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## TECHNOLOGICAL ASPECTS OF QUINE FRUIT USE IN ICE CREAM TECHNOLOGY

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**Topicality.** Providing the population with high-quality and varied food is an important task for the country to achieve a high standard of living. A serious trend in the food industry development is the production of health foods that will contribute to the prevention of food-dependent diseases, correction of the body's defense system and the restoration of impaired functions of organs and systems. Among food products, frozen desserts are very popular, namely ice cream. **The purpose of the article** is to study the technological parameters of quince puree for use in ice cream technology as a natural structure stabilizer. **Research methods:** physio-chemical, rheological, organoleptic, experimental-statistical, performed using modern devices and computer technologies. **The scientific novelty** lies in the justification of the use of quince puree in the technology of ice cream and the establishment of patterns of formation and stabilization of its structure. **Main results and conclusions.** Technological parameters of processing of pectin-containing raw materials for the technology of milk and fruit ice cream theoretically substantiated and experimentally determined. The pH influence, temperature and duration of heat treatment of quince on the process of accumulation of soluble pectin have been studied. The technology of ice cream with a natural stabilizing component - quince puree has been developed.

The quality indicators of the finished product have been determined. The obtained research results will contribute to the expansion of practical solutions in the technology of food dispersed systems with a combined composition of raw materials, including those with a high content of pectin substances in fruits and vegetables. The introduction of milk and fruit ice cream technology will expand the range of natural frozen desserts; diversify the diet of people suffering from obesity, heart and stomach diseases.

**Keywords:** quince, puree, pectin substances, structure stabilizer, ice cream, technology.

### The problem actuality

*Formulation of the problem.* A global problem for all countries is the imbalance of diets, which are deficient in functional ingredients such as vitamins, carotenoids, natural antioxidants, complete proteins, polyunsaturated fatty acids, minerals, polysaccharides, etc. (Pavliuk et al., 2011). Providing the population with high-quality and varied food is an important task for the country to achieve a high standard of living.

A serious trend in the development of the food industry is the production of health foods that will contribute to the prevention of food-dependent diseases, correction of the body's defense system and restoration of impaired functions of organs and systems (Tiurikova, 2019).

Among food products, frozen desserts are very popular, namely ice cream. Ice cream is a sweet refreshing product obtained by beating and freezing milk or fruit-berry mixtures with sugar and stabilizers and for some species are with the addition of flavoring and aromatic fillers. Ice cream plays an important role in human nutrition because it is a source of carbohydrates and energy needed to ensure the normal functioning of the body.

Ice cream should have high taste properties due to a well-chosen quantitative and qualitative combination of components of the mixture, sufficient whipping, and homogeneity of structure, not too much cooling of the mouth, slowly melting (Pavliuk et al., 2011).

In Ukraine, the range of ice cream is diverse, but mainly it is a high-calorie product with a low amount of biologically active substances (BAS) and a significant content of various synthetic additives that reduce nutritional, biological and physiological value. Usually ice cream contains from 10% to 18% fat, and sometimes - up to 30% (parfait), which can be replaced by carbohydrates or proteins.

Low-fat, high-fiber foods can help reduce the risk of cardiovascular disease, obesity, colon cancer and other diseases. Scientists have suggested using dietary fiber in foods as potential fat substitutes (Mendoza et al., 2001; Adapa et al., 2000).

Scientists are searching for the use of complex carbohydrates, namely pectin, in ice cream technology (Koxholt et al., 2001). This is due to their ability to actively bind free moisture, form a spatial jelly-like structure and increase the viscosity of mixtures, provide a delicate structure of ice cream, prevent the formation of large ice crystals and their growth, provide high resistance to melting and stabilize the structure during storage from the finished product in edible packaging (waffle sheets, cones, etc.).

Scientists have proposed the use of pectin-containing raw materials, in particular apple puree, to obtain a stabilizing effect during the production of fruit and berry ice cream (Deinychenko et al., 2016).

The technology of vitamin ice cream enriched with frozen fine additives in the form of nanostructured puree from vegetable raw materials (lemons and oranges with peel, apples, bananas) has been developed (Pavliuk et al., 2013). Available raw materials in Ukraine are the fruits of quince. They contain 5... 19% of sugars, 0.2 (2.9% of organic acids (in terms of malic), 9.8... 11.5% of pectin, up to 1.8% of tannins, 3... 50 mg / 100 g of ascorbic acid. It is a useful product for dietary nutrition, which does not contain cholesterol, fats and sodium, and quince fruit is rich in copper and dietary fiber (fiber) (Donchenko et al., 2008).

We have not found data on the use of quince puree as a biologically valuable additive in the technology of frozen desserts. In this regard, it is important to develop a technology of ice cream with low fat content and high BAS content through the use of quince puree. In this regard, it is important to develop a technology of ice cream with low fat content and high BAS content through the use of quince puree.

### **Purpose and research methods**

*The purpose of the work* is to study the technological parameters of quince puree for use in ice cream technology as a structure stabilizer. The research used standard

physicochemical, rheological, organoleptic, experimental and statistical methods using modern instruments and computer technology. *The object of research* is the technology of quince puree and milk and fruit ice cream. *The subject of research* is quince puree, ice cream with fruit additive.

### Research results

Fruit and vegetable purees with a high content of pectin can act as natural foaming, emulsifying and structuring ingredients. To stabilize the structure of ice cream in the technology it is necessary to make up to 0.44... 0.55% of soluble pectin. Therefore, the presence of a significant content of pectin in the puree, namely soluble pectin, is an extremely important indicator of the quality of raw materials (Bezusov et al., 2008).

In the technological process of production of dairy and vegetable food systems with a dispersed structure, the potential of the functional properties of raw materials is not fully used, which necessitates the use of additional factors of formation and stabilization of the structure in the form of food additives.

Mainly in the technology of products with a dispersed structure, vegetable raw materials are used as a flavor component, filler, source of BAS, etc. The stabilizing properties of vegetable raw materials due to the chemical composition, namely the content of hydrocolloids, have found less use.

Considering plant raw materials in terms of the content of functional and technological substances, low-consumption quince fruits are noted, which are a source of many important nutrients, including pectin and proto pectin, which can significantly affect the functional and technological properties of systems using them.

A series of experimental studies have been performed to scientifically substantiate the technological parameters and modes of obtaining quince puree for the purpose of their further use in the technology of dairy and plant compositions. The regulation parameters of the process of obtaining puree selected values of such indicators as pH, temperature and duration of heat treatment of fruits.

Based on previous studies on the production of puree, it was found that the hydrolysis of proto pectin is most intense in an acidic environment. The pH of the system was adjusted by introducing citric acid solutions. The research results of the pH effect on the content of soluble pectin in quince puree are shown in Fig. 1.

The results obtained (Fig. 1) show that the change in pH of the medium significantly affects the content of soluble pectin in quince puree. Studies have shown that the maximum amount of soluble pectin in the puree accumulates at pH 3.2. Heat treatment and its duration significantly affect the state and fractional composition of pectin substances (Deinychenko et al., 2016).

Thus, with increasing duration and temperature of treatment, the proportion of water-soluble fraction increases. However, to prevent the loss of dry matter, the decomposition of organic acids, the duration of hydrothermal treatment was limited by the appearance of violations of the fruit integrity. The research results are shown in Fig. 2.

Thus, hydrothermal treatment leads to the accumulation of pectin in the puree, which is positive given the working hypothesis (Fig. 2).

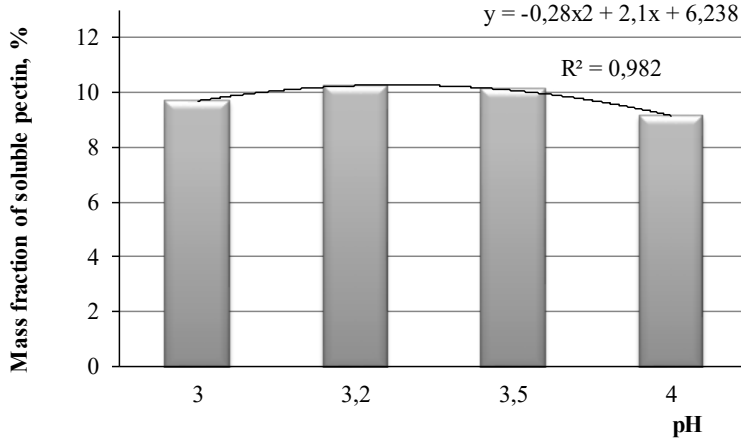


Fig. 1. pH effect on the content of soluble pectin in quince puree

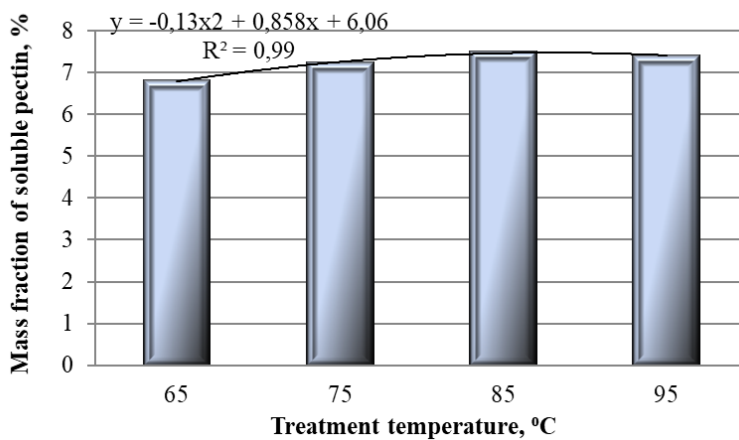


Fig. 2. The temperature effect of hydrothermal treatment of quince fruits on the content of soluble pectin in them

Thus, the maximum accumulation of pectin in the puree was 7.6% at the temperature of hydrothermal treatment of quince fruits 85 °C. The accumulation of water-soluble fraction of pectin is more pronounced and increases by 30 %. This indicates that according to certain process parameters is the hydrolysis of insoluble proto pectin, the amount of which is restored by hydrolysis of hemicellulose with the accumulation of polymers of pectin acids. It is known that temperatures above 80 °C lead to the destruction of puree BAS and negatively affect their nutritional value (Krapyvnytska, 2012), so we determined the effect of heating quince puree on the content of soluble pectin at a temperature of  $80 \pm 3$  °C for 30 min. The results of the obtained research are presented in fig. 3.

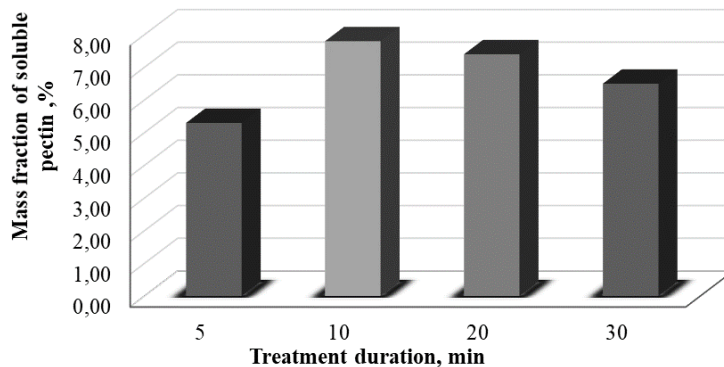


Fig. 3. Effect of the duration of heat treatment of fruits on the content of soluble pectin

The rational time of hydrothermal treatment of raw materials, during which the maximum hydrolysis of proto pectin takes place, is determined (10–12) min (Fig. 3).

The main physical and chemical parameters of quince puree, obtained according to the developed technological parameters, in comparison with the control - without processing (Table 1) have been determined.

Tabl. 1. Physical and chemical parameters of quince puree

Name of indicators	Quince puree	
	control	obtained
Soluble dry substances, %	16,7±2,5	15,5±2,3
Total carbohydrates, %	9,78±1,5	8,76±1,3
Titrated acid (calculated on apple)%	0,78±0,10	0,52±0,08
L- ascorbic acid, mg / 100 g	11,1±1,5	6,0±1,0
Pectic substances, %	4,9±0,7	7,8±1,1

Therefore, the obtained quince puree according to the developed technological parameters has high quality indicators (table 1). The high content of pectin (7.8%) allows it to be recommended as a stabilizer of the structure of frozen dessert.

A research was conducted to develop a new ice cream, the technology of which used quince puree. The technology of milk and fruit ice cream provided the following stages: preparation of hydrothermally processed quince puree; preparation of sugar-cream mixture; preparation of the mass (combination of prepared quince puree and sugar-cream mixture).

Experimental samples of ice cream with different content of puree in the finished product were developed (Table 2).

In the process of making ice cream, a rather complex structure of the product is formed, which is characterized by certain sizes of ice crystals, air bubbles and fat globules. Pectin substances of quince puree are adsorbed in the film of foam balloons and increase their density. Sugar creates a stabilizing effect in the formation of foam due to dehydration of molecules.

Table 2. Milk and fruit ice cream

Name of raw materials	Net weight, g				
	Cream ice cream (control)	The content of the puree, %			
		10	20	30	40
Cream 35% fat.	320	256	192	128	64
Milk 3.2% fat.	320	320	320	320	320
Ivy puree	-	109	173	237	365
Sugar	315	315	315	315	315
Stabilizer-emulsifier ISC 06001	40	-	-	-	-
Water	5	-	-	-	-
Exit	1000	1000	1000	1000	1000

Source: own development

Characteristic indicators of ice cream quality are resistance to melting and beating. The results of the research are presented in table 3.

Table 3. Quality indicators of milk and fruit ice cream

Name of the sample	Content puree, %				
	control	10	20	30	40
	<i>Resistance to melting, <math>\tau \times 60-1, c</math></i>				
Quince puree ice cream	45,4±2	46,1±2	46,8± 1	47,8± 1	36,1± 1
	<i>Beaten, %</i>				
	91,2±1	91,7± 1	91,5± 1	91,2± 1	87,4± 1

Source: own development

Studies have shown that milk and fruit ice cream with a substitute of 30% quince puree has a melting resistance of 47.8% against 45.4% in the control sample, and a whipping rate of 91.2% is equal to the control sample. Therefore, the addition of quince puree with a content of 30% allows you to stabilize the structure of the ice cream at the level of the control sample without adding an artificial stabilizer.

The organoleptic parameters of milk and fruit ice cream were studied according to the different content of quince puree in comparison with the control (cream ice cream) according to the 5-point system (Fig. 4).

It has been determined that fruit and milk ice cream with 30% of quince puree is not inferior to the control sample, and in some respects exceeds - smell, taste, color and appearance (Fig. 4). Ice cream with quince puree (30%) had a uniform cream color; pleasant creamy-fruity aroma with a hint reminiscent of honey; sweet with a noticeable acidity; dense consistency and soft-loose structure.

## Conclusions and results discussion

According to the results of experimental research, technological solutions for the development of technology of milk ice cream from quince puree are scientifically sub-

stantiated. Technological parameters of quince fruit processing are argued to ensure the realization of its target properties as a structuring: the temperature of hydrothermal processing of quince fruits -  $80 \pm 2$  °C, duration - 10-12 minutes, pH - 3.2. The expediency of using acid hydrolysis using citric acid as a pH regulator is motivated.

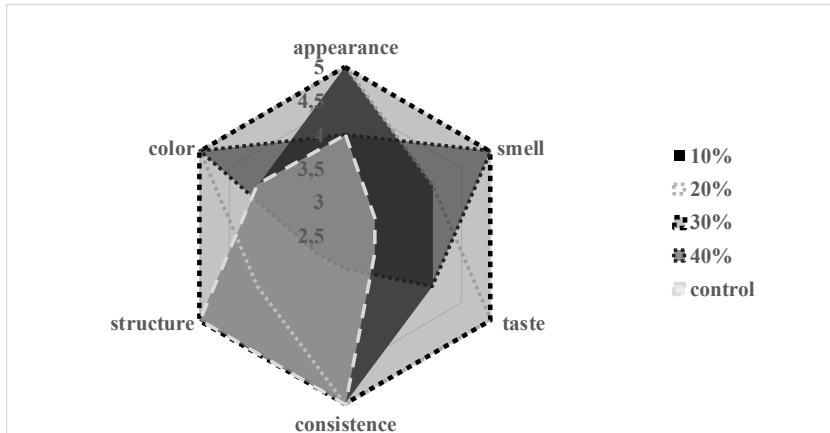


Fig. 4. Organoleptic characteristics of milk and fruit ice cream with different content of quince puree and control (without puree)

The conducted researches became the basis for development of technology of milk and fruit ice cream with the content of quince puree of 30% as the structuring. Its quality indicators are determined and its advantages are proved.

The obtained research results will contribute to the expansion of practical solutions in technologies of food dispersed systems with a combined composition of raw materials, including those with a high content of pectin substances in fruits and vegetables.

The introduction of milk and fruit ice cream technology will expand the range of health products; diversify the diet of people suffering from obesity, heart and stomach diseases.

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## ТЕХНОЛОГІЧНІ АСПЕКТИ ВИКОРИСТАННЯ ПЛОДІВ АЙВИ В ТЕХНОЛОГІЇ МОРОЗИВА

**Актуальність.** Забезпечення населення високоякісними і різноманітними продуктами харчування є важливим завданням країни для досягнення високого рівня життя. Серйозною тенденцією розвитку харчової промисловості є виробництво продуктів оздоровчого харчування, які сприятимуть профілактиці аліментарно-залежних захворювань, корекції діяльності захисної системи організму та відновленню порушених функцій органів і систем. Серед харчових продуктів широкою популярністю користуються заморожені десерти, а саме морозиво. **Мета роботи** – дослідження технологічних параметрів одержання пюре із айви для використання в технології морозива як природного стабілізатора структури. **Методи дослідження:** фізико-хімічні, реологічні, органолептичні, експериментально-статистичні, виконані з використанням сучасних приладів і комп'ютерних технологій. **Наукова новизна** полягає в обґрунтуванні використання пюре з айви в технології морозива та встановленні закономірності формування і стабілізації його структури. **Головні результати і висновки.** Теоретично обґрунтовано та експериментально визначено технологічні параметри оброблення пектиновмісної сировини для технології молочно-фруктового морозива. Досліджено вплив рН середовища, температури та тривалості теплового оброблення айви на процес накопичення розчинного пектину. Розроблено технологію морозива з природним стабілізуючим компонентом – пюре із айви. Визначено показники якості готового продукту. Одержані результати досліджень сприятимуть розширенню практичних рішень у технологіях харчових дисперсних систем із комбінованим складом сировини, в тому числі з високим вмістом пектинових речовин плодів та овочів. Впровадження технології молочно-фруктового морозива дозволить розширити асортимент натурального замороженого десерту, урізноманітнити харчовий раціон людей, які страждають на ожиріння, серцеві та шлункові захворювання.

**Ключові слова:** айва, пюре, пектинові речовини, стабілізатор структури, морозиво, технологія.

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## ТЕХНОЛОГИЧЕСКИЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ПЛОДОВ АЙВЫ В ТЕХНОЛОГИИ МОРОЖЕНОГО

**Актуальность.** Обеспечение населения высококачественными и разнообразными продуктами питания является важной задачей страны для достижения высокого уровня жизни. Серьезной тенденцией развития пищевой промышленности является производство продуктов оздоровительного питания, которые будут способствовать профилактике алиментарно-зависимых заболеваний, коррекции деятельности защитной системы организма и восстановлению нарушенных функций органов и систем. Среди пищевых продуктов широкой популярностью пользуются замороженные десерты, а именно мороженое.

**Цель работы** – исследование технологических параметров получения пюре из айвы для использования в технологии мороженого как стабилизатора структуры. **Методы исследования:** физико-химические, реологические, органолептические, экспериментально-статистические, выполненные с использованием современных приборов и компьютерных технологий. **Научная новизна** статьи заключается в обосновании использования пюре из айвы в технологии мороженого. **Главные результаты и выводы.** Теоретически обоснованы и экспериментально определены технологические параметры обработки пектинсодержащего сырья для технологии молочно-фруктового мороженого. Исследовано влияние pH среды, температуры и продолжительности тепловой обработки айвы на процесс накопления растворимого пектина. Разработана технология мороженого с натуральным стабилизирующим компонентом – пюре из айвы. Определены показатели качества готового продукта. Полученные результаты исследований будут способствовать расширению практических решений в технологиях пищевых дисперсных систем с комбинированным составом сырья, в том числе с высоким содержанием пектиновых веществ плодов и овощей. Внедрение технологии молочно-фруктового мороженого позволит расширить ассортимент натурального замороженного десерта, разнообразить пищевой рацион людей, страдающих ожирением, сердечными и желудочными заболеваниями.

**Ключевые слова:** айва, пюре, пектиновые вещества, стабилизатор структуры, мороженое, технология.