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Quantification of hydroxymethylfurfural and furfural in bread by high performance liquid chromatography

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Baking is a complex process that involves physical, chemical, and biochemical changes, which are essential for the development of the aroma, taste and color surface in the baked products. Colored compounds that result from Maillard reactions produced during the baking process are also related with nutritional aspects and formation of undesirable compounds. Hydroxymethylfurfuraldehyde (HMF) and furfural are furanic compounds generated during the advanced stages of Maillard reaction, commonly measured as quality parameters to evaluate the severity of the heat treatment. The objectives of this work were optimization and validation of an efficient extraction methodology for high performance liquid chromatography (HPLC) analyses of HMF and furfural in bread.

Extraction of HMF and furfural before quantification by HPLC was performed with acetic acid and with water [1] followed by clarification with TCA [2], and extraction with water and clarification with Carras I and II reagents [3]. Modifications of this last procedure were tried, namely, replacement of water extraction by different mixtures of water/methanol - 60/40; 70/30; 80/20 - followed by clarification with Carras I and II reagents. The solvent mixture methanol:water (30:70) allows the highest yield. The compounds under study were not detected in 100g of bread baked in microwave during 1 min and 30 sec, being an adequate matrix of baked dough free of HMF and furfural. Thus, it was used to study the matrix effect. Comparison was performed between the slopes of the regression lines obtained for pure standard calibration curve and for the sample curve calibration by least-squares analysis, and statistical differences were found (p = 0.05, n = 12). The Student’s t-test for paired samples, which points out the matrix effect and the eloquence of sample curve calibration for quantification of HMF and furfural in bread. Good quality parameters were obtained and the method was successfully applied to the analyses of different types of bread.

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Influence of the addition of B-glucans in the volatiles profile in homemade bread

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The quality of bread is normally defined according to its volume, texture, color, and flavor. However, the characteristic aroma of bread is undoubtedly one of the most important parameters influencing its acceptance by consumers. The volatile and nonvolatile compounds that contribute to the flavor of bread include acids, aldehydes, esters, ethers, ketones, furans, hydrocarbons, lactones, pyridines, pyroles, and sulfur compounds [1].

There is currently a growing research on the incorporation of new ingredients in bread with the aim of improving its flavor, nutritional quality and health properties. B-glucans improve cardiovascular health through a decrease in the cholesterol levels of lipoproteins of low density (LDL) and glycemic response. Also, they may have a powerful immunomodulating effect and show anti-inflammatory and antimutagen effects and promote greater stimulation of the immune system against infections [2]. The objective of this work was to evaluate the impact of the incorporation of B-glucans from cell wall in the volatile profile of bread.

Breads supplemented with B-glucans (0.5; 1.5; and 2.5 g/500g flour) were analyzed and compared with bread without supplementation. In all cases, the assessment was performed in triplicate. For the Headspace analysis by Solid Phase Micro Extraction (HS-SPME), 2 g of bread, crumb and crust, was crushed and weighed into a 50-ml vial. Then, 10 ml of a 20% NaCl solution (pH = 3 with 0.03M citric acid) were added into the vial and the vial immediately sealed at once and kept at +4°C during 10 min. Afterwards, the vial was placed into an ultrasonic cleaner during 15 min. To extract volatile compounds were used a CAR-PDMS SPME fibre (75 mm thickness, Supelco Co., Bellafonte, PA, USA) inserted into the sample vial through the septum and exposed to the HS for 60 min at 50°C under constant agitation (600 rpm). Therefore, the SPME fibre was inserted in GC-MS in the split-less mode.

The analysis of volatiles in the bread shows that predominant groups of compounds, expressed as relative percentage of area, are alcohols and aldehydes. The most important compounds in each category correspond to ethanol, hexanol, isoamylalcohol and butanal, 3-methyl-butanal, 2- methyl-butanal; hexanal and heptanal. Although, the B-glucans addition does not generate a significant change in the total area of volatile compounds found in different bread samples (p > 0.05). However, B-glucans addition reduced significantly (p < 0.05) the number of volatile compounds identified.

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