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INVESTIGATION OF THE COMPOSITION OF POLYPHENOLIC SUBSTANCES OF THE JUICE FROM ARTICHOKE TUBERS

Abstract. Currently, the growth of diseases with diabetes, metabolic disorders, and obesity increases the demand for preventive and functional products. Currently available technologies for the production of preventive products provide for the replacement of sugar with sugar substitutes or its complete absence, which naturally reduces the nutritional and energy value of the products produced.

One of the main promising areas of the processing industry is the production of new products and sugar substitutes based on non-traditional types of plant raw materials that have a rich carbohydrate complex in their composition.

These types of raw materials among vegetable crops include jerusalem artichoke. Currently, jerusalem artichoke juice is of particular interest for use in the production of soft drinks, as it has a rich chemical composition, which makes Jerusalem artichoke indispensable in dietary nutrition, in the preparation of highly effective medicines.

In this article, the chemical composition of tubers and juice-semi-finished products from jerusalem artichoke is investigated. The results of the studies showed that the bulk of the dry substances in jerusalem artichoke tubers are carbohydrates, most of which are represented by fructosides. In the semi-finished juice passes: oligosaccharides 22.54 %, monosaccharides 1.61%, as well as part of the structural polysaccharides-fiber 0.07 %, pectin substances 1.84 %.

The change in the fractional composition of the polyphenolic substances of the pulp and semi - finished juice was studied when the pulp was kept for 30 minutes. When developing the technology for the production of juices and beverages based on jerusalem artichoke, it was found that the polyphenolic substances of jerusalem artichoke tubers have a great influence on the technological properties of raw materials, the quality and nutritional value of the finished product. It was found that the enzymatic process of oxidative transformation of polyphenols occurs as much as possible in the first 5-10 minutes.

Key words: jerusalem artichoke, chemical composition, nutritional value, polyphenolic substances.

Introduction. The constant growth of diseases with diabetes, metabolic disorders, and obesity increases the demand for preventive nutrition products. Currently existing technologies for the production of canned food for preventive purposes provide for the replacement of sugar with sweeteners or its complete absence, which naturally reduces the nutritional and energy value of these products [1,2].

One of the main promising areas of the food industry is the production of new products and sweeteners based on non-traditional types of plant raw materials that have a rich carbohydrate complex in their composition. These types of raw materials among vegetable crops include jerusalem artichoke [3].

Of great interest is its ability to produce relatively large amounts of fructose polymers as spare carbohydrates. The rich composition of biological active substances makes jerusalem artichoke indispensable in dietary nutrition, in the preparation of highly effective medicines [4,5,6]. Jerusalem artichoke is one of the few inulin-bearing plants in nature and surpasses all other plants in terms of the

content of inulin and its polymers [7,8]. Inulin is poorly absorbed by the human body. In this regard, one of the most important scientific and technical tasks facing the food industry is to find an effective way to convert inulin into fructose, which can be successfully used as a sugar substitute in the production of canned food for preventive purposes, meeting the modern concept of a balanced diet.

Jerusalem artichoke is a promising agricultural crop for the production of industrial products, fuel production, as well as as a raw material for the food and biochemical industries [9,10,11]. The plant produces a large crop of tubers, can be cultivated on various soils, is resistant to agricultural pests, plant diseases and low temperatures.

Early studies show that the dry matter content of tubers varies greatly - from 19 % to 30 %.

The chemical composition of tubers largely depends on the place and conditions of growth, the weather conditions of the harvest year, and of course on the biological characteristics of the Jerusalem artichoke variety itself [12]. Carbohydrates occupy an exceptionally large place in the diet. Their share in human food is 50-60 % (in terms of calories) [13].

The chemical composition of jerusalem artichoke is mainly represented by a carbohydrate complex (80 %), the highest homologue of which is inulin. Inulin in the human body is absorbed by 60 %, which is one of the main tasks for scientists of our time, finding an effective way to convert inulin into sweet, fully digestible in the body and having dietary properties of fructose [14].

D-fructose, or fruit sugar, is a representative of ketosis. The imperial formula is C6H12O6. It is a white crystal that tastes 1.5 times sweeter than sucrose. It is soluble in warm and cold water. Fructose is obtained by hydrolysis of various Sugars, in this case inulin.

Carbohydrates in the storage of food, raw materials, and its processing into finished products undergo various and complex transformations. They depend on the composition of the carbohydrate complex, conditions (humidity, temperature, pH of the medium), the presence of enzymes, and the presence in processing products of other components that interact with carbohydrates (proteins, lipids, organic acids, etc.) [15].

The total acid content in jerusalem artichoke tubers ranges from 6 % to 9 % by dry weight, of which 35-50% is accounted for by di - and tricarboxylic acids [16].

DTA is represented by lemon, fumar, apple and amber. Malic acid-the predominant, its amount reaches 90 % of the total content of these acids.

The purpose of this study is to study the chemical composition of tubers and jerusalem artichoke juice, as well as to study the changes in polyphenolic substances depending on various factors.

Objects and methods of research. The object of research was jerusalem artichoke tubers of the "Dietetic" variety, zoned in the East Kazakhstan region. The research base was the NIL "Food Safety" of the Almaty Technological University.

To determine the total amount of polyphenols, methods are used based on the property of phenols to form reactive quinones, which give colored compounds when oxidized with certain reagents. In this study, the widely used photometric Folin-Denis method [17] was used, based on the formation of blue complexes during the reduction of W^{+6} to W^{+2} under the action of most polyphenols with the Folin-Denis reagent in an alkaline medium.

The results of the study. To achieve the intended goal, the initial task of the study was the need to study the chemical composition of jerusalem artichoke tubers of the "Dietetic" variety and semi-finished juice product taken from it.

The results of the studies showed that the bulk of the dry substances in jerusalem artichoke tubers are carbohydrates, most of which are represented by fructosides. Homologous series of fructosides starts with sucrose (n = 0), the lower homologue. And each of the following is different from another by one remainder of fructose. The highest homologue of this series is inulin (n = 35), it is valued as a reserve polysaccharide. In tubers, natural saccharification of inulin to oligofructosides can occur, and eventually to fructose (80 - 95 %) and glucose, respectively (20-5 %). Free sugars in tubers are represented by fructose and glucose. The results of hydrolysis of the oligosaccharides of jerusalem artichoke tubers show that they, in turn, consist of fructose and glucose.

Jerusalem artichoke tubers contain (by dry weight) inulin - 46.52 %, oligosaccharides-19.28 %, monosaccharides-1.02 %.

Structural polysaccharides (Table 1), which are part of the cell walls, are represented by fiber (by dry weight) 9.01 %. Pectin substances are contained in an amount of 3.45 %.

In the semi-finished juice passes: oligosaccharides 22.54 %, monosaccharides 1.61%, as well as part of the structural polysaccharides-fiber 0.07 %, pectin substances 1.84 %.

Table 1-Polysaccharide content in tubers and semi-finished jerusalem artichoke juice

Indicators	Content,% per dry weight	
	tubers	semi-finished juice
Monosaccharides	1,01	1,61
Oligosaccharides	19,8	22,54
Inulin	46,5	14,73
Pectin substances	3,5	1,84
Fiber	9,3	0,07

Jerusalem artichoke tubers are characterized by active components that have P-vitamin activity. The composition of polyphenolic substances includes chlorogenic acid-35 %, leucoanthocyanins-29 %, flavanols-22.6 %, coumarins - 6.08 % (Table 2).

Table 2 - Content of polyphenolic substances in tubers and jerusalem artichoke juice

Name of samples	Content of polyphenolic substances, mg per 100g				
	common	flavanols	leucoanthocyanins	chlorogenic acid	coumarins
Jerusalem artichoke tubers	230	52	67	81	14
Jerusalem artichoke juice	9,64	-	-	2,12	-

The vitamin composition of jerusalem artichoke tubers is represented by vitamins of group B (B_1, B_2, B_6), ascorbic acid, nicotinic acid (Table 3).

Table 3 - The Content of vitamins in the juice and tubers of Jerusalem artichoke

Name of samples	Vitamins, mg per 100g				
	B_1	B_2	B_6	C	PP
Jerusalem artichoke tubers	0.17	0.12	0.185	12.05	0.27
Jerusalem artichoke juice	0.15	0.11	0.17	6.42	0.19

Jerusalem artichoke tubers in the production of juice at the main stages of the technological process lose most of the original content of the components of the chemical composition.

Changes in the polyphenol complex in the production of semi - finished jerusalem artichoke juice indicate the course of deep oxidative processes. The semi-finished juice retains the content of

polyphenolic substances - 4 %, and chlorogenic acid-2.6 %, flavanols, leucoanthocyanins and coumarins are almost completely oxidized.

Polyphenolic substances are products of normal metabolism in the life of higher plants. The use of specific methods for determining the qualitative and quantitative content of polyphenols in the study of the chemical composition of fruits allowed a new assessment of the nutritional value of many of them. The predominance of certain polyphenolic substances determines a certain nutritional value, and leaves an imprint on the conditions of technological processing of fruitsm [18].

When developing the technology for the production of juices and beverages based on jerusalem artichoke, it was found that the polyphenolic substances of jerusalem artichoke tubers have a great influence on the technological properties of raw materials, the quality and nutritional value of the finished product [19].

The quantitative content of flavanols is represented by the sum of catechins and leucoanthocyanins capable of producing colored compounds with vanillin reagent, and chlorogenic acid-by the sum of isochlorogenic, chlorogenic and neochlorogenic acids.

The main part of the polyphenolic substances is oxidized at the stages of crushing and pressing the jerusalem artichoke pulp, part of the polyphenolic substances is lost with the pomace that is formed after the juice is separated. In the process of obtaining semi - finished juice, the color changes and the resulting samples have an aesthetically undesirable appearance.

Having studied the qualitative and quantitative composition of jerusalem artichoke tubers and semi-finished juice, we can say that the polyphenol complex of jerusalem artichoke tubers is destroyed by the action of oxidative enzymes in the production of semi - finished juice. The resulting juice cannot be allowed for further processing, due to its unsuitability.

To determine the optimal conditions for technological processing of raw materials, the influence of crushing processes, the duration of keeping the pulp of tubers, pressing and the enzymatic processes occurring at the same time on the polyphenolic substances and the color of the juice was traced.

Jerusalem artichoke tubers were crushed and the pulp was kept in the air at room temperature for a long time. 0, 5, 10, 15, 20, 25, 30 minutes from the moment of grinding.

The process of crushing and pressing fruits in industrial conditions lasts a little more than 30 minutes, so the time limit was chosen in accordance with the applicable technological modes.

Changes in the fractional composition of the polyphenolic substances of the pulp and semi-fabiricate juice during the aging of the pulp are shown in Figures 1-4.

Quantitative determination of the polyphenol complex showed that the process of enzymatic oxidation of polyphenols mainly occurs in the first 5 minutes after the crushing of tubers (Figure 2).

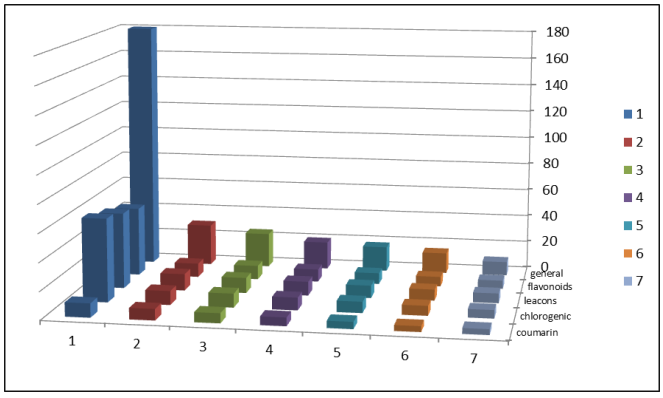

Figure 1. Fractional composition of polyphenolic substances when the pulp is kept for 30 minutes
1 - the contents of polyphenolic substances in tubers;
2, 3, 4, 5, 6, 7 - the content of poliphenolic substances when the pulp is kept for 5, 10, 15, 20, 25, 30 minutes respectively

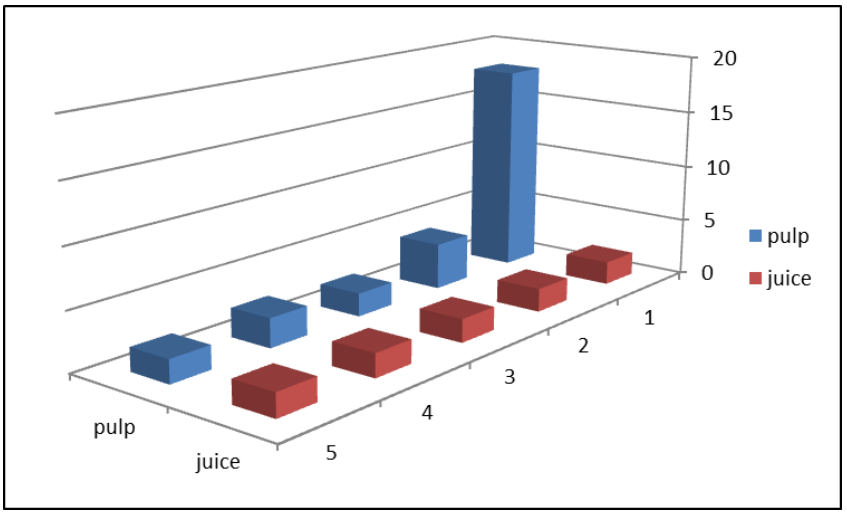

Figure 2. Fractional composition of polyphenolic substances

1-polyphenolic substances, 2-flavonols, 3-leucoanthocyanins, 4-chlorogenic acid, 5-coumarins;
Pulp - pulp, aged for 5 minutes; Juice - juice, pressed from pulp, aged for 5 minutes

After 5 minutes, the content of polyphenolic substances decreased to 16 %, and the content of flavonols to 10 %, leucoanthocyanins to 13 %, chlorogenic acid to 16.7 %, coumarins to 15.6 % of their original amount.

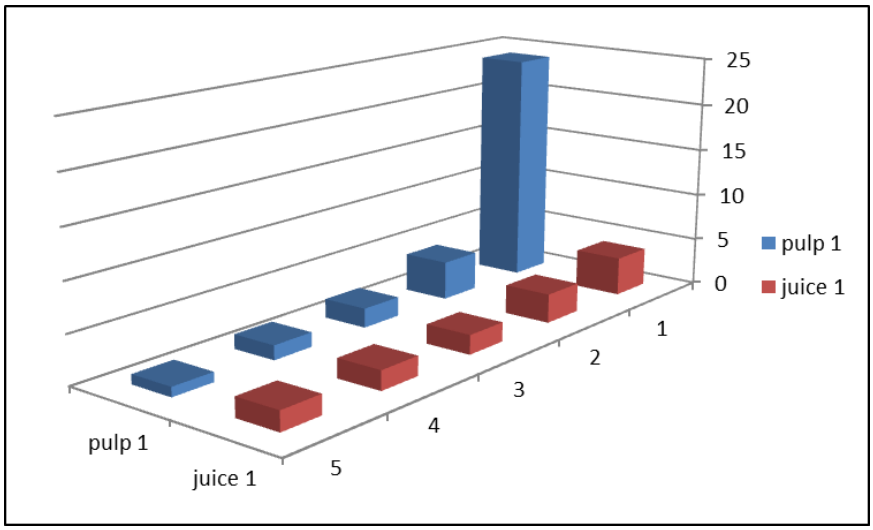

Figure 3. Fractional composition of polyphenolic substances

1-polyphenolic substances, 2-flavonols, 3-leucoanthocyanins, 4-chlorogenic acid, 5-coumarins;
Pulp 1 – pulp, aged for 10 minutes; Juice 1 - juice pressed from pulp aged for 10 minutes

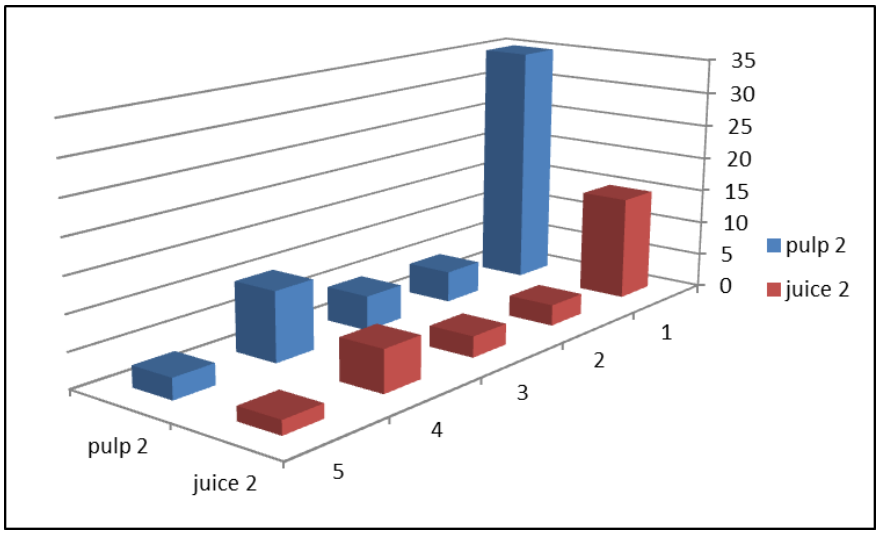

Figure 4. Fractional composition of polyphenolic substances

1- polyphenolic substances, 2-flavonols, 3-leucoanthocyanins, 4-chlorogenic acid, 5-coumarins; Pulp 2-pulp aged for 15 minutes; Juice 2-pressed from pulp aged for 15 minutes

In 10 minutes (Figure 3), the content of polyphenolic substances was 12 % (from the beginning), flavonols-8 %, leucoanthocyanins-4.7 %, chlorogenic acid-6 %, coumarins-1 %.

Jerusalem artichoke pulp aged for 15 minutes (Figure 4) had polyphenolic substances -8.5 %, flavonols-7 % and chlorogenic acid-1 %. Leucoanthocyanins and coumarins are completely oxidized by this time. When kept for 20 minutes, only flavonols -2% are found in the pulp. Even with a large expenditure of polyphenolic substances, we decided to trace the dynamics of the destruction of the polyphenol complex during the pressing of the pulp, aged for 5, 10, 15 minutes, where a small part of the polyphenolic substances is still preserved.

When pressing the pulp (exposure time-5 min) (Figure 2), 54% passes into the semi - finished juice, including flavonols 55%, leucoanthocyanins 25%, chlorogenic acid - 66%, coumarins 9 %. In the semi-finished juice obtained from the pulp (aging - 10 min) (Figure 3), the amount of PFV was 25 %. In the juice - after 15 and 20 minutes of aging, the pulp of polyphenolic substances was not detected (Figure 4).

The change in the color of the juice is related to the rate of enzymatic processes of oxidative transformation of polyphenolic substances. Instantaneous browning of the pulp begins from the moment of crushing and is accompanied by the accumulation of colored condensed compounds.

The maximum color change is observed after 15-20 minutes, which indicates the formation of colored compounds as a result of secondary oxidative processes and the contact of polyphenolic substances and the amino acid complex /4, 33/.

By a sharp decrease in the content of polyphenolic substances, a change in the color of the juice, it is possible to judge the depth of the enzymatic processes occurring during the mechanical grinding of tubers.

Conclusion. From the above, we can draw the appropriate conclusions:

1. the enzymatic process of oxidative transformation of polyphenols proceeds as much as possible during the first 5-10 minutes;

2. in order to more fully preserve the nutritional value and quality of juices, it is necessary to use non-corroding continuous equipment and reduce the duration of pressing to a minimum.

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ТОПИНАМБУР ТҮЙНЕКТЕРІНЕН АЛЫНҒАН ШЫРЫННЫҢ ПОЛИФЕНОЛДЫ ЗАТТАРДЫҢ ҚҰРАМЫН ЗЕРТТЕУ

Аннотация. Қазіргі уақытта қант диабетінің өсуі, зат алмасуының бұзылуы, семіздік ауруларының өсуі және функционалдық мақсаттағы өнімдерге сұранысты арттырады. Профилактикалық өнімдерді өндірудің қазіргі кездегі технологиялары қантты тәттілендіргіштерге алмастыруды немесе оның толық болмауын қамтамасыз етеді, бұл өнімнің тағамдық және энергетикалық құндылығын төмендетеді.

Өңдеу өнеркәсібінің негізгі перспективалық бағыттарының бірі - құрамы бойынша көмірсулар кешені бар өсімдік шикізатының дәстүрлі емес түрлеріне негізделген жаңа өнімдер мен қант алмастырғыштарды шығару.

Көкөніс өнімдерінің ішіндегі осы шикізат түрлеріне топинамбурды жатқызуға болады. Қазіргі кезде топинамбур шырыны алкогольсіз сусындар өндірісінде ерекше қызығушылық тудырады, өйткені оның бай химиялық құрамы бар, ол топинамбурды диеталық тамақтануда, өте тиімді дәрілік заттарды дайындауда таптырмайды.

Бұл мақалада түйнек пен шырын-жартылай фабрикаттағы топинамбурдың химиялық құрамы қарастырылады. Зерттеу нәтижелері көрсеткендей, топинамбур түйнектеріндегі құрғақ заттардың негізгі бөлігі көмірсулар болып табылады, олардың көпшілігі фруктозидтермен ұсынылған. Шырын құрамында - жартылай фабрикат: олигосахаридтер 22,54%, моносахаридтер 1,61%, сонымен қатар құрылымдық полисахаридтердің бөлігі - клетчатка 0,07%, пектиндік заттар 1,84%.

Болжыр мен шырынның жартылай фабрикаттардың полифенолды заттарының фракциялық құрамының өзгеруі болжырды 30 минут ұстағанда зерттелді. Топинамбур негізінде шырындар мен сусындар өндірісінің технологиясын жасаған кезде топинамбур түйнектерінің полифенолды заттарының шикізаттың технологиялық қасиеттеріне, дайын өнімнің сапасы мен тағамдық құндылығына үлкен әсері бар екендігі анықталды. Полифенолдардың тотығу конверсиясының ферментативті процесі алғашқы 5-10 минутта максимумда болатындығы анықталды.

Түйін сөздер: топинамбур, химиялық құрамы, тағамдық құндылығы, полифенолды заттар.

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ИССЛЕДОВАНИЕ СОСТАВА ПОЛИФЕНОЛЬНЫХ ВЕЩЕСТВ СОКА ИЗ КЛУБНЕЙ ТОПИНАМБУРА

Аннотация. В настоящее время рост заболеваний сахарным диабетом, нарушением обмена веществ, ожирением увеличивает спрос на продукты профилактического и функционального назначения. Имеющиеся в данное время технологии производства продуктов профилактического назначения предусматривают замену сахара сахарозаменителями или же его полное отсутствие, что естественным образом снижает пищевую и энергетическую ценность производимых продуктов.

Одним из главных перспективных направлений перерабатывающей промышленности является получение новых продуктов и сахарозаменителей на основе нетрадиционных видов растительного сырья, имеющих богатый углеводный комплекс в своем составе.

К данным видам сырья среди овощных культур можно отнести топинамбур. В настоящее время сок топинамбура представляет особый интерес для использования в производстве безалкогольных напитков, так как имеет богатый химический состав, что делает топинамбур незаменимым в диетическом питании, в приготовлении высокоэффективных лекарственных средств.

В данной статье исследован химический состав клубней и сока-полуфабриката из топинамбура. Результаты исследований показали, что основную массу сухих веществ в клубнях топинамбура составляют углеводы, большая часть которых представлена фруктозидами. В сок-полуфабрикат переходит: олигосахаридов 22,54 %, моносахаридов 1,61%, а также часть структурных полисахаридов-клетчатки 0,07 %, пектиновых веществ 1,84 %.

Изучено изменение фракционного состава полифенольных веществ мезги и сока-полуфабириката при выдерживании мезги в течение 30 минут. При разработке технологии производства соков и напитков на основе топинамбура установлено, что полифенольные вещества клубней топинамбура оказывают большое влияние на технологические свойства сырья, качество и пищевую ценность готового продукта. Установлено, что ферментативный процесс окислительного превращения полифенолов максимально протекает в первые 5-10 минут.

Ключевые слова: топинамбур, химический состав, пищевая ценность, полифенольные вещества.

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REFERENCES:

1. Tarasenko N.A., Tretyakova N.R. (2015) Natural sweeteners and sweeteners for the prevention of diabetes // Modern problems of science and education, №. 2-2. – P. 87-87 (in Russ.).

2. Belyaeva I.A., Panarina O.A. (2016) Jerusalem artichoke in therapeutic and prophylactic nutrition for diabetics// Innovative technologies in science and education, P. 89-92. (in Russ.).

3. Shanenko E. F., Silaeva M. A., Ermolaeva G. A. (2015) Jerusalem artichoke is a raw material for preventive nutrition // Nutrition issues, №. S2. – P. 219-219. (in Russ.).

4. Silaeva M.A., Arbuzova K.P. (2016) Non-alcoholic drink based on Jerusalem artichoke inulin autolysate // Beer and drinks, №4. (in Russ.).

5. Starovoitov V.I., Starovoitova O.A. (2015) Jerusalem artichoke is a unique vegetable raw material // Food industry, №8. (in Russ.).

6. Arsenyeva T.P., Yakovleva Yu.A., Feschenko V. (2011) Jerusalem artichoke as a means of treatment and prevention of various diseases // Scientific journal of NRU ITMO. Series "Processes and Apparatus for Food Production", №.1. (in Russ.).

7. Yuwen Mu, Wenting Gao. (2020)The antioxidant capacity and antioxidant system of Jerusalem artichoke (Helianthus tuberosus L.) tubers in relation to inulin during storage at different low temperatures // Industrial Crops and Products, Vol. 161. https://doi.org/10.1016/j.indcrop.2020.113229

8. Castellino M., Renna M. (2020) Conventional and unconventional recovery of inulin rich extracts for food use from the roots of globe artichoke// Food Hydrocolloids, Vol. 107. https://doi.org/10.1016/j.foodhyd.2020.105975

9. Gaetano Roberto. (2020)Globe artichoke crop residues and their potential for bioethanol production by dilute acid hydrolysis// Biomass and Bioenergy, Vol. 134,https://doi.org/10.1016/j.biombioe.2020.105471

10.YueWang, Yiguang Zhao. (2020) Nutritional value, bioactivity, and application potential of Jerusalem artichoke (Helianthus tuberosus L.) as a neotype feed resource// Animal Nutrition, Vol. 6. https://doi.org/10.1016/j.aninu.2020.09.001.

11. Starovoitov V.I. and others. (2013) Jerusalem artichoke - a culture of multipurpose use // Food industry,№4. (in Russ.).

12. Starovoitov V.I., Starovoitova O.A. (2017) Agro-methodology for growing Jerusalem artichoke // Agroengineering, №1. (in Russ.).

13. Titok V., Veevnik A., Yaroshevich M. (2014) Jerusalem artichoke culture for multifunctional purposes // Science and Innovations, №135. (in Russ.).

14. Ryzhov M.S., Mukhamedzhanova T.G., Churmasova L.A. (2006) Possibility of production of new fortified products from Jerusalem artichoke // Food industry,№11. (in Russ.).

15. Yaroshevich M.I., Evening N.N. (2009) Jerusalem artichoke (Helianthus tuberosus L.) - a promising crop for multipurpose use//Proceedings of the Belarusian State University: scientific journal. (in Russ.).

16. Dzhaboeva A.S., Shaova L.G. (2016) Biochemical composition of Jerusalem artichoke // Electronic network polythematic journal "Scientific works of KubGTU", №. 14. – P. 648-653. (in Russ.).

17. Mechikova G.Ya., Stepanova T.A., Zaguzova E. V. (2007) Quantitative determination of the sum of phenolic compounds in strawberry leaves // Chemical and pharmaceutical journal, №. 2. – P. 38-41. https://doi.org/10.30906/0023-1134-2007-41-2-38-41. (in Russ.).

18. Bakaytis V.I., Rubashanova E.A. Study of polyphenolic compounds and ascorbic acid in fresh fruits of honeysuckle cultivated in Altai Territory// Bulletin of the Siberian University of Consumer Cooperatives, №. 4. – P. 62-27. (in Russ.).

19. Baidalinova L.S., Melnikova V.A. (2016) Study of the antioxidant properties of a coffee substitute from Jerusalem artichoke in the Kaliningrad region // Izvestia KSTU , P. 91. (in Russ.).

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