Soy lecithin as an improver during freeze bread storage

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ABSTRACT

Freezing bread under controlled temperature conditions causes changes in the characteristics of the product, such as alterations in flavor and moisture loss due to starch retrogradation, which in turn, increases the crumb firmness. The freezing effect, however, can be minimized with the use of additives. The emulsifiers delay the starch retrogradation, and consequently the bread firmness. The aim of this study was to evaluate the influence of soy lecithin emulsifier on the technological characteristics of bread stored by freezing. Bread specific volume was determined after cooling on the same day of processing. The bread crumb hardness was measured using a TA-XT2 texturometer. The produced breads were stored in low-density polyethylene packaging at -24°C for 0, 7, 14, 21 and 28 days. After each period of bread storage, the specific volume and hardness were evaluated. The bread produced with soy lecithin showed a higher specific volume, on the first day of production, as compared to the bread without soy lecithin. Bread without the emulsifier showed an increase in its firmness during storage, from 4.32 N (first day) to 11.07 N (2z8-storage days). The soy lecithin addition contributed to maintaining the firmness of the frozen breads stored from 7th (6.49 N) to 28th day (6.66 N).

INTRODUCTION

While frozen bread has been improved because of technological advances and formulations, it still presents problems such as the drawn out fermentation, small volume, texture and varied performance (Romeu et al. 2006). Besides the adjusted ingredients of basic bread formulation to make the frozen bread, the freezing effect can be minimized with the use of additives, such as for enzymes, lipids, hydrocolloids and emulsifiers, in addition to some oxidants that are commonly applied as additives and improvers (Peng et al. 2017). The emulsifiers are applied as anti-stalling agents, dough modifiers and as improvers for high-protein bread (Selomulyo and Zhou 2007). The emulsifiers retard the starch retrogradation and consequently, the bread firmness (Pareyt et al. 2011).

After baking and during storage, many changes occur to the bread texture, influencing consumer acceptance and sale ability. The time and temperature of bread storage can be affected by the rate and extent of starch retrogradation (Mohamed et al. 2006), which is directly related to the increase in the bread crumb hardness (Ronda et al. 2011).

The aim of this study was to evaluate the influence of the soy lecithin emulsifier on the technological characteristics of bread stored under freezing.

MATERIAL AND METHODS

Raw material. The wheat grain (*Triticum aestivum* L.) used in this study was BRS Marcante, from the 2017 harvest in Rio Grande do Sul State, Brazil. The chemicals used were all of analytical grade, and the ingredients for the bread preparation were purchased in the local market. The emulsifier used was soybean lecithin CAS 8030 -76-0 (Dynamic Chemical Contemporary LTDA, Brazil, SP).

Refined wheat flour production. The refined flour was obtained by grinding wheat grains in the experimental mill (CD1, Chopin, France), according to method 26-10.02 of the American Association of Cereal Chemists International (AACCI 2010).

Bread production. The bread formulation was based on the El-Dash (1978) method. The formulation used for breadmaking was wheat flour (100%), hydrogenated vegetable fat (3%), refined salt (1.75%), ascorbic acid (0.009%), sugar (5%), yeast (3%) and water at 4 °C. The water content was added according to the farinograph analysis. Dry ingredients (flour, sodium chloride, sugar, ascorbic acid and emulsifiers) were initially mixed using a planetary mixer (KitchenAid, model BEA30A, Brazil) at low speed for 1 min. Then, the hydrogenated vegetable fat, dry yeast and water were added and mixed for 8 min until the the gluten network was completely developed. The dough was left to rest for 10 min before being divided into portions of 170 g, which were subsequently molded with the help of a wood roll. The shaped portions of dough were placed in greased moulds and were fermented in an oven (Ethik technology, model 400, Brazil) at 30°C for 90 min. The portions of dough were then baked in an electric oven (Fischer Grill, model 09.01.16, Brazil) to 220°C for 20 min. The breads were baked and cooled at room temperature for 1 h for further analyses.

Bread evaluation. Bread specific volume (SV) was determined after cooling on the same day of processing. The SV was obtained from the ratio of apparent volume (mL), using millet seeds according to the method 10-05.01 (AACCI 2010), and mass (g) after baking. The bread crumb hardness was measured using a TA-XT2 texturometer (Stable Micro Systems, UK). The tests were conducted according to method 74-10.02 (AACCI 2010) as seen in the Figure 1.

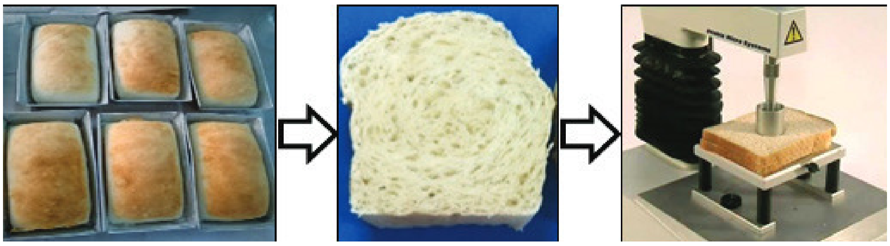

Figure 1. Schematic representation of the texturometer analysis.

The method consisted of compressing two, 25 mm thick slices in the center of the Texture Analyzer platform using a cylindrical probe of 36 mm in diameter under the following working conditions: speed of 1.0 mm/s for the pretest; speed of 1.7 mm/s for the test; speed of 10.0 mm/s for the post-test; 40% compression and 5-g trigger force. The firmness value was expressed in Newton (N).

Bread storage. The produced breads were stored in low density polyethylene packaging at -24 °C for 0, 7, 14, 21, and 28 days. After each time of bread storage, the SV and hardness were evaluated.

Statistical analysis. The analytical determinations were performed in triplicate. The results were submitted to an analysis of variance (ANOVA) and the means were compared by Tukey test or t test with 5% level of significance.

RESULTS AND DISCUSSION

Produced Breads can be seen in Fig. 2. The breads produced with soy lecithin showed a higher specific volume on the first day of production than the bread without soy lecithin (Fig. 3).

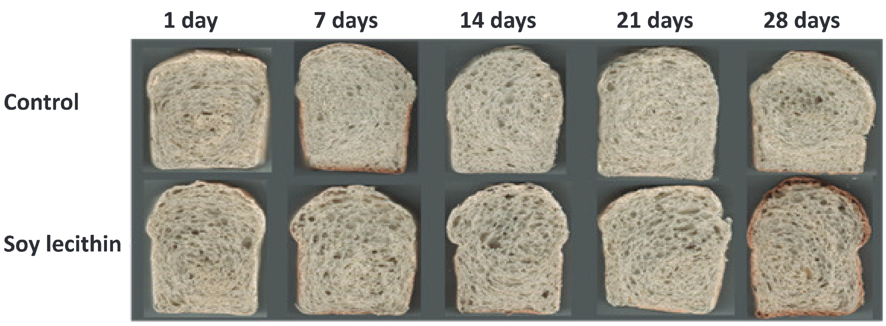

Figure 2. Breads with and without (control) emulsifier stored under freezing for 28 days.

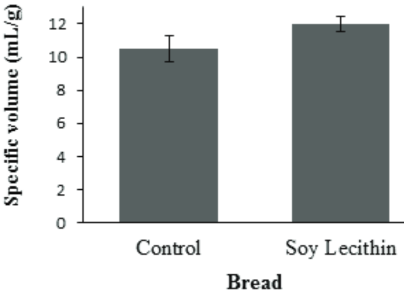

Figure 3. Bread specific volume with and without (control) soy lecithin emulsifier.

The specific volume of bread is defined as the peak force during the first compression and is inversely correlated with hardness (Martínez et al. 2018). This statement is in agreement with the results found in this work, since the bread with soy lecithin showed the highest specific volume and consequently the lowest firmness on the day of production (Table 1).

Table 1. Firmness of bread with and without the (control) emulsifier, stored and frozen for 28 days.

Bread	Bread firmness (N)[a]				
	0 day	7 days	14 days	21 days	28 days
Control	4.32 ± 0.26^{D}, *	7.16 ± 0.30^{C}, ^{ns}	7.44 ± 0.28^{C}, ^{ns}	8.66 ± 0.10^{B}, *	11.07 ± 0.35^{A}, *
Soy lecithin	3.34 ± 0.27^{B}	6.49 ± 0.19^{A}	6.84 ± 0.11^{A}	6.71 ± 0.02^{A}	6.66 ± 0.27^{A}

[a] The results are the means of three determinations. Values with different letters in the same row are significantly different ($p<0.05$). * and ^{ns}, significant and not significant, respectively, by *t* test ($p \leq 0.05$) between bread with and without emulsifier.

Breads without the emulsifier showed an increase in their firmness during storage, from 4.32 N (first day) to 11.07 N (28 days of storage). The addition of soy lecithin contributed to maintain the firmness of the freeze stored breads from 7th (6.49 N) to 28th day (6.66 N). Gómez et al. (2004) evaluated the influence of emulsifiers with different functionalities in bread parameters, storage for eight days at 25 °C, concluding that the soy lecithin delayed the aging of the breads during storage.

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