

Development Technology Of New Types Products Based On The Principles Of Integrated Processing Of Raw Materials



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Abstract: This article presents the results of the development of new types of products based on the use of biotechnological principles of deep processing of raw materials. The composition of multicomponent starter culture, which forms the probiotic properties of drinks, has been developed. The activity of the development of the starting microflora and the composition of the milk base of drinks were research with the aim of increasing the biological value, improving the organoleptic properties and structure of finished products. The proposed types and dosages of fillers of plant origin, the optimal dosage of their implementation from the point of view of the formation of high organoleptic indicators.

Keywords : food biotechnology, fermented milk drinks, probiotics, berry syrups.

I. INTRODUCTION

The production of products with functional properties is one of the priority areas in the food industry. Functional products related to healthy food products contribute to the improvement of many physiological processes in the human body and increase its resistance to various adverse factors associated with environmental problems, increased technological impact on the environment, increasing levels of stress and mental stress on humans. The use of secondary milk raw materials, in particular, cheese whey, which is a by-product in the production of cheese and contains about 50% milk solids,

deserves attention as a dairy base for the production of functional products. The effective use of cheese whey is also one of the reserves for increasing the volume of dairy raw materials.

Expanding the range and increasing the nutritional value of functional products can be achieved through the use of various functional ingredients in their production, one of which is probiotic microflora, as well as various herbal supplements with a high content of biologically active substances that enrich the carbohydrate, vitamin and mineral composition of products and improving their taste characteristics, consistency.

The purpose and objectives of research. The purpose of these studies included the development of the formulation and technology of fermented drinks enriched with probiotic microflora, using cheese whey.

In accordance with the goal, the following research tasks are defined:

- choose the composition of the starter microflora, which gives probiotic properties to drinks;
- to determine the composition of the milk-whey basis of products, taking into account the activity of the development of starter microflora, increasing biological value, improving organoleptic properties and the consistency of finished products;
- select fruit and berry fillers for drinks and establish a rational share of their introduction;
- explore the properties of drinks during storage.

II. MATERIALS AND METHODS

The objects of research at different stages were: raw whey milk, skim milk, Biolact bacterial concentrate, rosehip and sea buckthorn syrups, fermented drinks.

When performing the experimental part of the work, standard and generally accepted methods of physicochemical and microbiological studies were used.

The organoleptic properties of the developed drinks were evaluated using the profile method, which assumes a qualitative (using verbal descriptions - descriptors) and quantitative (numerical or graphic characteristics of the sensation intensity) assessment of organoleptic indicators and recommended when developing formulations of new types of food products. To determine the organoleptic characteristics, a list of evaluated descriptors was compiled, focusing on the desired properties of the drinks.

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When performing the profile analysis, a five-point scale was used to assess the intensity of the individual components of the organoleptic property (0 - a sign is absent; 1 - only a recognizable or perceptible sign; 2 - weak intensity; 3 - medium intensity; 4 - strong intensity; 5 - very strong intensity of a sign). The results of organoleptic evaluation were expressed graphically by constructing profilograms of taste, smell and consistency. For mathematical processing of experimental data, methods of statistical and regression analysis using a personal computer and a special application package were used.

III. RESULTS AND DISCUSSIONS

To develop a technology of fermented drinks with functional properties, enrichment of products with probiotic microflora, in particular, bifidobacteria and propionic acid microorganisms, which play an important role in the formation and functioning of various organs and systems, is associated with an increase in the general non-specific resistance of the human body, participation in the metabolism of carbohydrates, proteins, lipids, nucleic acids and other compounds, the production of biologically active substances, providing colonization resistance of the digestive tract.

Given that for the production of beverages under industrial conditions, the growth and acid formation rates of pure cultures of bifidobacteria and propionic acid bacteria are not high enough, which may be one of the reasons for the multiplication of extraneous microflora, it is advisable to jointly cultivate them with lactic microorganisms.

One of the problems that must be solved during the joint cultivation of probiotic microflora (bifidobacteria, propionic acid bacteria) and lactic acid microorganisms is associated with different activity of their development in milk environments. In this regard, for the enrichment of drinks with probiotic microflora, the Biolact concentrate was chosen, which includes the optimal ratio of probiotic microflora and lactic acid bacteria. The use of highly active bacterial concentrates containing probiotic microflora in an amount of at least 10^9 - 10^{10} CFU per 1 g allows them to be used as direct application cultures, which ensures a sufficiently high content of viable probiotic bacteria cells in the finished product (10^6 - 10^8 CFU per 1 g).

A comparative assessment of the development of starter cultures in cheese whey and skim milk is carried out. A decrease in the activity of growth and acid formation during their cultivation in serum was noted. In the production of fermented milk drinks based on cheese whey, a sufficiently long fermentation is required to obtain a pronounced fermented milk taste of the product, the appearance of whey flavor, heterogeneous consistency is noted.

To increase the activity of the development of starter microflora, improve organoleptic indicators, it is advisable to use whey and skim milk as the basis of milk drinks.

The results of the experiments confirmed that the introduction of skim milk into the whey base as a result of enhanced buffering properties has a positive effect on the activation of the growth of starter cultures and the rate of acid formation (Fig. 1), and contributes to the formation of a clot.

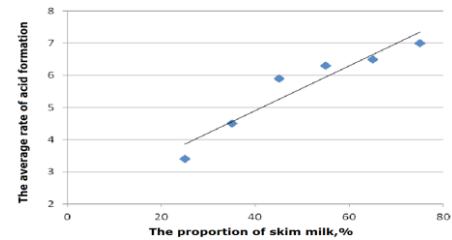


Fig. 1. The influence of the composition of the whey base on the average rate of acid formation in the process of ripening

The improvement of the structural and mechanical properties of acid clots obtained by fermentation of a milk-whey base, with an increase in the proportion of skim milk in it, confirms the calculation of such rheological parameters as viscosity loss, degree of restoration of the structure, and mechanical stability coefficient. The change in these indicators depending on the proportion of skim milk in whey is shown in Figure 2.

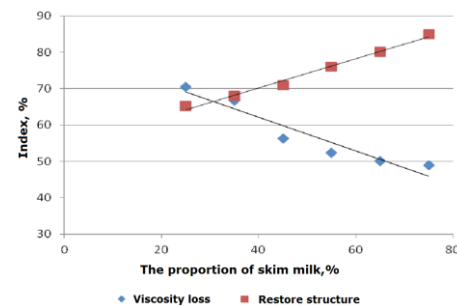


Fig. 2. The effect of a dose of skim milk in a whey basis on the structural and mechanical properties of a clot

As can be seen from the data presented, with an increase in the proportion of skim milk in whey, the thixotropic properties of acid clots improve. The study of the synergistic ability of acid clots using the centrifugation method showed that clots obtained by fermenting a whey base with a higher proportion of skim milk had better water-holding ability (Fig. 3).

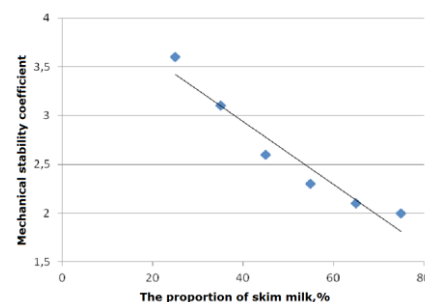


Fig. 3. Change in the water-holding ability of an acid clot depending on the proportion of skim milk in a whey basis

In order to increase the nutritional value of drinks, improve their organoleptic properties, the possibility of using fruit and berry syrups (rosehip syrup and sea buckthorn syrup) in their production is considered. It is known that rosehip syrup is obtained without added sugar, which is important for dietary nutrition.

Its use allows you to provide a sweet taste of the product without the use of sugar. Rosehip berries are known to contain monoaccharides and disaccharides, organic acids (citric, malic), pectins, B vitamins, ascorbic acid, copper and iron salts, antioxidants. Sea buckthorn berries contain vitamins C, K, the entire group of vitamins B, E, K, PP, P, trace elements, there are about 20 of them, such as titanium, selenium, silicon,

iron, calcium, aluminum, magnesium, manganese, sodium, fluorine, phosphorus, sulfur and others. Sea buckthorn is saturated with alkaloids, sterols, beta-carotenes, pectin, coumarin, betaine, choline, rutin, inoside, serotonin, leucoanthocyanins, flavonoids, phospholipids and a number of other substances. To establish the composition of the milk-whey basis of the products and obtain a mathematical model of the process, taking into account the influence of the selected fillers, the method of orthogonal compositional planning of the experiment was used. The range of variation of the studied factors is presented in table 1. Organoleptic characteristics of the product (y, point) were chosen as the output parameter. Fermentation of the milk-whey base, consisting of skim milk and raw whey, was carried out by Biolact BC at a temperature of 37 °C, optimal for the development of bifidobacteria. At the end of ripening, the clot was cooled to a temperature of 20 °C and fruit and berry syrups of rosehip or sea buckthorn were added, then the products were cooled to a temperature of 4-6 °C.

Table - I: Range of variation of technological factors

Factors	Range
Drink with rosehip syrup	
Share of milk base, %	15-45
The proportion of syrup, %	5-15
Drink with sea buckthorn syrup	
Share of milk base, %	15-45
The proportion of syrup, %	7-17

Based on the selected values, a planning matrix for a second-order orthogonal central compositional plan for a two-factor experiment was compiled. Based on the experimental data, mathematical models are obtained that reflect the dependence of the change in the organoleptic characteristics of drinks on the studied factors using the StatSoft program:

$y = -5.71 + 0.78 \times 1 - 0.016 \times 10 + 1.39 \times 2 - 0.09 \times 21$ (drink with rosehip syrup);

$y = -5.11 + 0.43 \times 1 - 0.016 \times 10 + 1.777 \times 2 - 0.064 \times 17$ (a drink with sea buckthorn syrup).

The significance of the coefficients of the equations was checked using Student's criterion. The adequacy of the obtained models was confirmed by analysis of variance using the coefficients of determination and the Fisher criterion.

Analysis of the response surface graphs and contour graphs of the obtained dependences made it possible to establish the composition of the milk base (for a drink with rosehip syrup: skim milk - 55-63%, whey - 30-35%; for a drink with sea buckthorn syrup: skim milk - 60-70%, serum - 30-40%), as well as to clarify the proportion of filler (for a drink with rosehip syrup - 7-8%; for a drink with sea buckthorn syrup - 14-15%), which provides the best organoleptic properties.

The influence of fillers on the organoleptic characteristics of drinks using the profile method confirmed that when adding rosehip syrup at a dose of 7-8%, sea buckthorn syrup at a dose of 14-15%, the product is characterized by a harmonious sour-milk, moderately sweet taste and aroma of

rosehip or sea buckthorn, as well as homogeneous consistency and light cream color when using rose hips and light orange when using sea buckthorn. The study of changes in the organoleptic and microbiological indicators of active acidity during the storage of drinks in sealed packaging for 8 days. The organoleptic characteristics and acidity of the products remained practically unchanged, the content of probiotic microflora amounted to tens to hundreds of millions of viable cells in 1 cm³.

IV. CONCLUSIONS

Based on the studies, the component composition and the fermentation parameters of the milk-whey base of fermented drinks are established, which ensure the formation of the required organoleptic, structural-mechanical and microbiological parameters in them. Mathematical models are obtained that adequately approximate the dependences of the organoleptic characteristics of drinks on their component composition. The use of cheese whey in beverage recipes will not only expand the range of dairy products with high nutritional and biological value, but will also increase the efficiency of milk processing through the introduction of resource-saving technologies.

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