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Shakhnozakhon SALIJONOVA
Tashkent Chemical-Technological Institute, Tashkent, Uzbekistan, shaxnozasalijanova@gmail.com

Akbarali RUZIBAYEV
Tashkent Chemical-Technological Institute, Tashkent, Uzbekistan, akbar216@mail.ru

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RESEARCHING OF THE SHELF LIFE AND QUALITY OF MARGARINE ENRICHED IN INULIN

Shakhnozakhon SALIJONOVA (shaxnozasalijanova@gmail.com),
Akbarali RUZIBAYEV (akbar240983@gmail.com)
Tashkent Chemical-Technological Institute, Tashkent, Uzbekistan

Extensive research is being carried out in the world on the effective use of non-traditional plant raw materials, its production in margarine, mayonnaise and similar oil and fat products. In this aspect, special attention is paid to improving targeted technological processes, developing margarine formulations from local raw materials, increasing the nutritional and biological value of products, efficient use of natural raw materials and expanding the range of products. The aim of the study is to study the shelf life of the obtained diabetic low-calorie margarine based on the extract of Jerusalem artichoke tubers. Based on the research, it was determined that the shelf life of margarine obtained on the basis of Jerusalem artichoke tubers extract is longer than the traditional one.

Keywords: Jerusalem artichoke tuber extract, emulsifier, inulin, fatty acids, peroxide value, anisidine value

ИССЛЕДОВАНИЕ СРОКА ХРАНЕНИЯ И КАЧЕСТВА МАРГАРИНА, ОБОГАЩЕННОГО ИНУЛИНОМ

Шахнозахон САЛИЖОНОВА (shaxnozasalijanova@gmail.com),
Акбарали РУЗИБАЕВ (akbar240983@gmail.com)
Ташкентский химико-технологический институт, Ташкент, Узбекистан

В мире ведутся обширные исследования по эффективному использованию нетрадиционного растительного сырья, его применению в маргарине, майонезе и аналогичных масложировых продуктах. В этом аспекте, особое внимание уделяется совершенствованию целевых технологических процессов, разработке рецептур маргарина из местного сырья, повышению пищевой и биологической ценности продуктов, эффективному использованию натурального сырья и расширению ассортимента продукции. Целью исследования является изучения срока хранения получаемого диабетического низкокалорийного маргарина на основе экстракта клубней топинамбура. На основе исследования определено, что срок хранения маргарина, полученного на основе экстракта клубней топинамбура больше, чем традиционного.

Keywords: экстракт клубней топинамбура, эмульгатор, инулин, жирные кислоты, перекисное число, анизидиновое число

INULIN BILAN BOYITILGAN MARGARINNING SAQLASH MUDDATI VA SIFATINING TADQIQOTI

Shaxnozaxon SALIJONOVA (shaxnozasalijanova@gmail.com),
Akbarali RUZIBAYEV (akbar240983@gmail.com)
Toshkent kimyo-texnologiya instituti, O'zbekiston

Dunyoda noan'anaviy o'simlik xom ashyolaridan samarali foydalanish, ulardan margarin, mayonez va shu kabi yog-moy mahsulotlari ishlab chiqarish bo'yicha keng qamrovli tadqiqotlar olib borilmoqda. Bu borada maqsadli texnologik jarayonlarni takomillashtirish, mahalliy xomashyodan margarin retsepturalarini tuzish, mahsulotlarning ozuqaviy va biologik qimmatini oshirish, tabiiy xomashyodan samarali foydalanish va mahsulot turlarini ko'paytirishga alohida e'tibor qaratilmoqda. Tadqiqotning maqsadi – topinambur tuganagining ekstrakti asosida olingan past kaloriyali diabetik margarinning saqlash muddatini o'rganish. Tadqiqotlar natijasida topinambur tuganagining ekstrakti asosida olingan margarinning saqlash muddati an'anaviydan uzoqroq ekanligi aniqlangan.

Keywords: topinambur tuganagining ekstrakti, emulgator, inulin, yog' kislotalari, perekis soni, anizidin soni

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Introduction

Jerusalem artichoke differs from other plant fruits in the presence of inulin, pectin and dietary fiber. Typically, a variety of foods for patients with diabetes are prepared on the basis of inulin-enriched artichoke tubers [1-3]. It can also be used separately from inulin. Using of Inulin is selected depending on the type and feature of the product to be applied with or without Jerusalem artichoke. For instance, inulin powder or its hydrolyzed derivatives are used in dairy products. In bread and confectionery, it can be used in the form of inulin powder or artichoke tuber's powder [4-7]. Research has also been conducted on the use of inulin or Jerusalem artichoke powder in mayonnaise and ice cream products [8-12].

In the manufacture of many foods, artichoke tubers powder or inulin powder is added to enrich the resulting products with inulin. However, Jerusalem artichoke also contains other biologically active substances, which allow to increase the physicochemical properties of the products obtained. Some of these are polyphenols, which are present in artichoke tubers at 120-240 mg/100g. Polyphenols are powerful antioxidants, and artichokes contain species such as flavanols, leukoanthocyanins, chlorogenic acids, and coumarins. These act as antioxidants in the composition of the product and allow to prolong the storage period of the product [13-17].

In order to enrich margarine with inulin, research has been conducted on the addition of artichoke extract to products recipe [18-20]. The authors of the study found that artichoke extract was included in the margarine recipe by taking it in several ways and that it was effective to extract by the extraction method. In the study [21], the main focus in obtaining inulin extract from the artichoke tubers was to obtain a clear color along with the amount of inulin. Due to it, the extraction method is preferred.

This study is a logical continuation of the above work, which aims to isolate the maximum amount of polyphenols in addition to inulin in Jerusalem artichokes and to study their effect on the quality of margarine [22, 23].

There are several ways to separate the extract from the tubers of the artichoke. These include pressing, pressing-extraction and direct extraction methods. These methods have their own advantages

and disadvantages and require specific technology and equipment. These methods are selected depending on the purpose for which the extract obtained is used. Today, undoubtedly, all three methods are widely used.

In order to obtain the extract with the highest content of polyphenols from the Jerusalem artichoke tubers, the methods of pressing and direct extraction were analyzed and then the most optimal methods were tested in the laboratory.

Research methods

Initially, experiments were performed to obtain inulin extract by the pressing method. To do this, the artichoke tubers were thoroughly washed, peeled, crushed and pressed in a laboratory press. The resulting extract was filtered and analyzed.

The amount of inulin in the Jerusalem artichoke tuber and extract obtained by pressing and extraction methods was determined by HPLC Shimadzu LC-20 [24].

The amount of polyphenols was determined according to GOST [25].

The amount of proteins in the extract of Jerusalem artichoke tubers was determined by the Kjeldahl method [26].

The amount of carbohydrates in the extract of Jerusalem artichoke tubers was determined by the Bertrand method [27].

The amount of pectins in the extract of Jerusalem artichoke tubers is determined according to GOST [28].

The amount of primary and secondary oxidation products was determined according to GOST [29, 30].

Results and discussion

Experiments were carried out to obtain extract by direct extraction from the tubers of artichokes in parallel. First, the artichoke tubers were thoroughly washed with water, then separated from the peel, cut into thin slices and cut. The cut pieces were dried under natural conditions. The dried product was crushed in a grinder into particles of 1-2 mm in size. The resulting powder was extracted for 30-150 minutes at 85-90 °C with water in an amount of 10:15 relative to the mass. In this case, the extract was filtered and analyzed.

The content of inulin and polyphenols in the extracts obtained by both methods was determined and compared. The results obtained are illustrated in Table 1.

From the data in Table 1, it can be seen that when the extract was extracted from the artichoke end by pressing, 60% of the polyphenols present in the artichoke were separated by the extract. When extracted, it is 85% extract. Similarly, inulin was 68% obtained by pressing and 80% by extraction, respectively. The large amount of inulin and polyphenols in the extract obtained by extraction is explained by their good solubility in water.

Due to the color of the extract obtained by the method of extraction and the relatively high content of biologically active substances, it is advisable to include it in the margarine recipe.

Consequently, artichoke extract was obtained under laboratory conditions, samples of different concentrations were prepared and the composition of the samples was determined. The results of the analysis are presented in Table 2.

As can be seen from Table 2, Jerusalem artichoke extract contains substances that have a positive effect on the shelf life of margarine, mainly inulin, a product suitable for diabetics, as well as polyphenols, i.e. components with antioxidant properties (carotenoids, chlorophyll and etc).

As margarine is one of these perishable foods, additives (phospholipids, carotenoids, etc.) with antioxidant properties are widely used in its composition. This will definitely affects the cost of the product.

An emulsion was prepared by adding a high concentration of aqueous extract of artichoke instead of water and sugar in the margarine recipe, and its

Table 1

The amount of inulin and polyphenols in Jerusalem artichoke and its derivatives

The name of indicators	in Jerusalem artichoke tubers	In the extract obtained by the method of press	In the extract obtained by the method of extraction
Inulin, g/100g	13,7	9,4	11,6
Polyphenols,	230	138	196

Table 2

Chemical composition of Jerusalem artichoke extract

Name of ingredients	Unit of measurement	Value change
Carbohydrates	%	16,30-50,0
Inulin	%	11,60-35,60
Proteins	%	0,80-2,08
Pectin	%	0,80-2,45
Polyphenols	mg/g	5,68-17,44

Table 3

The effect of artichoke extract on the change in the value of peroxides during the shelf life of margarine

Margarine type	Peroxide value changes, mmol O / kg during storage, month				
	0	3	6	9	12
Traditional margarine (control)	4,8	5,2	6,7	12,3	32
Margarine obtained using Jerusalem artichoke	4,8	5	5,4	6,5	10,2

Table 4

Changes in anisidine levels during storage of margarine

Margarine type	Changes in anisidine value, c.u. storage, month				
	0	3	6	9	12
Traditional margarine (control)	1,8	2,1	2,6	3,8	7
Margarine obtained using Jerusalem artichoke extract	1,8	1,9	2,15	2,55	3,25

shelf life was studied. During storage, the value of margarines from peroxide and anisidine were checked.

The change in the peroxide value of low-calorie margarines (60% fat) made from artichoke extract and traditional recipe is shown in Table 3.

As can be seen from Table 3, the value of peroxides in the low-calorie margarine made from artichoke extract is almost insignificant during the specified shelf life (6 months). For 12 months, the value of peroxides of this margarine exceeds the specified value (10 mmol/kg). The increase in the oxidation resistance of margarine with added extract is explained by the antioxidant properties of the polyphenols it contains. Therefore, they slow down the increase in the value of margarine peroxides.

This situation can also be observed in the study of secondary oxidized products formed in margarine. Table 4 shows the change in the value of anisidines in these margarines.

As can be seen from Table 4, margarines form aldehydes, ketones, etc. to a certain extent during their shelf life. This can be seen from the increase in their anisidine values. If we look at this changes, we can see that the value of anisidine in the proposed margarine increased more slowly than in conventional margarine during storage. This suggests that the proposed Jerusalem artichoke extract is a raw material rich in the ingredients needed to improve the quality of margarine rather than a sugar solution.

If the kinetic changes in Table 3 and 4 are compared, the rate of formation of secondary oxides in margarine appears to be slower when using Jerusalem artichoke extract than in the traditional recipe.

Conclusion

The following conclusions can be drawn from this:

In the production of low-calorie margarines (60% fat), the use of artichoke extract instead of water and sugar (sucrose) was found to be effective.

Due to the presence of polyphenols, as well as fructose and other carbohydrates in the extract of Jerusalem artichoke, it was found that the shelf life of low-calorie margarines made on its basis increases by 1.3-1.5 times.

It was found that the rate of formation of primary and secondary oxidized substances during the shelf life of low-calorie margarines (60% fat) depends on the traditional refined sugar solution (control) and artichoke tuber extract used in their preparation.

The possibility and conditions for the development of diabetic margarine using Jerusalem artichoke tuber extract were identified.

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