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Active Substances in Artichoke Leaves (Cynara Scolymus L.)

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Abstract:

This article is devoted to the study of biologically active substances in the leaves of prickly artichoke (Cynara scolymus L.).

Keywords: Cynara scolymus L, chemical analysis, extract toxicity.

Relevance of the topic: Prickly artichoke (*Cynara scolymus L.*) is a perennial herbaceous plant. The artichoke is considered to be native to Ethiopia, but it also grows in the Mediterranean countries and South America. The artichoke was known for several millennia BC. This plant was grown in ancient Egypt and in ancient Greece. In Rome, it was believed that this plant helps to cleanse the body, freshens breath and even prevents baldness. In the Renaissance and the Middle Ages, the artichoke was used as a choleretic, antirheumatic, and diuretic agent.

Vegetable culture of dual purpose. Eat baskets with unblown flowers containing 7-15% carbohydrates, up to 3% proteins, carotene, vitamins B1, B2, C (3-11 mg%). Baskets are eaten raw, boiled and fried. In the composition of carbohydrates there is inulin, useful for diabetics. In continental Europe, the artichoke has been eaten since the 15th century, and they began to consider it a medicinal plant only from the beginning of the 20th century, when the effect of artichoke leaves on the digestive system and, especially on the liver and biliary tract, was established, confirmed by modern research. Artichoke leaves are similar in their action to the seeds of milk thistle (*Silybum marianum*), used for liver diseases.

Taking advantage of the wide opportunities, especially created in recent years, a wide range of work is being carried out in our republic for the production of medicines based on the raw materials of medicinal plants, in particular: for the development and comprehensive improvement of drugs used in the treatment of diseases of the liver and biliary tract. According to the decree of the President of the Republic of Uzbekistan “further development of the pharmaceutical industry, improvement of providing the population and medical and preventive institutions with affordable, effective and high-quality medicines and medicines...”[1] important tasks have been identified. In this regard, the development of research on the creation of hepatoprotective and choleretic phytocompositions without side effects, using modern methods from natural raw materials introduced to the climate of the republic, is one of the important scientific areas.

The aim of the study is a pharmacognostic study of the medicinal plant prickly artichoke *Cynara scolymus L.*

To achieve this goal, the following **tasks** were formulated in the work:

[1] Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. DP-4947 "On the Action Strategy for the Further Development of the Republic of Uzbekistan"

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- to identify the possibility of introducing prickly artichoke in the conditions of Uzbekistan and to develop elements of the technology of its cultivation from seeds;
- to conduct a comparative chemical analysis of the raw materials of prickly artichoke cultivated in the conditions (Tashkent Botanical Garden) of Uzbekistan;
- to identify the characteristic anatomical and diagnostic features of vegetative and generative organs, confirming the authenticity of plant raw materials, and to establish the main numerical indicators of raw materials that determine its quality, to choose the optimal dry extract technology based on prickly artichoke raw materials;
- develop quality standards for raw materials (leaves) of prickly artichoke and dry extract obtained from fresh leaves;
- to study acute toxicity, hepatoprotective and choleretic activity, dry extract obtained from fresh leaves of prickly artichoke;

Dry extracts were obtained from fresh and dry leaves of prickly artichoke. HPLC method revealed 15 substances in the dry leaf extract, 11 compounds were identified: flavonoids (luteolin-7-glucoside, rutin, hyperoside, apigenin, robinin); phenolic acids (gallic acid, chicory acid); hydroxycinnamic acids (caffeic acid, chlorogenic acid, neochlorogenic acid, ferulic acid).

In the obtained extract from fresh leaves, 35 substances were found, 11 compounds were identified by HPLC: flavonoids (rutin, quercetin, luteolin, vicenin, apigenin); coumarins (umbeliferon, 4-hydroxycoumarin); phenolic acids (salicylic acid); hydroxycinnamic acids (chlorogenic acid, caffeic acid, neochlorogenic acid).

Practical significance of the study:

Methods have been developed for the qualitative and quantitative analysis of raw materials, prickly artichoke, based on the detection of phenolic compounds, polysaccharides and amino acids using thin-layer chromatography (TLC), spectrophotometry, high-performance liquid chromatography (HPLC) and gas-liquid chromatography (GLC). Quality standards for prickly artichoke leaves and dry extract from it have been developed, taking into account modern requirements for the authenticity and quality of medicinal plant materials.

The leaves contain the bitter aromatic substance cynarin, as well as numerous enzymes, beta-carotene and organic acids: malic, lactic, coumarin, sesquiterpene lactones (sinoropicrin), flavonoids and potassium salts. Due to the strong bitterness, it is often used in the form of preparations (dry or liquid extract, tincture, decoction, etc.).

Thanks to the action of cynarin, artichoke leaves stimulate the secretion of bile, protect and restore liver cells. In addition, it has been shown that cynarin significantly reduces the level of cholesterol and fatty acids in the blood. The diuretic effect of artichoke leaves is due to the presence of organic acids, potassium salts and flavonoids.

Chemical composition of the prickly artichoke *Cynara scolymus L.*

Artichoke inflorescences contain up to 3% protein, 15% carbohydrates, vitamin C, carotenes, vitamins B1, B2, mineral salts, inulin, cynarin, flavonoids: 3 hydrobenzoic acids, 17 hydrocinnamic acids, 4 lignans, 7 flavones, 2 flavonols and 1 derivative phenol.

Phenolic substances are found most of all in the leaves and heads of the artichoke. Artichoke seeds contain up to 30% fatty oil. Moreover, the oil contains α-tocopherol, 5-stigma-, 7-stigma-, and avenasterols. Artichoke leaves contain large amounts of K, P, Mo, Li, Mn, Co, Ni, Ti, Zn salts,

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chlorogenic and caffeic acids, cynarin, mineral salts, polysaccharides, in particular inulin, as well as vitamins A, B1, B2, C, tannin, pectin, potassium, organic acids. Due to the presence of polyphenolic derivatives of cynarin, chlorogenic and caffeic acids, artichoke extract has hepatoprotective and choleretic properties. Ascorbic acid, carotene, vitamins B1 and B2, as well as inulin normalize the metabolism in the human body.

The results of the quantitative determination of the main active substances by HPLC in prickly artichoke leaves showed a high content of chlorogenic acid, cynaroside, riboflavin, caffeine, caffeic acid, steroids and flavones (Fig. 1,2,3,4).

Figure 1.

Steroids

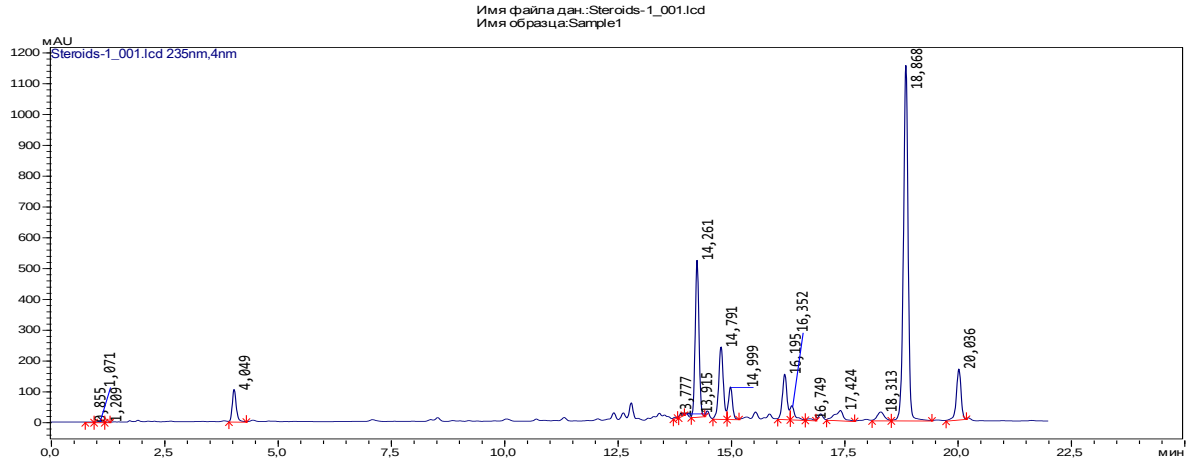
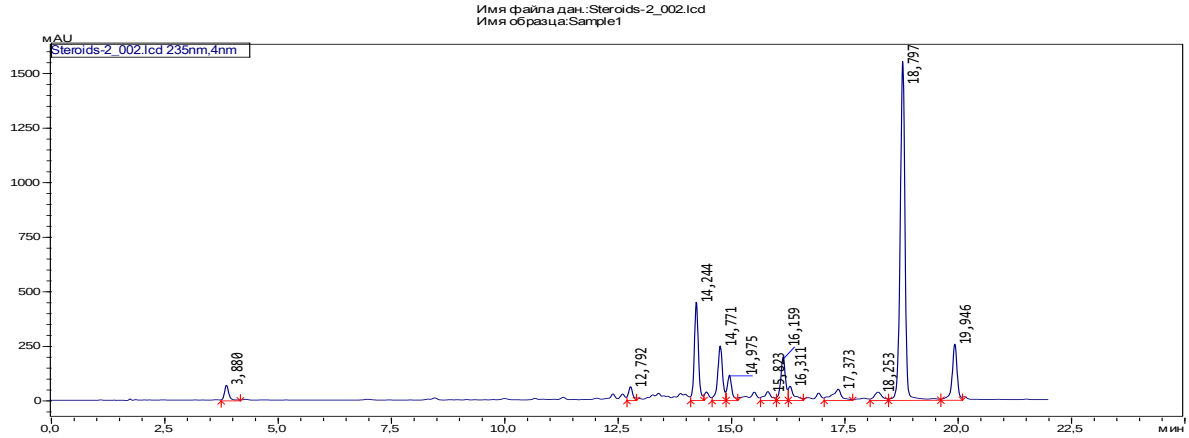


Figure 2.



Supelco Ascentis C18 4.6x250mm in MeCN Gradient

The analysis was performed on a Shimadzu Prominence LC20 HPLC system, including a 4-gradient pump with a degasser, a diode array detector, and a manual injector with a 20 µl loop. Column - Supelco Ascentis C18 4.6x250 mm, Supelco, Bellefonte, USA), elution mode - gradient, mobile phase - 35-55% (0-20 min) acetonitrile gradient (R Chromasolv for LC, Sigma-Aldrich) in water containing 0.1% orthophosphoric acid, flow rate 0.7 ml/min, detection - UV at 235 nm/slit 4 nm. Sample volume 20 µl. Data processing, construction of a calibration curve, and output of results were performed using Shimadzu Lab Solutions software.

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Figure 3.

Development of conditions for the separation of a mixture of flavones

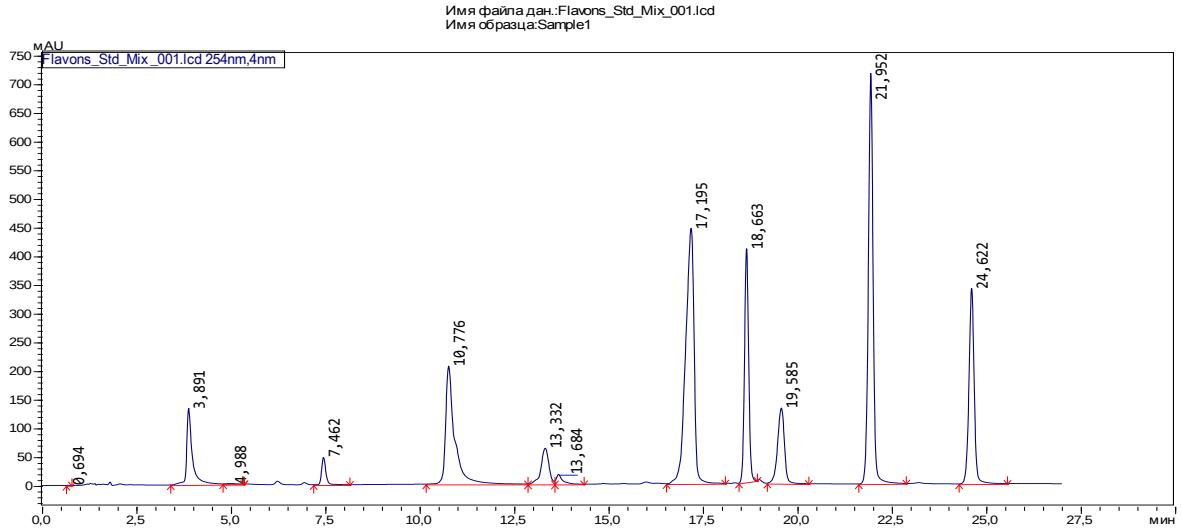
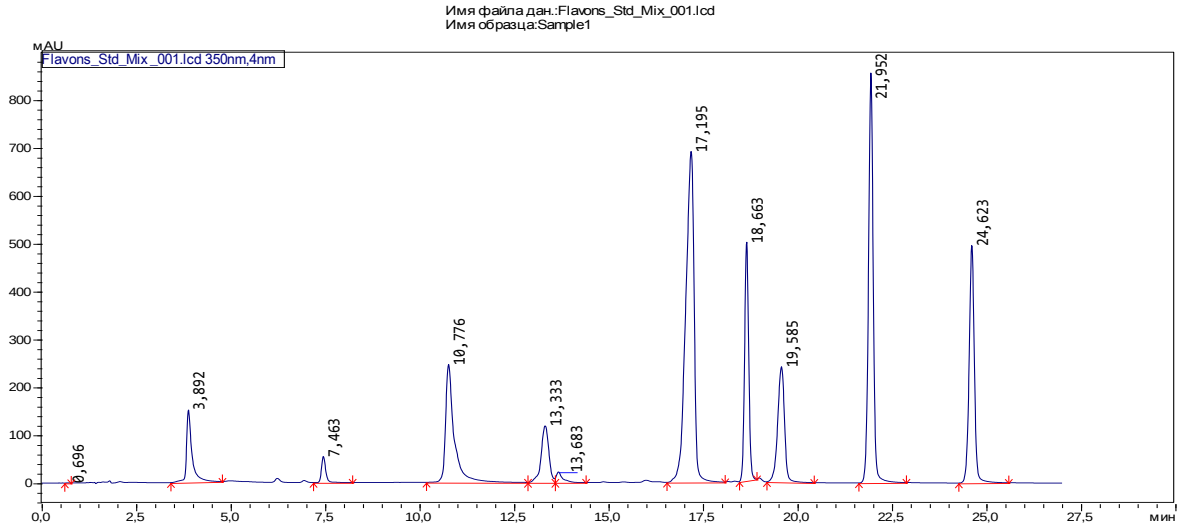


Figure 4.



Separation was performed on a Shimadzu Prominence LC20 HPLC system, including a 4-gradient pump with a degasser, a diode array detector, and a manual injector with a 20 µL loop. Column - Supelco Discovery HS C18 (4.6x75 mm, 3 µm, Supelco, Bellefonte, USA), elution mode - concentration gradient of acetonitrile (R Chromasolv for LC, "Sigma-Aldrich") in water 20-70%, flow rate 0 .6 ml/min, detection - UV at 254 and 350 nm/slit 4 nm. Sample volume 20 µl. Data processing and results output were performed using Shimadzu Lab Solutions software.

Thus, the following results were obtained: (Table 1)

Table 1. Flavonoid composition of plant extracts

Exit order	Retention time, min	Flavonoid
1	3.891	luteolin-3'-O-b-glucopyranoside
2	10.776	luteolin/quercetin
3	13.333	dinatin (hispidulin)
4	17.195	eupatillin

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5	18.663	routine
6	19.585	pectolinarigenin
7	21.952	artimetin
8	24.623	5-hydroxy-4-methoxyflavone

The obtained method can be used to determine the flavonoid composition of plant extracts. If additional standards are available, the list of defined compounds can be extended.

Application of prickly artichoke *Cynara scolymus L*.

In modern folk medicine, leaves, flowers, roots, artichoke seeds are used, in the form of decoctions, water infusions for heart diseases, as an antihypertensive, choleretic agent, as well as for liver diseases.

Artichoke leaf extract is used in the treatment of allergies, eczema and psoriasis, cholecystitis, chronic hepatitis, anorexia, hypokinetic biliary dyskinesia, chronic intoxication, urolithiasis, chronic renal failure.

Healing properties of prickly artichoke *Cynara scolymus L*.

- Protects the liver from the harmful effects of toxins, improves the regeneration of organ cells.
- Strengthens the immune system.
- Eliminates the manifestation of toxicosis in pregnant women.
- Improves bile secretion, reduces the risk of developing cholecystitis.
- Prevents premature aging, neutralizes the destructive effect of free radicals on the body, prolongs youth.
- Removes toxins, heavy metals, alkaloids, hepatotoxic substances.
- Reduces cellulite, smoothes wrinkles, accelerates hair growth. Cleanses and stimulates the kidneys.
- Improves metabolism, cerebral circulation, relieves discomfort after overeating.
- Reduces the risk of developing diseases of the heart, blood vessels, liver, malignant neoplasms.
- Alkalizes the body, reducing the increased content of acid in the stomach.
- Eliminates strong sweat odor.
- Fights hair loss, allergies, hepatitis, inflammation of the gallbladder, atherosclerosis, diabetes, obesity, intoxication.
- Reduces blood sugar.

Conclusion.

Artichoke can be consumed fresh and dry, as well as in the form of extracts, infusions. Boiled artichokes and leaf tincture help improve heart function. To prepare an alcohol tincture, you need to grind 200 g of fresh leaves and pour them with a liter of vodka. After 10 days, strain the tincture and drink 1 teaspoon 2 times a day after 30 minutes. after eating.

An infusion of dried leaves is recommended for diseases of the liver, gallbladder and kidneys. To do this, pour 200 ml of boiling water over 3 teaspoons of dried leaves. Insist for 20 minutes. Strained infusion to drink before breakfast and before dinner. To improve the taste of the drink, you can add a little honey.

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Juice squeezed from artichoke flowers has diuretic properties. To normalize urination, you need to drink 1/2 freshly squeezed juice with meals. If you add honey to the juice, you get an excellent rinse from stomatitis.

List of used literature.

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