LIGHT INDUSTRY AND FOOD INDUSTRY

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STUDY OF TECHNOLOGICAL REGIMES OF DAIRY PRODUCTION

A significant place in the diet of the population is occupied by fermented milk products, the consumption of which increases every year. It is known that dairy products make up from a third to a half of children's daily diet, although it should be noted that in Ukraine there is a rather limited range of dairy products intended specifically for children. This is due, first of all, to the fact that baby food products have stricter requirements regarding microbiological and quality indicators, which are difficult for the dairy industry due to the lack of necessary equipment and special technologies. Even high-quality fermented milk products, made according to traditional technologies, quickly lose their original properties during storage due to the further development of both useful, fermenting and foreign microflora in them. As a result, there is an increase in the acidity of products, a change in rheological properties, a decrease in viscosity, and a deterioration in taste (rancidity occurs).

According to the above information, the production of fermented milk products for children's nutrition must meet high sanitary and hygienic requirements regarding production conditions, the quality of raw materials and the finished product gastrointestinal tract of the child's body.

Therefore, the task of this study was to establish the main technological operations of the production of sour-milk products, namely: the conditions of heat treatment of milk and sour-milk mixture; choice of type and amount of structure stabilizer.

The technology of a functional dairy product for baby food requires the use of structure stabilizers that will allow its introduction. It is known that the structure formation of a sour-milk product (yoghurt) [1] occurs only when a critical concentration of phase parts is reached, which ensures the formation of the necessary number of contacts between parts to maintain a dense volume structure.

Fermented milk products produced by the tank method have a destroyed gel structure, and their aging processes are usually accompanied by the phenomenon of syneresis. In order to increase the ability to store such products without deterioration of their consistency, in addition to ensuring microbiological purity, it is also necessary to carry out measures that contribute to the stabilization of aging processes and the prevention or slowing down of syneresis. The use of hydrocolloids of vegetable origin can become one of the possible ways to stabilize the structural and mechanical characteristics of fermented milk products.

In this regard, the properties of such structure stabilizers as gelatin, agar, sodium alginate, modified starch № 1 were studied with the aim of their further use in the developed technology. The main criteria for the selection of structure formers were the range of temperatures at which the stabilizers showed their gel-forming properties, moisture-retaining capacity, viscosity of the stabilizer-water system, the ability to form a homogeneous mixture after cooling the stabilizer solution to the storage temperature of fermented milk products – (6±2) °C.

For conducting research, 3 % aqueous solutions of the structure stabilizers mentioned above were prepared and their properties were studied. The obtained results are shown in Table 1.

The analysis of the obtained data (Table 1) shows that the investigated hydrocolloids differ significantly from each other in terms of dissolution temperature. The modified starch was deemed unfit for further use, as its solutions had a non-homogeneous consistency, the system did not retain moisture upon cooling, and its delamination was observed. Pectin dissolves in water for a long time and forms a heterogeneous solution. In addition, it has low viscosity and rather low active acidity, which also complicates its use in the technology under development.

Table 1

Characteristics of structural stabilizers

The name of the stabilizer	Indicators			
	pH of the solution	The stabilizer dissolution temperature, °C	Gelation temperature, °C	Viscosity Pa·s $\cdot 10^3$
Gelatin	6.0	70.0	<20	0.572
Agar	5.8	94.0–96.5	<20	0.451
Sodium alginate	4.9	74.0–85.5	<40	0.542
Modified starch № 1	5.4	64.5	<20	0.383
Pectin	3.2	61.0	<15	0.214

Agar, sodium alginate, and modified starch № 1 are the most suitable for further use of all the studied structure stabilizers.

On the basis of the analysis of the behavior of the selected stabilizers in the conditions of thermomechanical processing, modified starch № 1 was used for further work.

To determine the optimal amount of stabilizer, as well as the temperature of thermomechanical treatment, the following studies were conducted: two types of sour milk base with stabilizer mass fractions of 3.0 % and 4.0 % were subjected to thermomechanical treatment at temperatures of °C: (65±2); (70±2) and (80±2). During the research, changes in product acidity, viscosity, organoleptic and microbiological indicators were determined.

As the conducted studies showed, the amount of the mass fraction of the structure stabilizer under the studied temperature regimes of the processing of the sour-milk base did not affect the acidity: titration acidity remained at the level of 110 °T, active – within 4.7–4.8 units pH.

Effect of stabilizer concentration and temperature thermomechanical processing of the sour-milk mixture on the quality indicators of the finished sour-milk product is shown in Tables 2–4.

Table 2

The influence of processing modes and stabilizer concentration on the organoleptic parameters of sour-milk mixtures

The mass fraction of the structure stabilizer	Characteristics of the sour-milk base for thermomechanical processing	Characteristics of the sour-milk base under different modes of thermomechanical processing, °C		
		65±2	70±2	80±2
3.0	The consistency is homogeneous, moderately thick, without presence air bubbles and separation of serum	The consistency is homogeneous, liquid, foamy, with a large number of air bubbles on the surface and inside the product; the taste of uncooked starch	The consistency is uniform, liquid, foamy, with a large number of air bubbles on the surface and inside the product, without extraneous aftertaste	The consistency is heterogeneous, floury, liquid, foamy, with a large number of air bubbles on the surface and inside the product, with separation of serum, without extraneous aftertaste
4.0		The consistency is homogeneous, moderately thick, with individual air bubbles balls on the surface of the product, the taste of starch	The consistency is homogeneous, moderately thick, with individual air bubbles balls on the surface of the product, without extraneous aftertaste	Foamy consistency, with single air bubbles and inside the product, with serum separation, no extraneous aftertaste

Table 3

The effect of processing modes and stabilizer concentration on the viscosity of sour-milk mixtures

The mass fraction of the structure stabilizer	Sour milk base for thermomechanical processing	Sour milk base under different modes of thermomechanical processing, °C		
		65±2	70±2	80±2
3.0	250.5	73.0	117.9	102.7
4.0	255.2	86.0	232.7	174.9

Table 4

The effect of processing modes and stabilizer concentration on the number of lactic acid bacteria in sour-milk mixtures

The mass fraction structure stabilizer	Sour milk base for thermomechanical processing	Sour milk base under different modes of thermomechanical processing, °C		
		65±2	70±2	80±2
3.0	3.6×10^{8}	6.4×10^{5}	7.0×10^{4}	5.0×10^{3}
4.0	3.7×10^{8}	6.6×10^{5}	7.2×10^{4}	5.2×10^{3}

Analysis of the data given in the table 2–4, shows that the desired results regarding the consistency of the product can be achieved by processing the sour-milk mixture under the following parameters: active acidity of the mixture 4.8 units. pH, mass fraction of stabilizer – 4 %.

Thus, the conducted research made it possible to select the mass fraction of the stabilizer, which provides improved consistency, increased heat resistance, and avoidance of foaming of the product.

References:

1. Jørgensen C.E., Abrahamsen R.K., Rukke E.-O., Hoffmann T.K., Johansen A.-G., Skeie S.B. (2019), Processing of high-protein yoghurt – A review, *International Dairy Journal*, 88, pp. 42–59.