IRSTI 65.33.29

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https://doi.org/10.55956/RZFJ4016

THE USE OF STARTER CULTURES OF FERMENTED PRODUCTS – KOMBUCHA TEA MUSHROOM AND PICKLED CABBAGE BRINE IN BREAD PRODUCTION

Abstract. The article considers the possibility of using natural starter cultures - fermented kombucha juice and pickled cabbage brine in bread production. The recipe and technology of wheat bread using a starter culture of spontaneous fermentation have been developed and its quality indicators have been determined.

Keywords:. fermented cabbage juice, kombucha, sourdough, bread.

Ivannikova N.V., Antimonova O.N. The use of starter cultures of fermented products - kombucha tea mushroom and pickled cabbage brine in bread production // Mechanics and Technology / Scientific journal. – 2023. – No.4(82). – P.60-66. https://doi.org/10.55956/RZFJ4016

Introduction. Today, the growing market potential for healthy food products requires a new approach to technological production techniques. The consumer can make an informed choice in the direction of a particular food product and its cooking technology. Thus, bread, one of the most affordable and socially significant products, is a suitable object for improving quality indicators. Among the many ways of making bread, the use of starter cultures, including spontaneous fermentation, is of particular interest. There is a particularly growing interest in artisanal sourdough baking. Sourdough bread is healthy, does not contain industrial pressed yeast, and with a wide range of useful properties has become an excellent addition to any diet, helping to reduce or maintain weight. It is a real storehouse of antioxidants that can protect the body from oxidative stress, reduce the risk of chronic diseases such as heart disease and cancer. Fermentation using natural wild yeast and lactic acid bacteria leads to the fact that bread is digested more slowly and causes a smaller spike in blood sugar levels, that is, a low glycemic index, reduces the level of harmful cholesterol. Sourdough bread is digested more easily than regular bread fermented with baker's yeast. This advantage of sourdough bread can be explained by the prebiotics present in it, as well as its probiotic properties. A healthy gut microbiome is essential for a strong immune system, as it helps fight harmful pathogens and supports overall immune function [1].

The purpose of the study is to develop sourdough bread using fermented products - pickled cabbage and kombucha brine. To achieve this goal, the following tasks are defined in the work: to argue the relevance of using fermented products-cabbage brine and kombucha, to develop a technology for making yeast-free sourdough bread, to determine the qualitative characteristics of the products. The object of the study was fermented cabbage juice and Chinese kombucha - a symbiotic culture of bacteria and yeast in the form of a pancake gives an excellent fermented product enriched with vitamins, probiotics, enzymes, active substances and acids in the process of vital activity. Amazing informative components of the kambucha: bacteria are primarily responsible for the production of organic acids (lactic acid and acetic acid), which contribute to the taste, texture and storage quality of sourdough bread. It is known that fermented kombucha juice, which is native to China, is a well-known improved version of a functional nutrition product that prevents the development of pathogenic cells, and therefore a product that is used for cancer prevention [2]. Fermented cabbage juice also has powerful antioxidant properties, helps to suppress the activity of Helicobacter pylori, a bacterium suspected of causing peptic ulcer disease. The presence of organic acids in the starter culture suppresses the influence of gram-positive and gram-negative microorganisms.

The starter cultures were prepared on wheat and rye flour with the replacement of water with non-standard combinatorics - pickled cabbage brine and fermented kombucha juice. Fermentation in the presence of leaven of pure cultures of lactic acid bacteria Laktobacillus plantarum was carried out for 5 days. The fermentation process during the preparation of starter cultures allows for microbiological activity by neutralizing phytic acid, which is a trigger for people with gluten sensitivity. It was 2004 when the scientists found that while preparing starter cultures, the components of the proteins gliadin and glutenin are changing, which are toxic to people suffering from flatulence, irritable bowel syndrome, and celiac disease. Phytase, which has been obtained as a result of prolonged fermentation in starter cultures destroys phytic acid, acting as an inhibitor. It is phytase which blocks the absorption of certain minerals by the stomach, such as Ca, Fe, Mn, Zn and introduces them from the body, making minerals more accessible. Fortification of bread with nutrients useful for the human body contributes to the improvement of the population, therefore it is necessary to make a careful selection of ingredients [3].

Conditions and methods of research. A spesific range of special research methods are required to study the specifics of the production of sourdough bread. The first of them was the method of studying the fermentation of semi-finished products - sourdough on fermented kombucha juice and pickle of sauerkraut. The implementation of starter cultures is a promising way to prepare bakery products [4]. The chosen technology is characterized by the efficiency and rationality of the management of starter cultures - the active ingredient of fermentation. The sourdough method was adopted as the basis for the scientific experiment of making bread. We have conducted experimental and control studies, having initially selected the ratio of the basic components of the formulation. Organoleptic, physico-chemical, and biochemical methods of analyzing raw materials, semi-finished products, and finished products were realised in the work.

Research results. “The preparation of a spontaneous fermentation starter is associated with a number of complex physical, biochemical and microbiological processes. The speed and nature of their course depends on various parameters of its preparation: the duration and temperature of fermentation, the acidity of the semi-finished product” [5]. The results were achieved when the options differed in one component of production and remained unchanged in the rest: this was how the

humidity and acidity of the starter cultures were controlled. The readiness of starter cultures was determined as a decrease in the rate of their gas formation after they reach their maximum. The samples hade been tested daily under thermostating: sample No. 1 - wheat starter culture on sauerkraut juice; sample No. 2 - rye starter culture on sauerkraut juice, sample No. 3 - wheat starter culture on kombucha juice and a control version of the starter culture. In this research we used the technology of removing a liquid five-day starter culture, which consists of the following stages: 1) the combination of flour and cabbage brine (water, fermented kombucha juice) in a ratio of 1:1, the fermentation time for each phase is 24 hours, the fermentation temperature is 30-31 ° C.; 2) the ratio of starter, flour and water is 1:1:1. The results of the qualitative indicators of starter cultures are shown in Table 1.

Table 1

Qualitative indicators of starter cultures

Name of indicators	Samples			
	The control option	No.1	No.2	No.3
Weight of flour, g	50	50	50	50
Weight of water, g	50	-	-	-
Weight of juice, g	-	50	50	50
2 day				
m before fermentation,		100	100	100
m after fermentation, g		82	83	84.6
t after fermentation, °C		26	26	25
The moisture content of the starter, W, %	62	61	60	61
Sourdough acidity, °N	13.0	16.6	19.6	23.5
3 day				
m before fermentation,	150	149	150	150
m after fermentation, g	142	141	145	115.8
t after fermentation, °C	26	26	26	27
The moisture content of the starter, W %	60	60	59	54
Sourdough acidity, °N	14.1	17.6	22.5	31.4
4 day				
m before fermentation,	150	150	150	150
m after fermentation, g	140	145	146	133
t after fermentation, °C	25	25	26	26
The moisture content of the starter, W %	60	61	61	66
Sourdough acidity, °N	14.9	15.1	27.4	16.4
5 day				
m before fermentation,	150	150	150	150
m after fermentation, g	147	146	148	141
t after fermentation, °C	28	28	28	28
The moisture content of the starter, W %	65	63	63	61
Sourdough acidity, final °N	15.3	17.3	23.5	16.6

The starter culture (Fig. 1) used as a baking powder in baking bread gives the product a specific aroma and taste, thereby improving its organoleptic properties.

Starter culture sample No. 1 | Starter culture sample No. 2 | Starter culture sample No. 3

Sample No. 1 | Sample No. 2

sample No. 1 – Hearth bread with sourdough from wheat flour using fermented pickle of sauerkraut; sample No. 2 – Hearth bread with sourdough from wheat flour using fermented kombucha tea mushroom product.

Figure 1. Samples of starter cultures and bread

Ferments on fermented products have a more active fermentation, but at the same time the process of assimilation of nutrients is slower, these ferments do not peroxide, do not liquefy, their porosity is higher [6]. Humidity is of great importance for the ratio of lactic and acetic acid formed. The higher the water content, the higher the lactic acid production and the lower the acetic acid production. The control sample was made according to the recipe of wheat bread with sourdough. As a result of biotransformation, lactic acid homo and heterofermentative bacteria are accumulated. The starter cultures had a bubbly structure, a pleasant smell with a slight sourness. The moisture content of starter cultures consists of average 60%. Sourdough is prepared on sourdough. The readiness of the sourdough was determined by increasing the volume by 1.5-2 times, at the end of fermentation, the dough was prepared. The control and experimental samples for experimental studies were obtained from wheat flour of the first grade according to a previously developed formulation using these starter cultures.

A series of trial laboratory pastries using fermented starter cultures of the specified composition was carried out. During the research, the most effective fermentation technologies for semi-finished products of sourdough, proofing parameters of dough pieces, baking modes of bakery products were selected. In our study a set of indicators that most strongly affect the overall attractiveness of ready-made bread for the consumer was selected: humidity, acidity, porosity and crumbiness of the crumb, as well as rheological characteristics of the bread crumb. The quality indicators of a series of starter cultures, dough, finished product samples, as well as an indicator of the resistance of bakery products to microbiological spoilage during storage have become the criteria for evaluating the technology.

Sample No. 2 had the best characteristics, although both prototypes have had sufficient porosity of the crumb. The porosity was 72%. Rheological characteristics of hearth bread samples were determined. As a result, the bread showed a decrease in baking losses, an increase in specific volume and less moisture loss, and a staling rate after 7 days of storage (staling slows down by 30-35%). Elastic and plastic deformations of wheat dough on sourdough (using pickled cabbage brine and kombucha juice) for bread were studied on a TexVol TVT - 300XP/XPH texture analyzer device. Figure 2 shows graphs for determining the plasticity of samples, i.e. the ability of the crumb to maintain deformation after removing the load. The spent time and the force for compression have been determined.

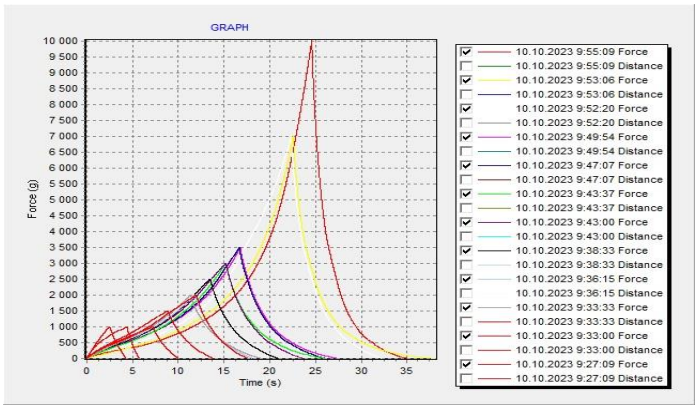

Figure 2. The results of single-cycle tests in a sample of sourdough wheat bread

All samples which have been investigated were characterized by high dimensional stability. Figure 2 shows the graphical dependences of the created loads on the sample, namely elastic deformation. Acceptable compression values for loads in weight equivalent have been determined – 1.5; 2; 2.5; 3; 3.5; 7; 10 kg. The samples withstood maximum loads of more than 10 kg. The dynamics of rheological tests in scientific work was required to study the structure and fundamental properties of the finished product. The volume of sourdough bread was determined using an electronic volume meter BVM-L370LC. According to the studied organoleptic parameters, all bread samples had the "good" quality category.

Discussion of scientific results. The paper proposes a discrete technology for making bread using biological ferments. To obtain them fermented juice of sauerkraut and kombucha is used. The results of the analysis indicate the prospects of using a consortium of these crops to obtain a probiotic starter culture for bakery products. Recipes for the preparation of sourdough and bread based on them have been developed and tested. In general, all experimental samples had fairly high quality indicators. As a result of the research, it was also found that the selected ratio of prescription components will give the optimal rheological profile to the test.

Conclusion. The analysis and systematization of scientific information have justified the expediency of using wheat starter cultures based on kombucha and cabbage juice. The introduction of starter cultures instead of yeast into the formulation can lead to a more healthy bread rich in biologically active compounds. The prepared starter culture based on non-standard fermenting microflora, such as sauerkraut juice and tea mushroom metabolism products makes it possible to obtain bread with a sufficiently loosened crumb and a very pleasant taste and aroma. It does not cause allergic reactions, it is fully balanced in its chemical composition and, most

importantly, without yeast. The proposed development of sourdough bread based on pickled cabbage brine and kombucha juice will expand the range of bakery products with an extended shelf life from natural raw materials - products in which all the nutrients inherent in nature are rationally used.

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Material received on 03.12.23.

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КОМБУЧА МЕН АШЫТЫЛҒАН ҚЫРЫҚҚАБАТ ТҰЗДЫҒЫНЫҢ АШЫТЫЛҒАН ӨНІМДЕРІН НАН ӨНДІРІСІНДЕ ҚОЛДАНУ

Аңдатпа. Мақалада нан өндірісінде табиғи ашытқыларды – ашытылған комбуча шырыны мен қырыққабат тұздығын қолдану мүмкіндігі қарастырылады. Өздігінен ашытылған ашытқыны қолдана отырып, бидай нанының рецептурасы мен технологиясы жасалды және оның сапасының көрсеткіштері анықталды.

Тірек сөздер: ашытылған қырыққабат шырыны, комбуча, ашытқы, нан.

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ИСПОЛЬЗОВАНИЕ ЗАКВАСОЧНЫХ КУЛЬТУР ФЕРМЕНТИРОВАННЫХ ПРОДУКТОВ – ЧАЙНОГО ГРИБА КОМБУЧА И РАССОЛА КВАШЕННОЙ КАПУСТЫ В ПРОИЗВОДСТВЕ ХЛЕБА

Аннотация. В статье рассмотрена возможность использования натуральных заквасок – ферментированного сока чайного гриба и рассола квашенной капусты в производстве хлеба. Разработана рецептура и технология пшеничного хлеба с использованием закваски спонтанного брожения и определены показатели его качества.

Ключевые слова: ферментированный сок капусты, комбуча, закваски, хлеб.