

BIOTECHNOLOGY SOLUTIONS FOR THE PRODUCTION OF DAIRY PRODUCTS WITH LONG SHELF LIFE IN KAZAKHSTAN

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ANNOTATION

The article is devoted to the issue of creating rational technologies for biologically complete, high-quality functional dairy products with long shelf life. The author analyzed the dynamics of changes in the acidity of buttermilk fermented in the presence of calcium pantothenate, carried out a regression analysis of changes in titratable and active acidity during the fermentation of buttermilk in the presence of soy flour in the production of a dairy dessert product with a long shelf life. The results of microbiological studies of the fermentation process have been obtained.

Keywords: immunomodulators, biocorrectors, probiotics, prebiotics, symbiotics, eubiotics, regression analysis

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In 2021, in his Address to the People of Kazakhstan, President Kassym-Jomart Tokayev touched upon a large block of issues on the development of the agricultural sector, as well as issues related to the processing of agricultural raw materials in Kazakhstan. He instructed to form a network of large ecosystems for the production and processing of agricultural products, including dairy products. To solve these tasks, the Ministry of Agriculture, within the framework of the implementation of the National Project for the Development of the Agro-industrial Complex of the Republic of Kazakhstan for 2021-2025, has set a goal of 80% to saturate the domestic market with socially significant food products of domestic production, including products largely imported from neighboring countries [1,2].

At the same time, in 2022, Kazakhstan approved a "Program for the development of domestic value and export-oriented industries" [3].

The expansion of the range of healthy food products is carried out on the basis of the use of modern achievements of nutrition science. Modern nutrition science is a rigorous scientific theory that has a set of biomedical and hygienic approaches to substantiating food requirements. When developing these requirements, ideas about functional norms of nutrition, ways to ensure food safety, as well as information about the real economic possibilities of society for the production of necessary products and the solvency of the population to purchase them are used.

For faster and more effective resolution of vital problems, one of the acquired, extremely promising, safe and economically feasible directions is the research, production and use of food additives (PD), biologically active additives (dietary supplements), as well as natural biocorrectors (NBK) of a new generation with functional properties and a wide range of practical applications. The use of biologically active additives, biologically active substances (BAS), immunomodulators, biocorrectors, macro- and micronutrients, probiotics, prebiotics, symbiotics, eubiotics in the production of dairy products, make it relatively easy and fast to fill the deficiency of micronutrients, change the metabolism of toxicants, strengthen the nonspecific resistance of the body, have a regulating and normalizing effect either on the body in as a whole, or on certain organs of the system or functions.

In this regard, it is especially important to create multicomponent functional dairy food products with high nutritional, biological value and containing biologically active substances of natural origin, which give the product protective and immune-modulating properties.

Considering the above, it is especially important to create multicomponent functional dairy food products with high nutritional, biological value and containing biologically active substances of natural origin, which give the product protective and immune-modulating properties. Therefore, in this research work, the goal is set: to create competitively capable domestic dairy-based products – fermented protein supplement and fermented milk dessert with its use.

The characteristics of almost all groups of propionic acid bacteria indicate that they are similar in their nutritional needs. Among the substances included in the spectrum of needs of most groups of propionic acid bacteria is pantothenic acid, the exchange of which is closely related to the exchange of vitamins C, B12, folacin.

In these studies, the calcium salt of D (+) pantothenic acid (Calcii pantothenas) was used. Synonym: vitamin B3. Its brief description is as follows. Calcium pantothenate is a part of coenzyme A, plays an important role in the processes of acetylation and oxidation, participates in carbohydrate, fat metabolism and synthesis of acetylcholine. In dietetics, it is used directly or

Figure 1 – Dynamics of changes in the acidity of buttermilk fermented in the presence of calcium pantothenate

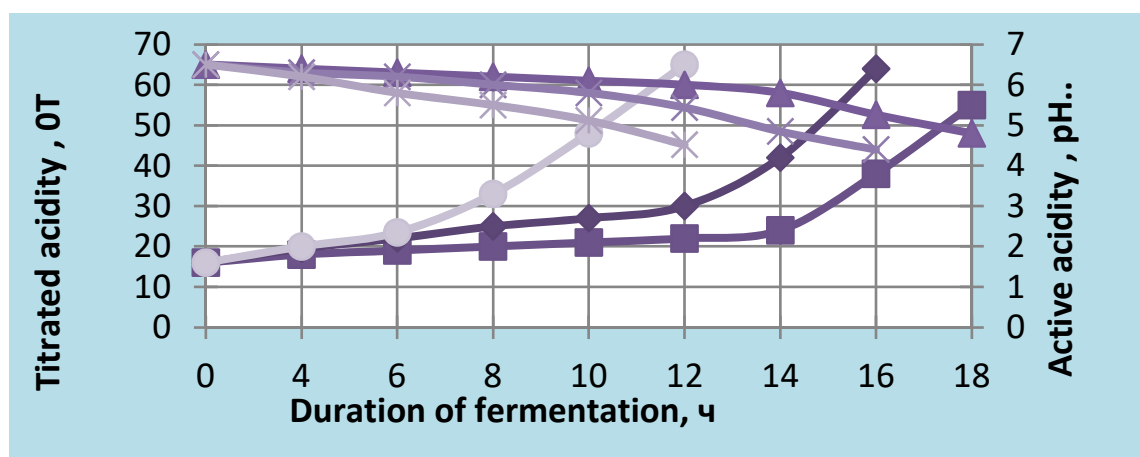


Table 1 – Regression analysis of changes in titrated and active acidity of buttermilk fermented in the presence of calcium pantothenate

Research options	Regression equations		The value of the approximation confidence (R ²)	
	titrated acidity	active acidity	titrated acidity	active acidity
0,1 % Ca pantothenate	$Y = 0,9762x^2 - 5,9619x + 24,786$	$Y = -0,0305x^2 + 0,1146x + 6,3214$	$R^2 = 0,907$	$R^2 = 0,972$
0,3 % Ca pantothenate	$Y = 1,2232x^2 - 5,3601x + 23,616$	$Y = -0,0385x^2 + 0,0558x + 6,4173$	$R^2 = 0,936$	$R^2 = 0,993$
0,5 % Ca pantothenate	$Y = 1,9821x^2 - 4,2036x + 18,9$	$Y = -0,0254x^2 - 0,2065x + 6,714$	$R^2 = 0,998$	$R^2 = 0,995$

as part of dietary supplements. The results of the study of the fermentation process of buttermilk by propionic acid bacteria, which took place at the same fermentation temperature (34-2) - C are shown in Figure 1 and in Table 1.

Analysis of data on the dynamics of changes in the acidity of buttermilk fermented in the presence of calcium pantothenate indicates that as the amount of growth stimulant increases, the fermentation process time decreases. In this case, relatively strong clots are formed, without separating the serum.

However, it should be noted that a dose of calcium pantothenate in an amount of 0.3% by weight of buttermilk or more leads to the appearance of a slight bitterness in the fermented product, which increases as the amount of the additive increases. The amount of propionic acid bacteria in the fermented product in the presence of 0.1% calcium pantothenate by 16 hours of fermentation was at the level of 24 hours of the buttermilk fermentation process without its addition.

It is known from the literature that pantothenic acid is found in many foods, including: legumes 1-2 mg/100 g, wheat 1-3 mg/100 g, oats (grains) 2-5 mg/100 g.

Considering that the product, when using a natural vegetable supplement, is simultaneously enriched with vegetable protein, as a natural growth stimulator of propionic acid bacteria, soy was studied in the form of soy flour, its chemical composition is given in table 2.

Table 2 – Chemical composition of soy flour

Components	Indicator
Water, %	9,0
Protein, %	36,5
Fat, %	18,6
Carbohydrates, %	17,9
Dietary fiber, %	13,3
Ash, %	4,7
Mineral substances, mg%	
Na	5,0
K	1600,0
Ca	217,0
Mg	200,0

P	600,0
Fe	9,0
Vitamins, mg%	
B ₁	0,70
B ₂	0,20
PP	2,00

As can be seen from Table 2, soy flour has a valuable chemical composition, especially the quantitative composition of minerals necessary for the growth of propionic acid bacteria. In the studies, soy flour was used as a protein component in amounts of 5, 10, 15% (respectively, experiment 1, 2 and 3) of the mass of the mixture, which influenced the chemical composition of the product, its properties and qualitative indicators of the fermentation process (Figure 2 and Table 3).

The analysis of the experimental data shown in Figure 2 indicates a certain influence of soy flour on the dynamics of the fermentation process. The process of clot formation is accelerated, while the titrated acidity of the final product is somewhat reduced, which is explained by the natural (alkaline) nature of the soy additive. Organoleptic evaluation of fermentation products

shows that the amount of soy flour over 5% leads to the appearance of a specific vegetable taste classified for fermented dairy products as extraneous.

Microbiological analysis of fermented buttermilk with the addition of soy flour indicates its positive effect on the vital activity of cells of propionic acid bacteria. However, apparently due to the fact that vegetable proteins predominate in the product, biotechnological processes are shifting towards the accumulation of acetic acid and its decomposition products. As a result, an increase in which leads to the formation of unpleasant foreign odors and tastes in the fermentation product.

All of the above suggests that it is necessary to increase the concentration of protein carbohydrates in buttermilk, by partially thickening it, preferably in a soft mode.

The results of microbiological studies of the fermentation process of buttermilk in the presence of soy flour are shown in Figure 3.

The creation of rational technologies of biologically full-fledged, high-quality products is an urgent and priority direction of the modern dairy industry of Kazakhstan. Dairy products occupy a leading position in the diet of different age groups of the population as

Figure 2 – Dynamics of the buttermilk fermentation process in the presence of soy flour

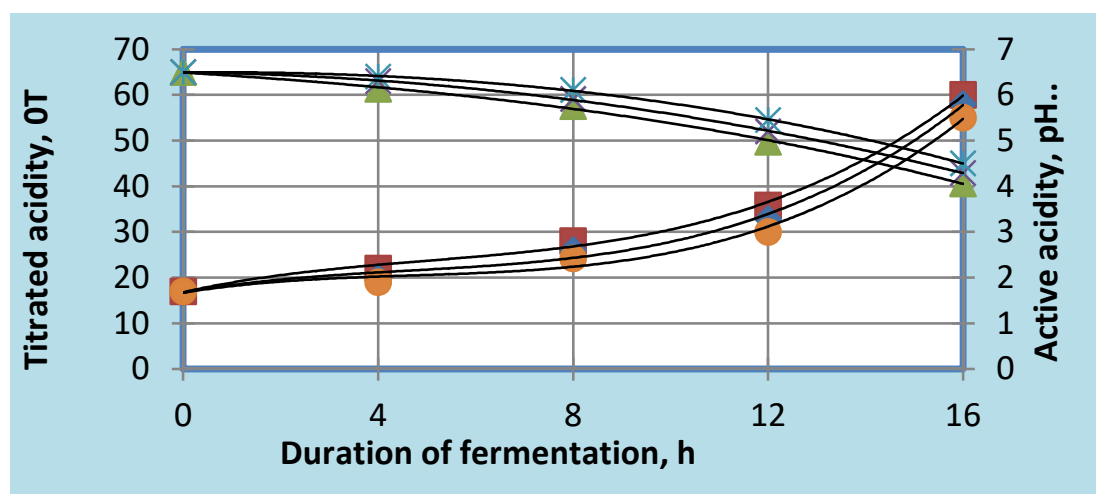
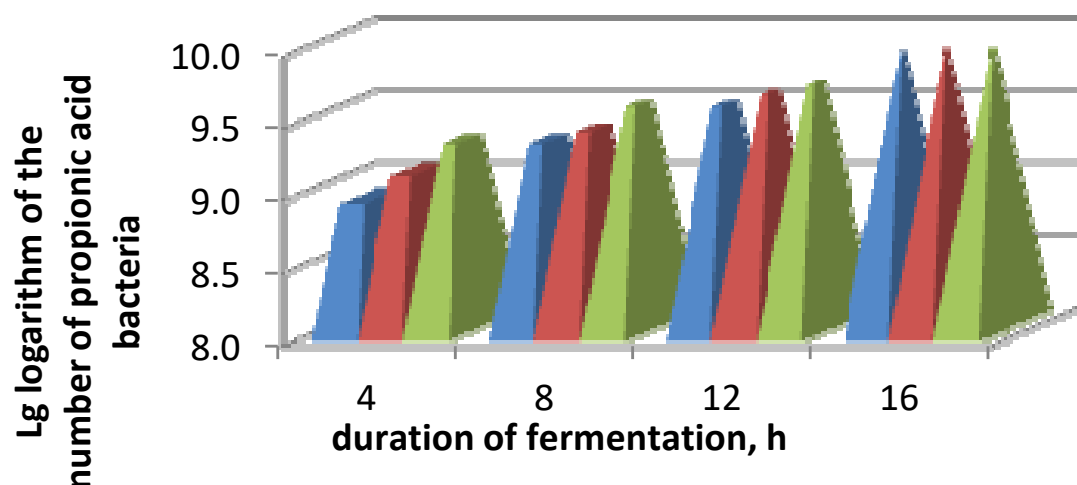


Table 3 – Regression analysis of changes in titrated and active acidity during the fermentation of buttermilk in the presence of soy flour

Research options	Regression equations		The value of the approximation confidence (R ²)	
	titrated acidity	active acidity	titrated acidity	active acidity
5 % соевой муки	$Y = 2,8714x^2 - 7,2486x + 22,72$	$Y = -0,1057x^2 + 0,0303x + 6,554$	R ² = 0,9768	R ² = 0,998
10 % соевой муки	$Y = 3,2286x^2 - 9,8914x + 24,92$	$Y = -0,1243x^2 + 0,1937x + 6,426$	R ² = 0,972	R ² = 0,999
15 % соевой муки	$Y = 3,3286x^2 - 11,271x + 26,24$	$Y = -0,1479x^2 + 0,3921x + 6,242$	R ² = 0,966	R ² = 0,999

Figure 3 – Comparative histogram of the number of viable microbial cells in the fermentation process (5% soy flour, 10% soy flour, 15% soy flour)



a source of biologically valuable substances, among which there are such nutrients as minerals and vitamins with a special role assigned to them among all the nutrients necessary to ensure the vital functions of

the body. The production of probiotic dairy products of preventive orientation with long shelf life, having high biological and nutritional value, is of certain scientific and practical interest.

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