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Apricot addition influence on bread quality

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Abstract

The Bread is the most constantly present product of the daily human diet, providing the human organism with an important part of the substances necessary for its vital activity. For establishing the bread quality, a special importance shows it's chemical composition, because the substances that enter in it's constitution serve to obtaining the energy necessary to the human body, at tissues formation and to regulating different processes of the human body. Beside the chemical composition, the bread quality and alimentary use, respectively, depends a large measure on a series of signs: flavor and taste, external appearance, crumb porosity and texture, breads' volume.

This paper belongs to a more complex study, which aims are obtaining some bread assortments with high nutritional value, and improving their rheological features, by adding apricots that successfully replace the dough strengthener and flavor substances, used in bakery. The following analysis were performed on bread, in this regard: sensorial, physio-chemical analysis and a series of rheological tests (compression tests) with 5%, 10% and 15% apricot addition, respectively.

Keywords: bread quality, apricots, chemical composition, viscoelastic properties

1. Introduction

Bread is one of the most necessary food products, of the most nourishing and wanted, and there are few regions on the globe in which bread is not known. Nowadays bread has become a food stuff so common, that when a slice of bread is being cut, nobody asks himself questions about it's history, about it' s production process (Stoin, 2009).

On a national scale lately, a diversification of the bakery products developed by local customs, that regard products weights, shape, recipe, technologies and products flavour, but also by taking over the local consumers to some products from other countries. On an international scale, it entered into force that established the enrichment of all flour types (except the black one) with minimum calcium, iron and vitamin B1 amounts, laws that also established the composition and the permitted additives in bread and flour (Saseanu, 2005).

Due to nutritional features that are incorporated with, bakery and floury products represent useful ways of flour consumption development , as a derived product obtained from wheat processing. Applying the proper recipes and technologies, by flour processing, as basis raw material, a large variety of products can be obtained, in order to satisfy the more increasing and more various products of the human nourishment. Different kinds of white, SEMI-white and black bread, simple and with addition products and dietetically products are obtained. The products differentiate in aspect, taste and way of use. These features are given eather by the flour assortment used, or by the dough composition that the bread is obtained from, at the preparing of which, beside flour, water, dough strengthener and salt, there are used fats, sugar, milk, vegetables, eggs, fruits and flavors, too (Lăpuşneanu, 2001).

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The diet issue is one of the most important matters of the contemporary society. During the past years, a very important role is given to diet-illness relation, hoping that a „diet - health" tactics will be elaborated. Having reference to these observations, the aim of this paper was to obtain some high nutritional value bread assortments, and also the improving these rheological (texture) features, by apricot addition. In this regard, the following analysis were performed on bread: sensorial, physio-chemical analysis and a series of rheological tests (compression tests) with 5%, 10% and 15% apricot addition, respectively.

The use of the apricots as addition in common bread preparing, is justified starting from the complex composition of these. The benefits of the apricots on the human health are due to the high contribution of vitamins (A, B1, B2 and C), minerals (potassium-250 mg per 100 g fruit, calcium, iron, phosphorus) and microelements (bromine, cobalt and magnesium). The apricots contain beta-carotene and lycopene, that transform into vitamin A, inside the human organism.

The apricots have a high mineral content, that makes these fruits to have curative qualities in anemia, tuberculosis, ASTM and bronchitis. Fresh fruits are astringent, antidiarrhoeic, the dry fruits are slightly laxative (Marranca, 2003; Terry, 2001). The influence of apricots content on rheological properties of bread crumb was studied. Rheological characterization was made by compressive loading tests (Dogaru, 2004; Gamero, 1993; Mateescu, 2001; Sivaramakrishnan, 2004; Steffe, 1996).

2. Material and methods

A. Bread obtaining technological process

The technological process for apricot addition bread obtaining was the common one. The recipe used, was the following one: flour 1000 g, water - 56%, yeast – 2,5%, salt – 2%, and apricot addition in various amounts: 5%, 10% and 15%, respectively. Similarly, a witness bread sample without apricot addition was performed. The optimum parameters of the technological process were: *kneading* 20 minutes, *fermentation* 60 minutes, *baking* 25 minutes.

B. Apricot supplemented bread quality evaluation

- ***Bread sensory analysis***

The bread obtained after the above described method was submitted to the **sensory exam**, following: the external appearance, crumb state and aspect, flavor, taste, microbial alteration signs and impurities presence *(according to **STAS 91-83** „Bread, loaf products and bakery specialties. Analysis methods").*

- ***Bread physio-chemical analysis***

Also, the bread obtained after the above described method, was submitted to the **physio-chemical exam,** following: *the product volume, crumb porosity and elasticity, height/diameter ratio, moist and acidity (according to **STAS 91-83** „ Bread, loaf products and bakery specialties. Analysis methods").*

- ***Bread rheological features evaluation***

From the so obtained bread, a slice of about 3 cm was cut. The slice was cut after 2 hours of room temperature storage. From this slice, samples were taken with a cylinder 3 cm long and 2 cm in diameter. Further, compression tests were performed. For each bread assortment, 3 times each were performed.

For the experimental study, a compression JTL Janz apparatus was used. The so obtained samples were compressed with a constant speed to 120 seconds, the compression force being read at every 5 seconds. The obtained data were interpreted in the ORIGINI 7.0. program. Two replicates were analyzed and averaged (Mateescu, 2001; Stoin, 2009).

3. Results and discussion

The apricot supplemented bread quality appreciation was performed by correlating the rheological measures with sensory and physio - chemical tests taken.

- ***Apricots supplemented bread sensory evaluation***

The bread obtained according to the *paragraph A*, showed the following sensory features *(table 1)* which are in accordance with STAS 91-83.

- ***Apricot supplemented bread physio-chemical evaluation***

The bread obtained according to the *paragraph A*, showed the following physio-chemical features *(table 2)* which are in accordance with *STAS 91-83.*

Table 1. Apricot supplemented bread sensory features

Analysed sensory features	Recorded sensory features
Product's shape	- volume in proportion with weight, increased with 10-30%;
Crust:- aspect;	- shiny, well developed surface, thin crust with slights cracks (1-2mm);
- color.	- golden yellow, characteristic to the analyzed assortment;
Crumb – kerfs;	- unbalanced pores mass, with no pellets or traces of unkneaded flour, with no impurities (foreign bodies);
- color;	- the crumb is characteristic to the analysed assortment;
- consistency.	- elastic, when easy pressed accrues to the initial shape, unagglutinative, well baked crumb;
Taste and flavor	-pleasant, aromatic, characteristic to well baked product;
Microbial alteration signs	- upon bursting no mucilaginous filaments are formed.

Table 2. Apricot supplemented bread physio-chemical features

Analysed physio-chemical features	Witness (S1)	5% apricot supplemented bread (S2)	10% apricot supplemented bread (S3)	15% apricot supplemented bread (S3)
Product volume (cm^3/100 g product)	275	278	280	276
Crumb porosity(% volume)	68.8	72.1	75.8	73.9
Crumb elasticity (%)	95.2	96.3	96.7	96.8
Diameter/height ratio (cm)	0.429	0.466	0.500	0.487
Dough moist (%)	33.94	35.14	37.43	39.49
Product moist (%)	27.65	31.26	34.46	36.76
Dough acidity (acidity degrees/100g product)	0.56	0.69	0.74	0.85
Product acidity (acidity degrees/100g product)	0.09	0.1	0.11	0.12

Centralizing the obtained data, it may be said that, in all cases in which apricots paste was added, the obtained products were proportional, specific to the assortment, the volume-visually appreciated-was higher than the witness sample volume, the products were not excessively flattened or curved.

For H/D ratio values ranging between 0,4 - 0,5, it is considered that the bread volume and shape are adequate, over 0,5 the bread is curved and below 0,4 the bread is flattened. It can be seen that, upon apricot addition, the bread volume rised; thus, for upon a 10% addition, H/D ratio ranges in the proper limits.

Analyzing the porosity aspect, it was found that, in the case of 10% apricot addition, the pores aspect is mentained. From the data presented in *table 2*, it can be seen that all samples volume was, no exception, higher than the witness sample volume, the porosity was more higher and uniform, the elasticity better (*table 2*), and the crust exhibited a more developed color due to Maillard compounds formed during baking (Scanlon, 2001).

Also, previously baking, the dough moist is higher (34.49%) in the sample with 15% apricots in comparison to the witness sample (33.94%), and decreases after the baking, to 36.76% and 27.65%, respectively, as a result of the colloidal processes (protein substances coagulation and starch gellification) that take place during baking. The higher moist of the samples supplemented with apricot, in comparison with the witness sample, is given by the apricot paste contribution with water.

Regarding the dough and final product acidity, this has a higher value before baking (for example, 0.85 degrees in the sample with 15% apricots), value that decreases to 0.12 degrees as a result of the biochemical processes (enzymes activity) that take place during baking.

The high acidity of the dough with apricot addition, is higher than the witness sample acidity, due to the presence of the organic acids in the apricot chemical composition.

- ***Bread rheological features evaluation***

The bread assortments with different amounts of apricot addition (5%, 10%, 15%) were submitted to compression tests. As follows, the tests applied on the various bread assortments, are presented. Experimentally, for the compression, the dependence F =f(t) was obtained. in order to calculate the rheological features of the apricot supplemented bread, this dependence was transformed into τ =f(ε) (Simatos, 1995; Steffe, 1996; Stoin, 2009).

The graphical τ =f(ε) is not a linear dependence, but in the small deformations domain, the dependence is linear, and from its slope, the compression modulus was calculated (Mateescu, 2001; Swyngedau, 1991).

The experimental compression curves and linear specific deformation upon which, sample ruptures are initiated, respectively, for the witness bread samples and bread samples with 5%, 10% and 15% apricot addition, compressed with a constant speed to γ_c = 0,4 - 0,6 , are shown in *figures 1-4.*

For the same bread assortments, *table 3* presents the values of the compression modulus, values calculated from the compression curves.

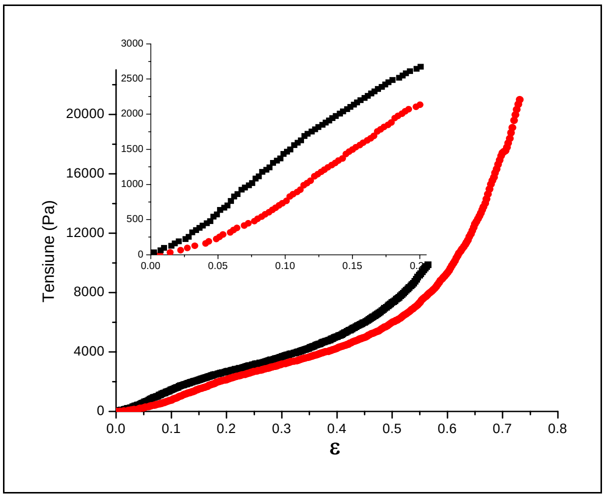

Figura 1. Compression curves for the witness bread (without apricots) (■ sample 1; ● – sample 2)

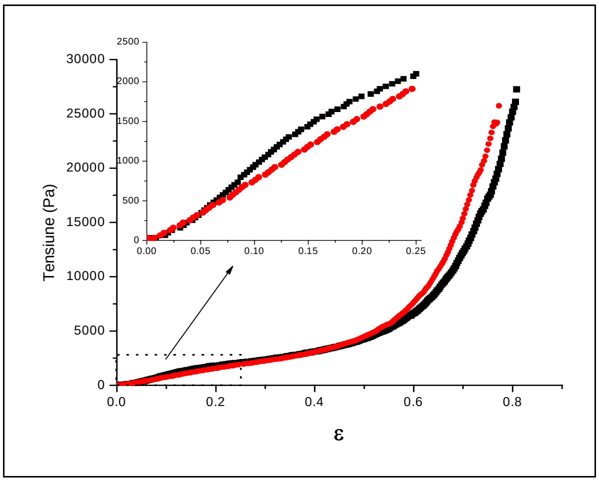

Figura 2. Compression curves for the 5% apricot supplemented bread (■sample 1; ● – sample 2)

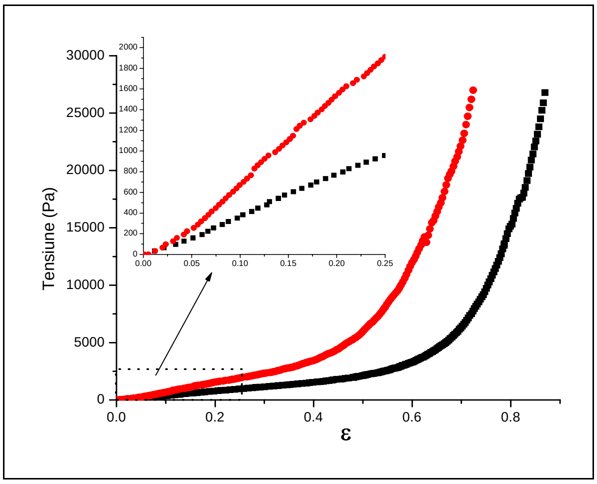

Figura 3. Compression curves for the 10% apricot supplemented bread (■sample 1; ● – sample 2)

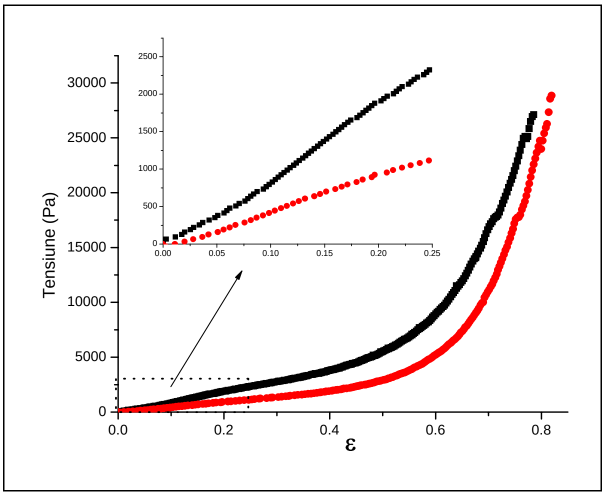

Figura 4. Compression curves for the 15% apricot supplemented bread (■-sample 1; ● –sample 2)

Tabelul 3. Apricot content influence on Young modulus for the obtained bread assortments

Assortment (% apricots)	Sample number	Young modulus (Pa)	Young modulus Average value (Pa)
0	1	16550 ± 110	15290 ± 90
	2	14020 ± 70	
5	1	11370 ± 90	9740 ± 60
	2	8110 ± 30	
10	1	4010 ± 30	6100 ± 50
	2	8180 ± 60	
15	1	7580 ± 120	6440 ± 90
	2	5290 ± 60	

It can be seen from *figures 1-4,* a sigmoid dependence for $\tau = f(\varepsilon)$, for all bread assortments. The first part of the sigmoid for $\varepsilon < 0.2$ may be a result of the elastic compression of the bread crumb. On this portion that is for small deformations the bread crumb behaves as an elastic material with spongy structure (like a sponge). Having in view these specifications, the compression modulus of the bread crumb for the tested assortment, was calculated from the slope of this portion approximated as linear.

Also, from *table 3* it can be seen that, the 10% apricot supplemented bread has the lowest compression modulus, which means that this bread assortment is the most elastic. The second portion, more flattened, situated around values $\varepsilon \in (0.2 - 0.6)$, corresponds to the compression domain, in which ruptures of the gas bubbles walls from inside the bread crumb appear. The start of this portion corresponds to the breaking point, which has the coordinates ε_r and τ_r. The ε_r values from *figure 3,* suggest also, that the samples with 10% apricots have the highest elasticity, because the first ruptures into the bubbles walls, appear at $\varepsilon_r \cong 0.23$.

Also, from *figure3,* it can be seen that, for $\varepsilon = 0.15$, the compression tension necessary for reaching this deformation, is around 6100 Pa, for the 10% apricot supplemented bread. This is an extra proof of the special elasticity given by the apricot paste, to the bread crumb. On the last portion of the sigmoid, corresponding to a value $\varepsilon > 0.6$, a high increase of the slope value can be noticed. This portion may be a result of the sample compression, from which all the gas bubbles were removed.

Regarding the apricots paste homogeneity from the bread dough, according to *figures 2-4,* it can be seen that in the 5% apricot paste supplemented bread, this was the best included into the dough upon kneading.

Having in view that, kneading was performed manually, and the 5% addition was better made uniform into the dough, it is recommended that, in the case other ingredients addition, other than the basic ones, the kneading must be performed mechanized, for a better homogenization inside the dough.

Thus, it is observed the influence that the apricot content has on the overall rheological studied features. The dependence between the compression modulus and the apricots content, from *figure 5,* emphasize that a 10% apricots content (the lowest Young modulus value is 6100 Pa), provides the best elasticity for the bread crumb.

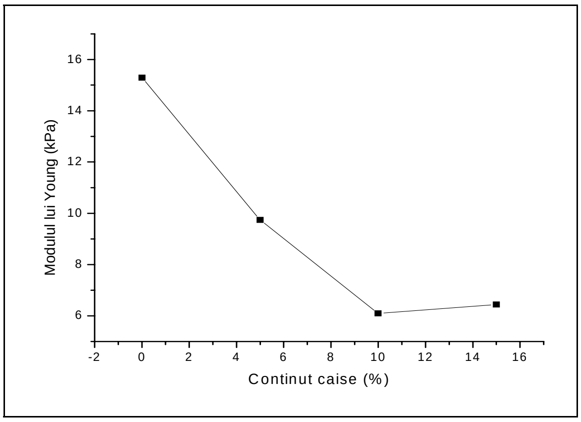

Figure 5. Apricot content influence on the Young modulus value for the studied bread

4. Conclusions

By apricot supplement in the bread obtained with the classical method, results a bread assortment with high nutritional value as a result of the vitamins and mineral salts contribution brought by these.

Additionally, beside improving the processing features, the advantages of apricot addition, as a secondary helping ingredient of the bread, are: rising the bread volume, improving the crumb structure and increasing its "shelf life", as a result of the natural sugars and organic acids content.

Also, 10% apricot addition has the best influence on the dough rheological features improves the elastic properties of the bread crumb.

Thus, the experimental data suggest that apricot addition can be successfully used in bakery.

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