

Investigation of the fermentation process of demineralized whey concentrates for ice cream production

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Introduction. The cheapest source of biologically complete whey proteins in ice cream is condensed and dry whey. However, whey contains up to 70-75% of lactose from the total dry matter content, the excess of which in ice cream causes its excessive crystallization [1]. The purpose of the research is to study the patterns of the process of lactose hydrolysis in reconstituted concentrates of sweet demineralized whey, intended for the production of ice cream with higher content of whey proteins and low lactose content.

Materials and methods. Physicochemical parameters of reconstituted fermented and unfermented concentrates of demineralized sweet whey with dry matter content from 10 to 40% were studied. The lactose content was determined by the accelerated colorimetric method, water activity – on the water activity analyzer.

Results and discussion. In order to intensify the fermentation process of lactose, the possibility of combining the hydrolyzing action of the enzyme GODO-YNL2 and the lyophilized starter «*L. acidophilus* LYO 50 DCU-S» was investigated.

For this purpose, the following regularities of the fermentation process of whey concentrates with a mass fraction of dry matter from 10 to 40% by starter on the basis of the lyophilized preparation «*L. acidophilus* LYO 50 DCU-S» were established. Within 3-4 hours the titrated acidity of fermented concentrates increased slightly – from 22-25 °T (pH = 6.1-6.6) to 38-42 °T (pH = 5.7-5.9), which characteristic of the lag phase of bacterial development. During the next 2-3 hours there was an active increase in acidity to values of 90-100 °T (pH = 4.2-4.36). The subsequent period was characterized by a decrease in the activity of acidophilic starter with increasing titrated acidity to 110-120 °T, which is a well-known pattern and is due to the preservative action of lactic acid as a product of lactic acid fermentation on microorganisms included in compositions of starters [2].

Since the values of active acidity below 5.5-5.6 will inhibit the enzymatic activity of the preparation GODO-YNL2, it was decided to simultaneously add to the whey concentrates enzyme preparation GODO-YNL2 and activated starter «*L. acidophilus* LYO 50 DCU-S».

To ensure the maximum possible degree of lactose hydrolysis by the enzyme preparation within 4 hours for samples of whey concentrates was selected such it amount: for whey concentrate with mass fraction of dry matter 10% selected 0.1% of the preparation GODO-YNL2; for 20% of concentrate – 0.2%; for 30% of concentrate – 0.3%; for 40% of the concentrate – 0.4%.

The degree of lactose hydrolysis in concentrates of reconstituted demineralized sweet whey with different dry matter content with simultaneous application of enzyme and fermentation preparations are given in Figure 1.

The combination of hydrolyzing action of the enzyme and starter preparations allows to increase the degree of lactose hydrolysis in the composition of lactose concentrates to 80% and above. To do this, it is necessary to ensure the duration of the total hydrolytic process in concentrates with a dry matter content of 10-30% for 6-8 hours. Prolongation of the hydrolysis process to 10 hours does not lead to a significant result in terms of changes in the composition of fermented samples of whey concentrates, except for the sample with the maximum dry matter content.

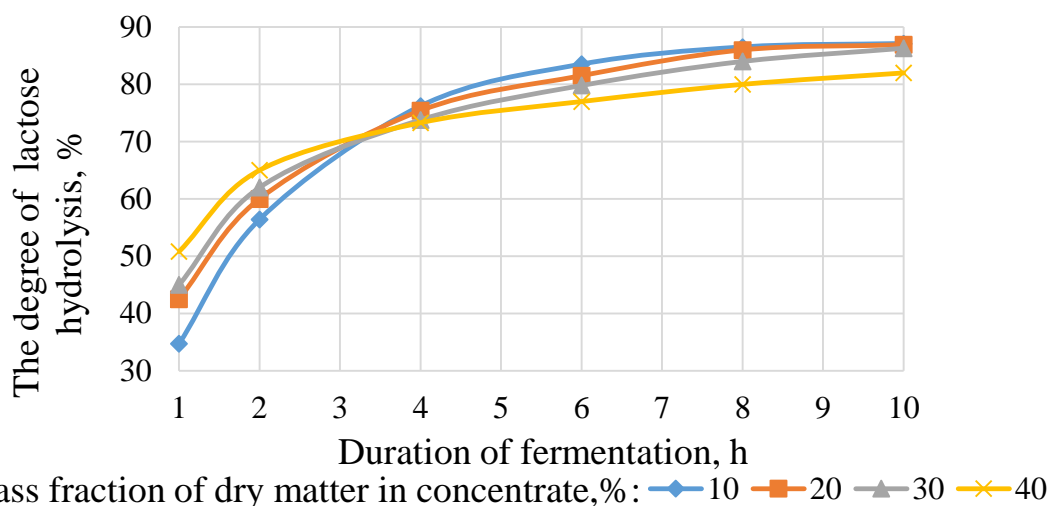


Figure 1 – The degree of lactose hydrolysis (%) in concentrates of reconstituted demineralized sweet whey of different dry matter content with the simultaneous introduction of enzyme and starter preparations ($P \geq 0.95$; $n = 3$)

In contrast with recent studies [3], based on the use or production of enzyme monopreparations of narrow direction, revealed a symbiotic effect of the joint interaction of the enzyme and the starter of *L. acidophilus*. The revealed symbiosis of the applied preparations increases the efficiency of lactose hydrolysis by 10-15%, compared with the use of only one enzyme GODO-YNL2.

Conclusions. Simultaneous use of acidophilic starter and enzyme not only increases the efficiency of lactose hydrolysis, but also has the following advantages: the possibility of enriching whey ice cream with probiotic culture; providing ice cream with original organoleptic properties; formation of a thick consistency and increasing of resistance to melting of ice cream in the presence of viscous exopolysaccharides produced by *L. acidophilus*.

Key words: whey, lactose, enzymolysis, β -galactosidase, *Lactobacillus acidophilus*, ice cream

References

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