Importance of technological properties of Jerusalem artichoke

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Abstract. Nowadays, providing the world's population with quality food products and controlling food safety is one of the important tasks. Implementation of innovative technologies of high-quality processing while fully preserving biologically active substances contained in food and medicinal plants and its prospective development are becoming increasingly important. In this regard, it is time to create, improve and introduce new technologies, i.e. integration of science and education production, in order to produce ecologically clean, competitive and quality food products of various types. Full analysis of physical, chemical, mechanical properties of local agricultural products, scientific justification of technological processes is given special attention. Jerusalem artichoke, one of the agricultural plants, contains polysaccharide compounds, organic acids, salts, minerals, inulin, macro and microelements, fiber (substance composed of plant cells), pectin, vitamins, essential oil, starch, carbohydrates, protein, amino acids and other substances. The selection of the optimal operating mode of the equipment used in the technological processes in the process of processing with preservation is of great scientific and practical importance.

1 Introduction

Jerusalem artichoke (Heliantus tuberosus L.) is one of the unconventional agricultural products with polysaccharides . It was first cultivated in North America and brought to Europe in the early 17th century[1]. It was brought and adapted in Uzbekistan after the second half of the 19th century. Jerusalem artichoke consists of 20-70 pear-shaped, oblong, ovate and smooth or wrinkled nodules. The root is tuberous and produces fruit at a depth of 20-25 cm in the soil[2]. Many varieties of Jerusalem artichoke are grown in Uzbekistan. Including: "Bianca", "Cross Bloomless", "Vadim", "Roter Topinambur", "Challenger", "HEL 69", "Hybrid 120", "Karina", "Faiz Baraka", " Mujiza " varieties. Jerusalem artichoke attracted all scientists with its resistance to dehydration, salinity, and high price. The first table shows the vitamin-rich composition of Jerusalem artichoke grown in Bukhara [3].

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Table 1. Vitamin content of Jerusalem artichoke roots.

№	Vitamins	Content, mg/100 g	Vitamins daily requirement, %
1.	β-carotene	0.012	0.2
2.	A	0.001	0.1
3.	B 1 (thiamine)	0.2	16.7
4.	B 2 (riboflavin)	0.1	4.6
5.	B 3 , PP (niacin, nicotinic acid)	1.3	8.1
6.	B 4 (choline)	30	6.0
7.	B 5 (pantothenic acid)	0.4	7.9
8.	B 6	0.1	5.9
9.	B 9 (folic acid)	13	3.3
10.	C	4	4.4
11.	E	0.19	1.3

Jerusalem artichoke is rich in vitamins, i.e. vitamin B 4 is 5 times more than the daily requirement. Also B 1 (thiamine), B 5 (pantothenic acid), B 9 (folic acid) and C vitamins serve to increase the immunity of the human body [4-6].

The mineral substances contained in Jerusalem artichoke root also serve to maintain the fluid composition of the human body at a constant level and to meet the demand for inorganic substances [7,8]. Table 2 shows the amount of mineral substances in Jerusalem artichoke grown in Bukhara.

Table 2. Mineral content of Jerusalem artichoke roots.

№	**Minerals**	**Content, mg/100 g**	**Minerals daily requirement, %**
1.	Potassium (K)	429	9.1
2.	Sodium (Na)	4	0.3
3.	Calcium (Ca)	14	1.4
4.	Magnesium (Mg)	17	4.3
5.	Phosphorus (P)	78	11.1
6.	Iron (Fe)	3.4	34.0
7.	Zinc (Zn)	0.12	1.1
8.	Copper (Cu)	0.14	15.6
9.	Manganese (Mn)	0.06	2.6
10.	Selenium (Se)	0.7	1.3

As can be seen from the above, the mineral substances in the Jerusalem artichoke are higher than the daily requirement of potassium (K), sodium (Na), calcium (Ca), magnesium (Mg), phosphorus (P) and iron (Fe).

Jerusalem artichokes are distinguished from other plants by being high in protein and containing natural forms of the polysaccharides inulin and insulin [9,10]. The composition of amino acids in Jerusalem artichoke is presented in Table 3 below.

Table 3. Amino acid content of Jerusalem artichoke.

№	**Amino acid content of tapinambur rhizome is medicinal**	**Ingredients (mg/100g)**
1.	Aspartic acid	288.9
2.	Threonine	154.6
3.	Serina	180.1
4.	Glutamic acid	264.5
5.	α-pyrrolidinecarboxylic acid	107.8
6.	aminoacetic acid	237.1

7.	aminopropionic acid	77.8
8.	aminoisovaleric acid	138.9
9.	Methionine - 2-amino-4-methylthiobutanoic acid	56.2
10.	isoleucine	77.5
11.	an aliphatic amino acid	88.1
12.	aminor propi on acid	104.6
13.	α-amino acid	78.1
14.	Lysine is an α-amino acid	97.1
15.	Histidine, α-amino-R-5imidazolylpropionic acid	62.9
16.	Arginine is an amino acid	1744.4

The composition of Jerusalem artichoke ash is rich in minerals, and it is close to the composition of sunflower ash. The mineral composition of Jerusalem artichoke and other plant ashes is given in Table 4 below.

Table 4. Mineral content of ash of different plants (in %).

No	Plant	Ash	CaO	MgO	K_2O	Na_2O	P_2O_5	CO_3	Cl
1 .	Jerusalem artichoke	27.73	5.92	3.44	1.55	0.17	0.40	0.66	0.22
2.	Sunflower	33.62	4.81	2.98	5.12	0.17	0.73	1.06	0.16
3.	Corn	13.1	1.26	0.79	2.81	0.06	0.43	0.50	0.16

As can be seen from the table, Jerusalem artichoke ash contains a sufficient amount of alkaline earth metals necessary for human health, especially for the growth of young children.

2 Materials and mehtods

Jerusalem artichoke's health benefits include inulin, a polysaccharide compound that helps treat ulcers and other ailments in the gastrointestinal tract. This property is a prebiotic fiber that helps regulate bowel movements, balance blood sugar, regulate blood pressure, lower cholesterol, and protect against cancer [11].

The chemical composition of Jerusalem artichoke changes depending on the biological characteristics of the variety, the weather in the year of growing the crop, the agrotechnical indicators of the land, and geographical factors. The mass fraction of fructose in the studied samples was 24.7%, 19.3%, 15.3% and 17.0% in the wet state. It has been scientifically proven that the amount of inulin is 25.04%, 18.60% and 8.12% higher in the Miracle variety than other varieties, and it is recommended to use the Miracle variety of Jerusalem artichoke in the production of fructose juice [12].

3 Results and discussion

Jerusalem artichoke contains carbohydrates, which are the plant's main source of nutrients. Carbohydrates are widely distributed in all anatomical parts of the root. Carbohydrates are divided into 2 large groups, monosaccharides and polysaccharides .

Polysaccharides are linear or branched high-molecular compounds, which are composed of monosaccharides whose molecules are linked by glycosidic bonds. They are reserve starch, inulin, glycogen, hemicelluloses. They accumulate a lot in Jerusalem artichokes. It is converted into organic acids, polyatomic phenols, digestible substances, anthocyanins, amino acids, fats, protein, etc.

Jerusalem artichoke contains inulin, which is a polysaccharide composed of excess fructose residues in the plant. Inulin is similar in structure to starch and glycogen. It is also hydrolyzed by the enzyme inulase and broken down into fructose. Inulin is found in large quantities in Jerusalem artichoke. Inulin can be used in the preparation of food for people with diabetes. The amount of polysaccharides in Jerusalem artichoke is presented in Table 5.

Table 5. Carbohydrate content of Jerusalem artichoke (in %).

No	Names	Amount, %	
		in the wet mass	In dry matter
1.	Inulin	11.71	48.31
2.	Starch	0.26	1.08
3.	Hemicellulose	1.03	4.28
4.	Cellulose	2.13	8.82
5.	Mannose	0.16	0.62
6.	Disaccharides	6.14	25.35

Table 5 shows that Jerusalem artichoke fruit is rich in polysaccharides that are quickly hydrolyzed in an acidic environment. Also, Jerusalem artichoke contains up to 6% protopectin, 2.5% of which is soluble pectin. In addition, Jerusalem artichoke contains organic acids such as citric, malic, fumaric, succinic, quinin, and sialic acids. Jerusalem artichoke also contains minerals, including potassium, sodium, calcium, magnesium, phosphorus, chlorine, and trace elements such as cobalt, molybdenum, manganese, iodine, copper, and zinc, which play a role in the complete metabolism of the human body and constant control of the body's activity. It should be noted separately that cobalt is a provitamin B12, which is part of copper tyrosinase and other enzymes.

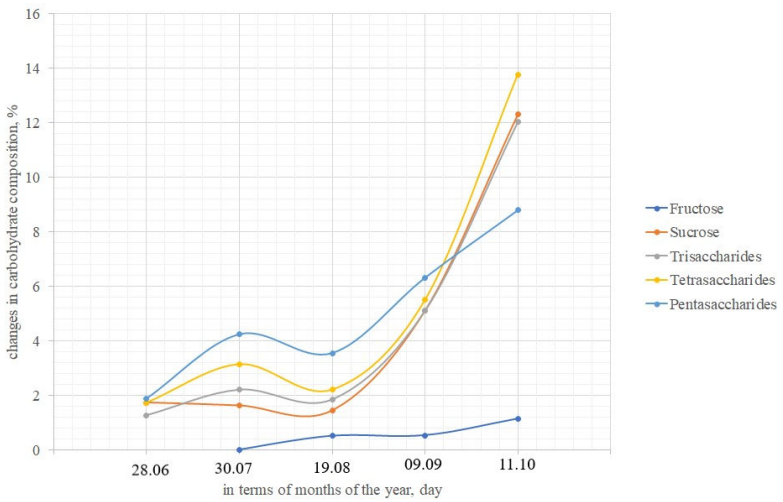

Fig. 1. Fructan content of Jerusalem artichoke fruit of the "Mujiza" variety (in %).

Fig. 1 shows that the carbohydrates in Jerusalem artichoke root reach the norm during the development stage of the plant and cause a sharp increase in the content of fructose, sucrose and tetrasaccharides in the fruit. These carbohydrates contained in Jerusalem artichoke are maximally matured during the growth of the plant and create a great opportunity to obtain various products from the root.

4 Conclusion

As a result of research, the content of organic and inorganic substances, vitamins, minerals, amino acids and biologically active compounds in Jerusalem artichoke was studied. By studying the specific properties of Jerusalem artichoke, it is possible to extract juices with different types of natural sugars from it, and to add it as an additional element during the preparation of food products as an additional element to ensure product quality in various areas of the food industry, and it can be used for therapeutic and preventive purposes in pharmaceuticals. Jerusalem artichoke contains elements useful for the human body, such micro-macro elements are unique to Jerusalem artichoke. The benefit of the local Jerusalem artichoke to human health, the amount of daily consumption, and its medicinal properties compared to other fruits and vegetables were established as a result of scientific research and experimental tests.

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