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INFLUENCE OF DRIED PLANT MATERIAL ON BAKED-PRODUCT QUALITY

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The chemical composition of sea buckthorn meal, stevioside sweetener, lemon and orange zest is studied. The recipe of a new low-calorie bun was established with mathematical modeling. Yeast activity, active and titratable acidity of the dough in dynamics and moisture of the dough were studied. Titratable acidity and moisture of curb were studied in the baked products. The results of organoleptic and microbiological researches were presented. Possibilities of using dried plant materials in baked products were discovered.

Key words: *bun, sea-buckthorn meal, stevioside, acidity, yeast activity, moisture, organoleptic research*

INTRODUCTION

The development of medicinal products is a global problem of people nutrition in Russia. There is an increase of such diseases as diabetes, obesity and other gastrointestinal problems in Kaliningrad region. Sugar is a product of daily-mass consumption that, simply, gives us energy. But, in fact, these diseases are often caused by enormous consumption of sugar-containing products. So we need to control amount of sugar we consume every day in order to prevent dangerous diseases.

According to the marketing researches it was conducted that bakery products are a popular products of daily mass consumption. Also it was found out that bakery products assortment is about to be developed by enriching bakery products with secondary raw plant materials.

Bakery products, in definition, should contain 14% or more of sugar or fatty components [1]. Bakery products consuming causes health problems by increasing blood sugar level. That is why it was decided to give up the use of sugar in bakery products.

However, sugar consumption causes problems not just with excess weight, but with blood vessels too. Sugar forces premature aging of blood vessels. The glucose in sugar destroys protein

in organism cells, blood, etc. Also sugar consumption results in insulin resistance, so then it causes diabetes of 2nd type [2]. In order to strengthen the walls of blood vessels, it was decided to enrich bakery products with natural antioxidants – bioflavonoids.

Another problem of people nutrition is a lack of alimentary fiber. The lack of alimentary fiber causes such gastrointestinal problems as: constipation, bloating, cramps, stomachaches. Therefore, alimentary fiber sources usage in bakery products will solve the global nutrition problem [3].

OBJECTS OF RESEARCH

Stevioside sweetener has zero glycemic index, that allows diabetics to use this product without any risk for their health.

Sea-buckthorn meal is rich in protein (about 23% in mass), there are 18 unical amino acids. 1/3 of their amount is essential such as lysine, threonine, valine, methionine, thryptophan, isoleucine, leucine, phenylalanine. The meal contains minerals such as calcium, copper, zink, iron and phosphorus [4].

Lemon and orange zest are rich in pigments that are carotenoids – predcessors of vitamin A. It also has essential oils which help our digestive tract to process food faster.

Butter bakery product, according to the State Standard 32677-2014, is a bakery product, with 14% or more sugar/fat content. Yeast usage in dough-making is the most popular way to produce buns which are of high quality. Bakery products are popular among the residents of Kaliningrad region. So buns can be called daily-mass consumption product. The basic recipe of the bun was taken from TTK 3043 «Dorozhnaya bun» [5].

PURPOSE AND COURSE OF RESEARCH

The purpose of the research is to find out and explain how dry plant components affect the organoleptic, physical and chemical parameters of bakery products. Such enriching components as sea-buckthorn meal, stevioside sweetener, lemon and orange zest were studied.

The course of the research included following stages:

-assessment of yeast activity;

-determination of titratable and active acidity of the dough;

-determination of dough moisture;

-baking;

-determination of titratable and active acidity of the baked products;

-determination of the baked products moisture;

-organoleptic research.

METHODS OF RESEARCH

The study of the lifting force of the yeast was carried out using the method of dough ball floating over a certain period of time.

The active acidity of the dough was determined by using a pH-meter, the titratable acidity was determined during titrating with an alkali solution.

The moisture of the dough and finished products was determined using an accelerated method with the help of a high frequency device of Chizhov.

The acidity of the finished products was determined according to the State Standard 5670-68 “Bakery products. The method for acidity determination".

The organoleptic research was carried out taking into account a 5-point organoleptic scale developed for each sample, by sensory and visual methods.

RESULTS OF RESEARCH

To study the lifting force of the yeast, control and experimental dough samples weighing 20 g were taken. Both samples were immersed into a 250 cm^3 glass filled with water at a temperature of 32 ° C. The glasses with the dough samples were placed into a thermostat at the same temperature. The obtained results are shown in figure 1.

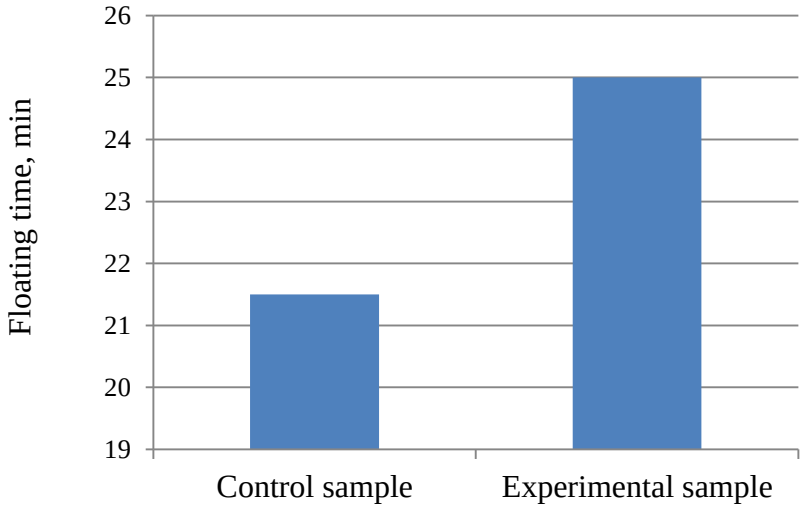


Figure 1 – Results of yeast lifting force.

The lifting force of dry yeast during the producing cycle should be less than 30 minutes. As it can be seen in figure 1, stevioside provides the highest fermentation activity of yeast, in contrast to sugar.

The study of the acidity in dynamics was conducted in order to determine the end of the dough fermentation. The active acidity is an indicator that displays the concentration of free hydrogen ions formed during the dissociation of acids. There are carbonic, acetic, lactic, citric and other weakly dissociating acids in wheat flour dough.

In order to check the active acidity of the dough, the sample of dough weighing 5 g was used. The dough was ground in a mortar with 50 cm^3 of distilled water. The pH-meter was immersed into the beaker with the sample so that the tip of the analyzer did not touch the walls and the bottom of the beaker. The results of dough active acidity in dynamics are shown in figure 2.

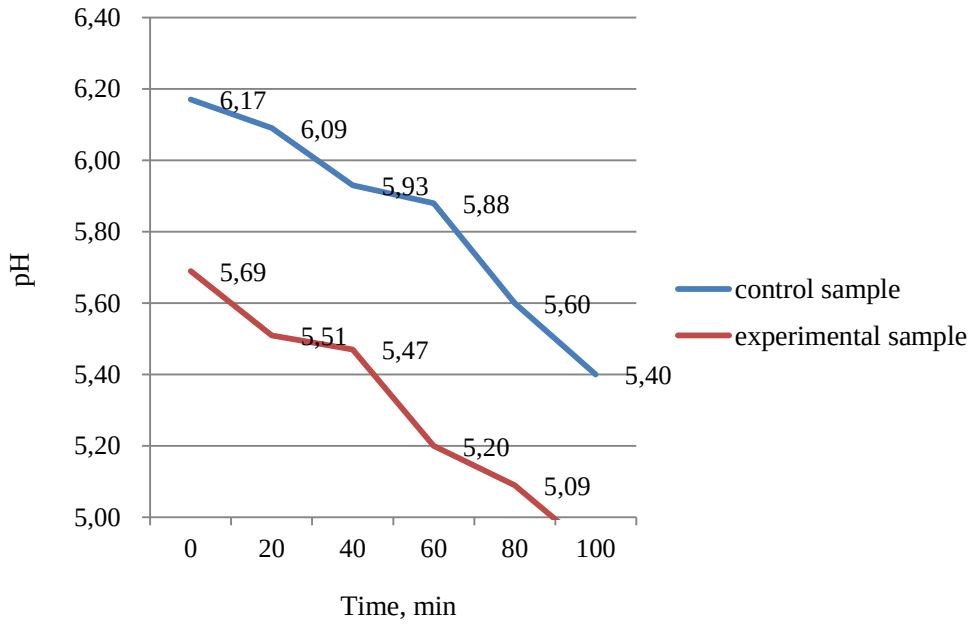


Figure 2 – Active acidity of the dough in dynamics

As it is seen in figure 2, it is possible to describe experimental sample as a sample with a greater free acids amount. This phenomenon is explained by dry plant components presence in dough.

Titratable acidity is the sum of acids and their acid salts contained in the substrate, including dissolved carbon dioxide, as well as the amount of soluble protein compounds, which are amphoteric electrolytes. The results of the dough titratable acidity determination in dynamics are shown in figure 3.

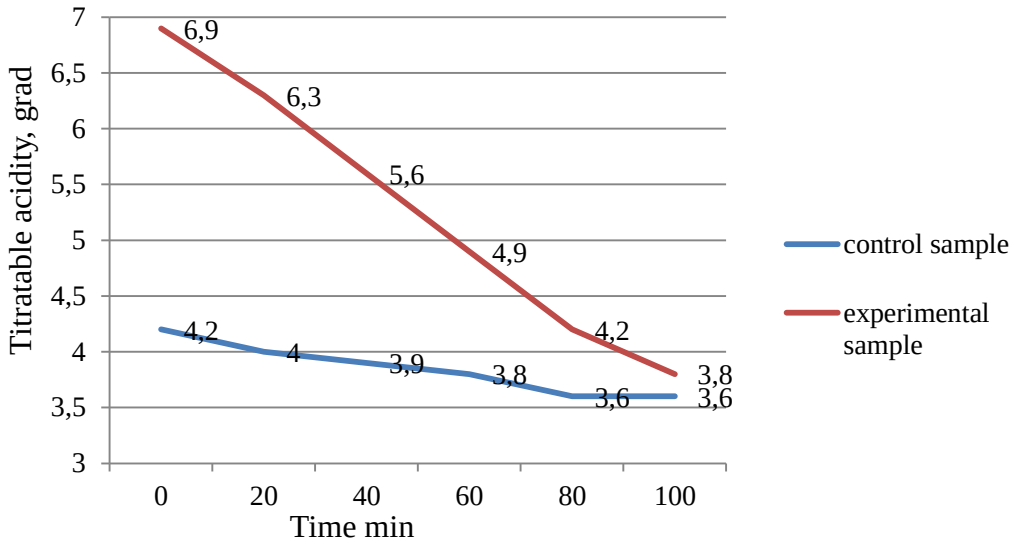


Figure 3 – Titratable acidity of the dough in dynamics

Taking into consideration the results of the dough titratable acidity, it is possible to make a conclusion about more active fermentability of the dough. It means that the experimental sample has larger number of compounds that affect the value of titratable acidity.

Dough moisture was determined using an accelerated method with a help of a high frequency device of Chizhov at the temperature of 160 ° C. A sample of dough weighing 5 g was placed into a pre-tared foil bag. The drying time was 5 minutes [6].

The results of determining dough moisture are presented in table 1.

Table 1 – Moisture of dough samples

The name of the sample	Moisture, %	Normative value, % [7]
Control sample	30,05 ± 0,50	33,00 ± 0,50
Experimental sample	32,25 ± 0,50	33,00 ± 0,50

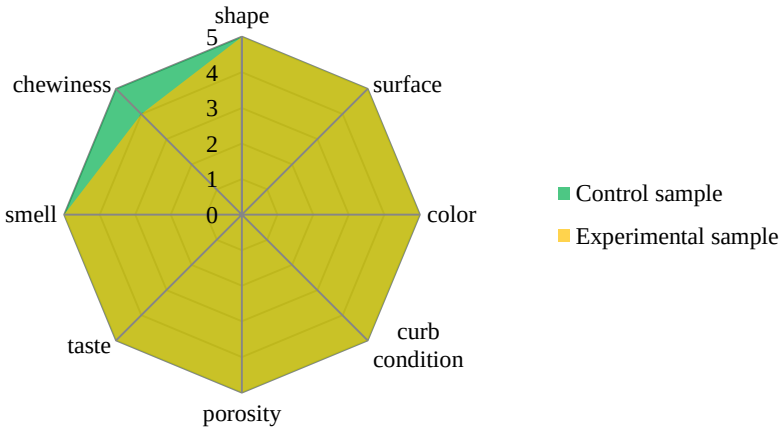
The experimental sample contains more moisture than the control sample. That is explained by the presence of additional moisture from enriching components.

After the quality indicators of the dough had been examined, the dough pieces were baked in a combi-steamer at a temperature of 180 ± 5 °C during 12 minutes.

In order to check organoleptic characteristics of the baked samples, 10 respondents were involved. They rated the products according to individually developed 5-point scales for each sample.

They rated the products according to such parameters: appearance, shape of the product, surface condition, smell, taste, chewiness, crumb condition, porosity.

The results of the organoleptic research were combined into profilograms presented in figures 6.



Picture 6 – Organoleptic quality assessment of the bun samples

As it shown in figure 6 all the products are of great quality. Small degradation of chewiness in experimental sample is easily explained by shredded sea-buckthorn seeds presence.

Physicochemical characteristics of the baked products are easily described according to their crumb moisture and titratable acidity. The methods for baked products are the same as for dough. The obtained results were combined in table 2.

Table 2 – Physicochemical characteristics of baked products

Name of characteristic	Control sample	Experimental sample	Normative value, not more than [7]
Crumb moisture, %	27,98 ± 0,50	32,72 ± 0,50	34,00± 0,50
Titratable acidity, grad	2,4 ± 0,5	2,1 ± 0,5	2,5± 0,5

As it is show in table 3, all the results match the state standards.

In order to confirm the safety of the products, microbiological research was made. Microbial contamination, the presence of *E. coli* bacteria group, molds and yeast presence were checked [8]. The obtained results are presented in table 3.

Table 3 – Results of baked products microbiological research

The name of the sample	Total aerobic mesophilic, CFU/g, no more	Molds	Yeast	*E.coli* bacteria group, not allowed in 1,0 g of product
Control sample	$1 \cdot 10^3$	Not detected	Not detected	Not detected
Experimental sample	$1 \cdot 10^3$	Not detected	Not detected	Not detected

According to the results of microbiological research, all of these baked products are safe for consumption.

CONCLUSION

Main nutritional characteristics of dried plant materials such as sea-buckthorn meal, stevioside sweetener, lemon and orange zest were studied.

Some main physicochemical properties of two samples of wheat flour dough were studied and compared. The stevioside provides higher yeast activity than sugar. The experimental dough sample has greater free acids amount. This is explained by plant components presence. In contrast to the control dough sample, the experimental dough sample has higher titratable acidity value. The experimental dough sample has larger number of compounds that affect the value of dough titratable acidity. Also, it was found out that the fermentation has ended after 100 minutes. The dough samples were different in terms of total moisture content. The experimental sample has higher moisture, than the control sample. That is explained by the presence of additional moisture from enriching components.

Organoleptic research was made with 10 respondents involved. The results of organoleptic research proved that all of the buns were of great quality. The experimental bun had worse chewiness, in contrast to the control sample, because of shredded sea-buckthorn meal seeds presence.

Crumb moisture and titratable acidity of baked products were studied and compared to the State Standard values. The experimental sample has higher titratable acidity level and higher crumb moisture value, but all the results match the State Standard.

Microbiological research was made in order to confirm hygienic safety of baked products. Microbial contamination, the presence of *E. coli* bacteria group, molds and yeast were checked. All the buns were made under aseptic condition. Both samples were low in total aerobic bacterial count. Low level of bacterial contamination is caused by high baking temperature and hygienic safety of used ingredients. The *E. coli* bacteria group, molds and yeast were not detected in bun samples. The absence of these microorganisms confirms the safety of both baked products for people.

In fact, dry plant components usage in bakery products is a good choice. It can manage a lot of problems, connected not just with nutrition. Using dry plant components, including secondary raw plant materials, can solve the plant origin waste to minimum. Dry plant components help to reduce calorie content, improve the quality of dough and baked products, improve the taste and appearance of the final product. Dry plant components usage allows to enrich bakery products with additional sources of alimentary fiber, minerals, protein.

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ВЛИЯНИЕ СУХИХ РАСТИТЕЛЬНЫХ КОМПОНЕНТОВ НА КАЧЕСТВО ХЛЕБОБУЛОЧНЫХ ИЗДЕЛИЙ

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Исследован химический состав облепихового шрота, сахарозаменителя стевиозида, цедры лимона и апельсина. Представлена рецептура новой низкокалорийной булочки, полученный с помощью математического моделирования. Были исследованы показатели активности дрожжей, активная и титруемая кислотность теста в динамике, влажность теста. Были исследованы показатели титруемой кислотности и влажности мякиша готовых изделий. Представлены результаты органолептического и микробиологического исследования. Обоснованы возможности использования сухих растительных компонентов в технологии производства хлебобулочных изделий.

Ключевые слова: *хлебобулочное изделие, облепиховый шрот, стевиозид, кислотность, активность дрожжей, влажность, органолептические исследования*