

Effect of Beer Yeast on the Quality of Wheat Bread

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Abstract— The effect of beer yeast on quality of wheat bread was studied. Based on the studies it was found that the samples with partial replacement of water and fresh yeast with beer yeast for floor bread, has a higher volume compared to the control sample. Excepting the floor bread with full replacement of water and fresh yeast with beer yeast, which has a lower volume. The samples with full replacement of water and fresh yeast with beer yeast, it is obtained formed bread volume lower than those of the control sample. Replacement of fresh yeast with beer yeast positively influence on the sensory profile of the product by the indicators – volume, taste and odor. Beer yeast improves a porosity of wheat bread.

Keywords— Quality, Wheat bread, Beer yeast, Sensory evaluation.

I. INTRODUCTION

One of the oldest known biochemical processes is a production of beer and bread by fermentation (Linko et al., 1997). The relationship between the fermentation process and the quality of the final product has not yet been fully studied (Mondal et al., 2008). The final product characteristic depends on several factors – specific loaf volume, crumb structure. One of the most important quality indicators is a specific loaf volume of the bread. According to analyses performed for a specific loaf volume, different samples involved with bread yeast *S. cerevisiae* T-58, have the highest results (4.45 ± 0.2 mL/ g), and those in which is used *S. cerevisiae* US-05 have the lowest specific loaf volume (2.89 ± 0.1 mL/ g) (Heitmann et al., 2015). Considering the results for specific loaf volume, it can be concluded that the products by the yeast *S. cerevisiae* T-58 are best suited for baking purposes, as having a high specific loaf volume. The crust colour is formed by the reaction of Maillard and caramelization. This complex series of reactions between reducing sugars and amino acids leads to the colour formation and taste of bread crust. There was evidence of significant differences between the bread samples prepared with various yeast (Heitmann et al., 2015). Lightness (L^*) of the crust varies widely between 35.79 (for samples with *S. cerevisiae* US-05) to 44.86 (for samples with *S. cerevisiae* WB-06). The differences in the results for L^* are estimated on the basis of Maillard reaction and processes of caramelization which are influenced by the quantity of water, reducing sugars and amino acids. As more is the quantity of such substances such more pigmented compounds will be formed, which leads to brown of the bread crust. Dark skin may be due to the ability of yeast to produce protease, which leads to the formation of amino acids. On the other hand browning of the crust may be associated with the quantity of reducing sugars which are not metabolized by the microorganisms during the fermentation (Heitmann et al., 2015).

Literary sources do not provide complete information about the effects of beer yeast on the quality of wheat bread.

Therefore, the general objective of this study is to determine the influence of beer yeast in different quantity on the quality of wheat bread.).

II. MATERIALS AND METHODS

Materials

A standard commercial grade wheat flour type 500 (moisture – 10.6 %), baker’s yeast, salt and beer yeast were used for bread formulation.

Methods

Baking test

Wheat flour, salt, and fresh yeast as well as water (as guided by the preliminary baking tests and the results of farinograph measurements) is mixes in dough. The dough was prepared at a temperature 29-30 °C; 20 min resting time, bread formation, final fermentation – 60 min at 35 °C, baking temperature – 17 min for floor bread and 22 min for formed bread at 220-230 °C.

Determination of the H/D index

The diameters and height of the bread samples were measured 10 times each and the mean values were determined. On the basis of the results the H/D index (the ratio of height to diameter of bread) of bread was calculated.

Determination of loaf volume of bread

The loaf volume of each bread sample was measured 120 minutes after the loaves were removed from the oven, by bread volumeter with seed displacement method using poppy grains (A.A.C.C., 2000).

Determination of specific loaf volume of bread

Specific loaf volume of bread was calculated as the ratio of Loaf volume of bread and bread weight.

Sensory evaluation (Sensory analysis, 2003) – Sensory evaluation of bread was performed by hedonic test according to ISO 8586:2012 with the following indicators: volume, crust color, crumb color, odor, taste, bitterness and aftertaste. Briefly, the samples were sliced (slices about 1.5 cm thick), coded and served to untrained consumers. The panel consisted of 15 consumers (22-43 years old), who evaluated the bread’s acceptability. The degree of liking for different types of bread based on a nine-point hedonic scale (1: dislike extremely, 5: neither like nor dislike, 9: like extremely). Plain water was used for mouth rinsing before and after each sample testing.

TABLE 1. Basic recipe for wheat bread.

Ingredients	Quantity	
	%	g
Wheat flour, t. 500	100	500
Water	55	275
Fresh yeast	2.0	10
Salt	1.5	7.5

The studies are made with partially (1/3 and 2/3) and full replacement of water and fresh yeast with beer yeast. The quantities used for analysis are presented in table 2.

TABLE 2. Recipes for wheat bread with beer yeast.

Samples	Fresh yeast quantity, %	Replacement of water with beer yeast
AB1	2.0	1/3
AB2	2.0	2/3
AB3	1.5	1/3
AB4	1.5	2/3
AB5	0.5	1/3
AB6	0.5	2/3
AB7	0.0	1/3
AB8	0.0	2/3
AB9	0.0	3/3

III. RESULTS AND DISCUSSION

Based on the method mentioned by Plovdiv, UFT, the comprehensive baking assessment of bread is made using baking laboratory test. Thus, describing standard indicators of both types of bread can be obtained by evaluation the influence of beer yeast on the bread quality.

Following baking laboratory test, there is evaluation of specific loaf volume of sample breads (figure 1).

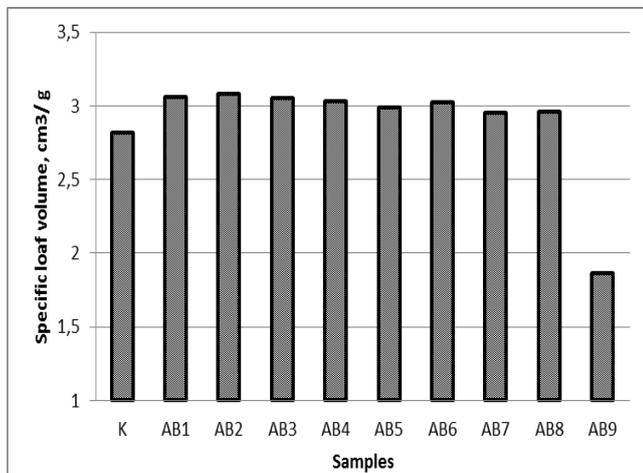


Fig. 1. Specific loaf volume of floor bread with partially (1/3 and 2/3) and full replacement of water and fresh yeast with beer yeast.

The addition of beer yeast increased the values of loaf volume of floor bread. Bread samples AB1 and AB2 obtained the best results (3.06 and 3.08 respectively). With the increase in the percentage of beer yeast, the loaf volume decreased. The decrease in loaf volume may be attributed to lower gas retention of dough or to its toughening effect on gluten proteins. This may be due to the stiff consistency of dough which is an indicator for a decrease in the water absorption of the samples. Low values indicated a dense and compact bread crumb.

According to Sullivan et al. (2011) and Nwosu et al. (2014), the effect of different flour (barley, cassava flour) addition on wheat flour decreases the loaf volume and the specific loaf volume of bread.

On the other hand the test sample with full replacement of water and fresh yeast with beer yeast (sample AB9) has a lower value for the specific volume compared to the control sample K. The samples AB7 and AB8 (fully replacement of fresh yeast and partially (1/3 and 2/3) replacement of water with beer yeast), for floor bread, has a higher volume compared to the control sample. This leads to the conclusion that beer yeast positively influences the properties of dough, respectively bread and suitable substitute for fresh yeast in bread.

The index H/D is determined by the ratio between the height and the diameter of the bread after baking. Figure 2 showed the index H/D of the control and test samples of flour bread.

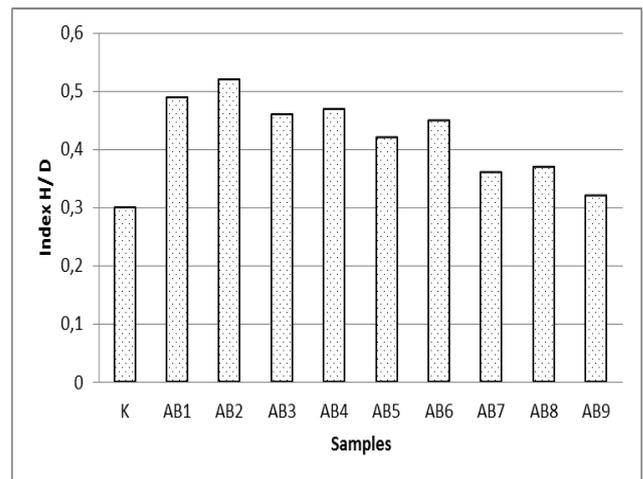


Fig. 2. Index H/ D of floor bread with partially (1/3 and 2/3) and full replacement of water and fresh yeast with beer yeast.

From the results obtained for the index H/ D of wheat bread by replacing 1/3 of the water with beer yeast is observed that the addition of beer yeast index H/ D increased relative to the control sample by 63.3 %. The control bread sample had the lowest H/D index (0.3). The dough with 2 % yeast and 1/3 replacement of water it is significant increase in sample AB1 – 0.49 by 0.19 units to control.

With addition of beer yeast (2/3) it is obtained bread with high index H/ D. With decreasing a quantity of fresh yeast the results also decreased. The sample AB8 (0 % fresh yeast) has a higher index H/ D than that of the control sample – respectively by 26.7 %.

Parallel with this studies on the effects of beer yeast on quality of floor wheat bread, it is determined the result for formed bread.

Figure 3 compares the results to a specific loaf volume of the experimental and control sample bread with 1/3 and 2/3 replacing of water with beer yeast.

Results specific loaf volumes of formed bread are similar to those of floor bread. With replacement of a part of the water with use of beer yeast and 2 % fresh yeast data demonstrate an increase in specific bread loaf volume (sample AB2). Reducing a fresh yeast quantity, the specific loaf volume decrease proportional to beer yeast quantity. The specific loaf

volume of the samples without fresh yeast and water (sample AB9) is lower by 29 % compared with that of the control sample. From the diagram it can be concluded an increase of specific loaf volume of the test sample by replacing the water with 2/3 beer yeast. Comparing the samples with 1/3 and 2/3 beer yeast it has seen an increase in specific loaf volume for samples AB1 and AB2 and decrease for samples from AB3 to AB8 the quantity of beer yeast used.

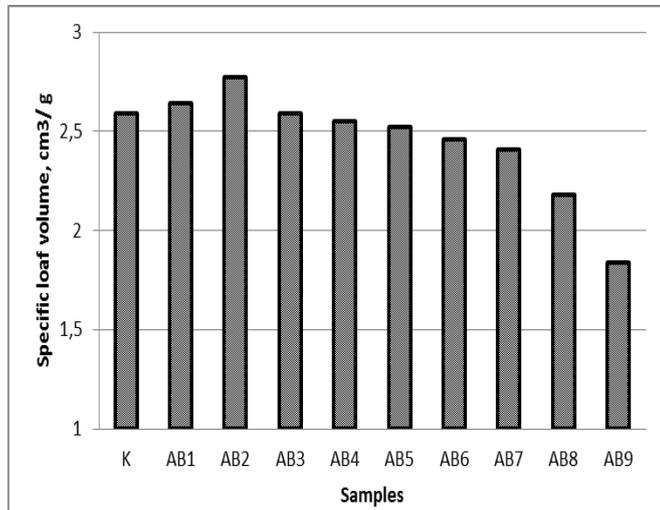


Fig. 3. Specific loaf volume of formed bread with partially (1/3 and 2/3) and full replacement of water and fresh yeast with beer yeast.

The studies carried out for the gas formation intensity, with a partial or full replacement of fresh yeast and the water with beer yeast showed a longer period of fermentation compared to fresh yeast used. These results are made earlier (a publication is in press).

Heitmann et al., 2015 found similar results in bread characteristics. The bread made with *S. cerevisiae us-05* with the lowest specific volume than the other samples.

Sensory Evaluation of Wheat Bread with Beer Yeast

After baking test and the results of specific loaf volume and index H/ D for making a sensory characteristic it is selected a control sample and the sample with the highest values for the parameters. AB2 sample and a control sample were assessed by 15 independent consumers, once familiar with the methodology of the study. Sensory evaluation of all bread samples prepared with 2.0 % fresh yeast and 2/3 replacement of water with beer yeast was conducted (fig. 4).

The results of test samples are significantly higher than control the following parameters: volume, odor, taste, aftertaste and bitterness. This may be due to increased gas formation and gas retention properties to the beer yeast, and secondary metabolites produced by beer yeast during fermentation. The consumers noted atypical odor and taste of test samples with beer yeast. It is more perceptible in test sample AB2. In the test sample the odor is light, pleasant, resembling odor of beer, while the taste – unobtrusive bitter taste, resembling beer. Bitterness is reported only in test samples. According to 9 consumers it is feel a pleasant bitter aftertaste. When comparing the test sample with a control

sample it is shows that the bread with beer yeast is obtained with better results for the taste. The values for this indicator for sample AB2 exceed those of the control sample by 2 units.

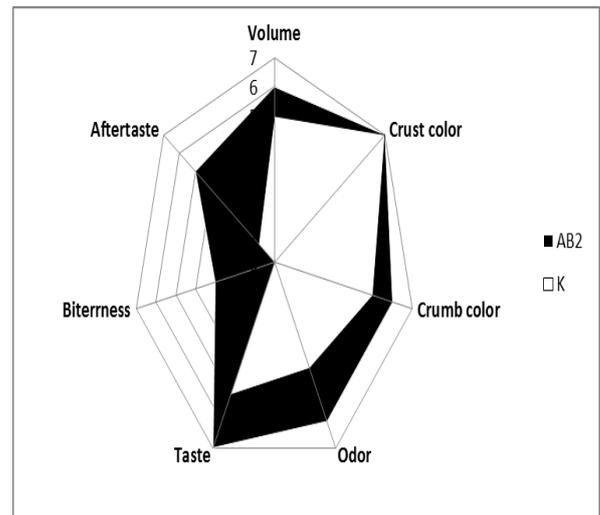


Fig. 4. Sensory profile of control sample and sample AB2.

The control sample shows saturated dark bread crust and crumb. According to the consumers the differences in crust color between the test and control sample is weak. There is a clear difference in bread crumb color. This may be due to the substantial quantity of reducing sugars and amino acids in dough after the fermentation of beer yeast.

The results from the analysis reported a higher volume of the test sample compared with the control sample. The difference between the test sample AB2 and control in percentage is 9.6.

It can be concluded that the replacement of fresh yeast with beer yeast has a positive effect on sensory characteristics of the finished product.

IV. CONCLUSIONS

Based on the studies it was found that the samples with partial replacement of water and fresh yeast with beer yeast for floor bread, has a higher volume compared to the control sample. Excepting the floor bread with full replacement of water and fresh yeast with beer yeast, which has a lower volume. The samples with full replacement of water and fresh yeast with beer yeast, it is obtained formed bread volume lower than those of the control sample. Replacement of fresh yeast with beer yeast positively influence on the sensory profile of the product by the indicators – volume, taste and odor. Beer yeast improves a porosity of wheat bread.

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