introduction

Bread is one of the most consumed foods, needing few ingredients to produce it. However, industrial formulations normally include additives to improve rheological properties of the dough and quality of the breads. To achieve the same results and keep a "clean label", the use of enzymes is a good alternative<sup>1</sup>.

As bread staling is the main reason of rejection of the consumers, the aim of this study was to retard it by adding TG (0 to 30 ppm, f.b.), XYL (0 to 80 ppm, f.b.) and AM (0 to 100 ppm, f.b.).

### Results and Discussion

Although the bread quality parameters that were observed were specific volume, crumb texture, crumb and crust moisture, crumb and crust water activity, and crumb and crust color, the Response Surfaces obtained were for the moisture and water activity of the crust on the 1<sup>st</sup> day and texture on the 5<sup>th</sup> day, as shown in the Figure 1.



**Figure 1.** Response Surfaces for moisture on day 1 for AM x TG (a), AM x XYL (b), TG x XYL (c), water activity on day 1 for AM x XYL (d) and texture on day 5 for XYL (e).

Higher concentrations of AM and intermediate concentrations of TG and XYL gave the highest moisture of the crust on day 1. Higher concentrations of AM and high-intermediate concentrations of XYL gave the highest water activity of the crust on day 1. On day 5, higher concentrations of XYL gave the lowest firmness.

The formulations with the lowest (E6, E7 and E8) and the highest (E13) firmness, the control and the standard were evaluated as to the acceptance of the consumers. The results are shown in the Table 1.

**Table 1.** Results of the acceptance evaluation.

	APP	COL	ARO	FLA	TEX	OA
CTRL	6.77 <sup>d</sup>	6.97 <sup>d</sup>	6.52 <sup>a</sup>	6.55 <sup>a</sup>	6.17 <sup>d</sup>	6.52 <sup>a</sup>
STD	7.07 <sup>ab</sup>	7.46 <sup>a</sup>	6.79 <sup>a</sup>	6.87 <sup>a</sup>	6.67 <sup>ab</sup>	6.95 <sup>a</sup>
E6	7.09 <sup>ab</sup>	7.20 <sup>ab</sup>	6.63 <sup>a</sup>	6.73 <sup>a</sup>	6.71 <sup>ab</sup>	6.88 <sup>a</sup>
E7	6.96 <sup>ab</sup>	7.04 <sup>b</sup>	6.73 <sup>a</sup>	6.70 <sup>a</sup>	6.89 <sup>a</sup>	6.82 <sup>a</sup>
E8	7.19 <sup>a</sup>	7.24 <sup>ab</sup>	6.64 <sup>a</sup>	6.50 <sup>a</sup>	6.37 <sup>ab</sup>	6.68 <sup>a</sup>
E13	7.07 <sup>ab</sup>	7.27 <sup>ab</sup>	6.82 <sup>a</sup>	6.90 <sup>a</sup>	6.43 <sup>ab</sup>	6.70 <sup>a</sup>

Where: CTRL – control (without enzymes and additives); STD – standard (0.1% (f.b.) sodium stearoyl lactylate (SSL), 0.01% (f.b.) ascorbic acid and 0.001% (f.b.) fungal alpha-amylase); E6 - 80 ppm of AM, 6 ppm of TG and 64 ppm of XYL; E7 - 20 ppm of AM, 24 ppm of TG and 64 ppm of XYL; E8 - 80 ppm of AM, 24 ppm of TG and 64 ppm of XYL; E13 - 50 ppm of AM, 15 ppm of TG and 0 ppm of XYL; APP – appearance; COL – color; ARO – aroma; FLA – flavor; TEX – texture; OA – overall acceptance. \*Averages with the same letters in the same column indicate that there is no significant difference between the samples using Tukey's test ( $\alpha < 0.05$ ).

There were significant differences for "appearance", "color" and "texture". Appearance and color are intimately related and, considering that color varies according to the temperature of the oven, these differences are not very important. Formulation E7 had a better texture than the control. All formulations with enzymes produced breads equivalent to the STD and, except for E7, to the CTRL.

### Conclusions

Although only few Response Surfaces were obtained and more studies are needed, this study showed that the addition of enzymes brought positive results and they could possibly replace emulsifiers and oxidants in "clean label" pan breads.

### Acknowledgement

The authors would like to thank FAPESP for the scientific initiation grant (2017/10783-3).

<sup>1</sup> CABALLERO, P. A., GÓMEZ, M. & ROSELL C. M. Improvement of dough rheology, bread quality and bread shelf-life by enzymes combination. *Journal of Food Engineering*, **2007**, 81, 42-53.