RESEARCH FEATURES OF LOW-FAT ICE CREAM MIXTURES STRUCTURING WITH BETA-GLUCAN AND PECTIN-CONTAINING VEGETABLE RAW MATERIALS

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Introduction. Ice cream, as a food polydisperse system, requires special production conditions, in particular compliance with the maturation time of the ice cream mixtures, which ensures a regulated degree of the mixture structuring before freezing.

Ice cream mixes show a viscosity anomaly, especially with a low shear gradient, so they are classified as non-Newtonian structured liquids. Effective viscosity is one of the most important y properties of non-Newtonian systems, which changes with the change in shear rate as a result of the gradual destruction of their structure. This explains the pattems of changes in the speed-viscosity characteristics of mixtures during the hnological process of ice cream production under the influence of heat and mechanical trealment: mixing, pasteurization, homogenization, cooling, maturation, freezing.

The effective viscosity of ice cream mixtures significantly affects the formation and stabilization of the structure of the finished product and depends on many factors: chemical composition, individual moisture-binding capacity of polysaccharides and proteins, interaction between biopolymers and other components, thermal coagulation of whey proteins and crystallization its content, temperature, shear stress, which destroys the structural network and aggregates of points along the velocity vector [1].

Recommended by scientists from around the world, the ranges of effective viscosity of ice cream mixes at 20 °C are contradictory, due to the use of rotary viscometers of different brands, different methods of pre-treatment of mixes, and the emergence of fundamentally new types of ice cream with modified chemical composition and innovative ingredients.

The recommended viscosity of modern ice cream mixes ranges from 350 to 850 MPa depending on the chemical composition of the product. If the specified viscosity range is exceeded, the efficiency of air dispersion into the aqueous phase during freezing decreases. In turn, too low viscosity does not provide proper stabilization of the formed dispersed ice cream systems [2].

The aim of the research is to identify the features of structuring mixtures of low-fat ice cream and check the structuring ability of B-glucan in the presence of pectin-containing vegetable raw materials.

Materials and methods of research. The Department of Milk and Dairy Products Technology conducted a study of the viscosity-speed characteristics of ice cream mixtures using a rotary viscometer with a cylinder-cylinder measuring system. Shear stress measurements t (Pa) were performed at a temperature of 20 °C for twelve values of the shear rate gradient in the range from 3 to 1312 s' in forward and reverse [3]. During the study, the maximum effective viscosity of the practically unstructured structure, the minimum effective viscosity of the extremely destroyed structure and the effective viscosity of the restored structure were determined.

The thixotropic capacity, which is characterized by the degree of restoration of the structure, was determined as a percentage of the difference between the effective viscosity of virtually undamaged structure in the shear rate gradient and the effective reverse viscosity in the same shear rate gradient [4].

The studies were performed in 8 samples of ice cream mixtures: control No 1., 2 with the composition of classical hydrocolloids and Cremodan®SI 320, respectively; sample No 1...3 with beta-glucan in the amount of 0.5, 0.75 and 1,0 %, respectively; sample No 4...6 with beta-glucan (0.5, 0.75 and 1.0 %, respectively) in combination with vegetable puree (15 %).

Research results. According to the results of the study, the effective viscosity of all samples of the mixture at the beginning of the measurement was not lower than the recommended value for modern ice cream mixtures. It should be noted that only the amount of beta-glucan 0.75 % of the effective viscosity values approached the characteristic values of the control mixture No 1. However, with increasing beta-glucan structuring of the mixture increases, indicating that low-energy bonds between functional groups of polysaccharide macromolecules may increase. At the same time, it is interesting that the final time of destruction of the structure to equilibrium and the viscosity of the mixture with beta-glucan at the maximum shear rate gradient is greater compared to control samples.

Of particular interest is the possible effect of pectin-containing vegetable purees on the property of changing the effective viscosity in the chain of rheological measurements. In this study, fermented beet puree in the amount of 15 % was selected as a carrier for high amounts of soluble pectin (about 1 %) [5], which can provide up to 0.15 % of pectin in milk-vegetable mixtures. The specific structuring ability of beta-glucan (0.5...1.0 %) and soluble pectin (0.15 %) for their complexation allows to increase the thixotropic capacity of ice cream mixes from 52.9...62.6 % to 69.4...72,1 %. This feature suggests that there may be mutual synergy between polysaccharides, which is an important indicator of the stable structure of ice cream after portioning and before freezing and storage. It should be noted that this effect requires additional scientific study.

Analysis of the characteristics of two control and two experimental samples showed that mixtures with beta-glucan had a slower process of destruction of the structure. In addition, this process continued until the effective viscosity va es became almost twice as high up to 40.1 MPa s for sample No 2 and up to 47.4 MPa's for sample No 5, compared to control samples No 1 and 2-25.1 MPa's and 26 MPa's, respectively. Mixtures of milk and milk-vegetable ice cream can be attributed to systems with a pronounced coagulation structure with the detection of thixotropic properties. The latter property is most pronounced for systems containing beta-glucan.

In view of this, further research is needed on the technical modes of the freezing process, especially the duration of freezing and beating ice cream mixtures with beta-glucan. These processes will be considered in further research.

Conclusions. Thus, the use of beta-glucans from oats in low-fat ice cream is advisable and provides structuring of mixtures in the recommended range of effective viscosity and increases their thixotropic capacity. Simultaneous use of 0.75...1.0 % beta-glucan and fermented vegetable puree in the amount of 15%, can significantly improve the viscosity-speed characteristics of mixtures: the effective viscosity increases by 11.5...15.9 %, and the degree recovery – by 10 %.

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ПЕРСПЕКТИВИ ВИКОРИСТАННЯ СКОРЦОНЕРИ У ТЕХНОЛОГІЇ КИСЛОМОЛОЧНИХ ПРОДУКТІВ

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Кисломолочні продукти, у тому числі йогурти, у дієтичному і лікувальному харчуванні за своїми функціональними властивостями перевершують молоко. Вони містять усі складові частини молока у більш засвоюваному вигляді. Ринок виробництва українських йогуртів постійно розвивається, підвищується інтерес споживачів до збагачених і функціональних видів. На сьогодні існує досить багато робіт в області виробництва йогуртів, збагачених рослинними інгредієнтами і біологічно активними добавками. Однак, розширення їх асортименту можливо за рахунок введення рослинних харчових збагачувачів та дієтичних компонентів.

Скорцонера – рослина, яка цінна за своїми харчовими і лікарськими властивостями, хімічний склад якої багатий на біологічно активні речовини, що представлені полісахаридами, макро- і мікроелементами, вітамінами, флавоноїдами, незамінними амінокислотами. Особливо багата обрана сировина на цінні полісахариди: інулін, пектин, клітковину.

Цінність інуліну – в його впливі на обмін речовин протягом усього часу перебування в організмі людини. Інулін сприяє розвитку бактерій, сприяючи нормальному функціонуванню шлунково-кишкового тракту, стимулює скоротливу здатність стінок кишечнику, справляє імуномоделюючу дію.

Пектинові речовини, одні з основних ефектів терапевтичного впливу. Клітковина покращує процес травлення, стимулює перистальтику, збільшує швидкість проходження їжі через шлунково-кишковий тракт, поглинає жири, токсини і слиз із шлунку і кишечнику, підвищує всмоктуваність поживних речовин.

Таким чином, використання скорцонери у технології кисломолочних продуктів, зокрема в технології йогуртів, дозволить збагати продукт значною кількістю полісахаридів: клітковини, пектину та інуліну, що має пребіотичні властивості і тому є досить перспективною сировиною для використання в сфері оздоровчого харчування.

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Література

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