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ANTIOXIDANT ACTIVITY OF AILANTHUS ALTISSIMA AND GLEDITSIA TRIACANTOS FRUITS

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Annotation

The article provides information on the botanical description, chemical composition, and use in folk medicine of the plants Ailanthus altissima (tree of heaven) and Gleditsia triacanthos (honey locust). Additionally, the results of analyses determining antioxidant activity based on the auto-oxidation reaction of adrenaline in mixtures of plant fruits in different ratios of Ailanthus and Gleditsia, growing in the Andijan region, are presented.

How to Cite

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Introduction. Currently, with the increase of various synthetic and modified food products, as well as the addition of a large amount of sugar and sugar substitutes, preservatives, and stabilizers in almost all types of products consumed by humans daily, various diseases are increasing among the population even from a young age. Diseases such as diabetes, gastrointestinal and cardiovascular diseases, hormonal imbalance, and accumulation of excess weight have already begun to occur among the population under 30 years of age. If previously these diseases spread from the age of 40, at this time the diseases are rejuvenated. This is primarily a violation of oxidation-reduction reactions between human cells, which leads to a violation of the metabolism between cells and many biochemical processes, resulting in oxidative stress in the human body increasing or decreasing. To prevent the above abuses, it is important to consume foods or food additives with antioxidant or prooxidant properties [1,2].

Antioxidant activity is the rate at which antioxidants neutralize free radicals, thereby reducing oxidative stress in the body while remaining inactive particles themselves. Prooxidants are chemicals

that cause oxidative stress by participating in the formation of reactive oxygen species. Both of these substances play a significant role in maintaining the redox balance of cells. Some substances, such as vitamin C, act as both antioxidants and prooxidants [3,4].

Ailanthus altissima is a fast-growing tree, a species of the genus Ailanthus, of the Simaroubaceae family, reaching more than 30 meters in height, with a straight, slender trunk, ovoid-lanceolate leaves, yellow-green flowers, and an oblong fruit. The homeland of the ailanthus tree is China. The plant is widely used in folk medicine in Central Asian countries: an infusion of the bark and leaves is used for tapeworms, leishmaniasis, menstrual irregularities, hemorrhoids, and others. Modern medicine has shown that the bark of the ailanthus has antipyretic, analgesic, antibiotic, antifungal, antimalarial, antibacterial, antitumor, and antiviral effects [5].

Gleditsia triacanthos is a species of tree from the genus Gleditsia, the legume family. A powerful tree with a spreading crown and a height of up to 20-40 m, with alternate, paripinnate dark green leaves, inconspicuous flowers, and a leathery fruit - beans. The tree's homeland is North America. For the past 2000 years, it has been used in folk medicine in East Asia and China to treat inflammatory skin conditions (boils, scabies, rashes), asthma, diarrhea, dysentery, acute mastitis, plague, eczema, and is used as an antiparasitic, diuretic, expectorant, analgesic, antiseptic and antitumor agent[6].

The antioxidant activity of Ailanthus altissima and Gleditsia triacanthos plants was studied by several researchers [6,7]. In particular, the antioxidant properties were studied and the amounts of polyphenolic compounds and flavonoids of plant extracts of Ailanthus leaves were determined, the amounts of gallic acid, catechin, epicatechin, rutin, quercetin, salicylic acid, vitexin, isovitexin, orientin, apigenin and others were presented [8,9]. Based on sources of information on the medicinal properties of Ailanthus altissima and Gleditsia triacanthos trees growing in different countries, we were interested in the antioxidant properties of the fruits of these plants growing in our territory.

Purpose of the work. Study of the antioxidant activity of the fruits of Ailanthus altissima and Gleditsia triacanthos plants growing in the Andijan region of Uzbekistan.

Experimental part.

Preparation of raw materials. For the analysis, ripe fruits of Ailanthus altissima and Gleditsia triacanthus were collected in September-October, peeled, and crushed mechanically.

Reagents used. Chemically pure reagents, chemically pure, and bidistilled water were used for the study.

Obtaining extracts. To prepare the extract, the fruits of Ailanthus altissima and Gleditsia were crushed in a blender until smooth, weighed 0.75 g of each in a ratio of 1:1, 1:3, and 3:1. Then the samples were dissolved in 50 ml of distilled water and boiled in a water bath for 10 minutes. The prepared aqueous extract was cooled to room temperature, filtered through a syringe filter with a pore size of 0.45 μm, and used for analysis.

Determination of antioxidant activity. The antioxidant activity of the mixture of fruits of the Ailanthus altissima and Gleditsia triacanthus plants growing in the Andijan region was determined using the in vitro method of inhibiting the adrenaline autooxidation reaction, that is, by its ability to prevent the formation of active oxygen species. For the analysis, 3 ml of a buffer solution (Na2CO3-NaHCO3, pH = 10.65) with a concentration of 0.2 M was used and 0.15 ml of a 0.18% solution of adrenaline tartrate was added to it. After rapid mixing, the mixture was poured into a 10-mm cuvette, and the optical density (D1) was measured on a K7000 spectrophotometer (YOKE, China) at a wavelength of 347 nm for 10 min with an interval of 30 s. For the analysis of plant extracts of ailanthus and honey locust, 0.045 ml of extract, 3 ml of buffer solution, and 0.15 ml of 0.18% adrenaline tartrate solution were taken. After mixing, the optical density was measured at 347 nm (D2); a solution of vitamin C at a concentration of 0.1 mg/ml was used as a control [10].

Research results. The optical densities of aqueous extracts of the mixture of fruits of ailanthus and honey locust plants are given in Table 1.

Table 1

Measured values of optical density of adrenaline and samples

Time, sec	Adrenaline (D_1)	Ailanthus:Gleditsia 1:1 (D_2)	Ailanthus:Gleditsia 1:3 (D_2)	Ailanthus:Gleditsia 3:1 (D_2)
0	0,089	0,061	0,062	0,058
30	0,14	0,115	0,115	0,109
60	0,188	0,159	0,157	0,155
90	0,23	0,195	0,19	0,187
120	0,265	0,224	0,222	0,218
150	0,295	0,251	0,249	0,247
180	0,32	0,277	0,274	0,275
210	0,341	0,302	0,3	0,296
240	0,358	0,323	0,328	0,321
270	0,373	0,343	0,342	0,342
300	0,386	0,362	0,361	0,361
330	0,396	0,378	0,38	0,38
360	0,406	0,393	0,392	0,397
390	0,415	0,407	0,406	0,415
420	0,422	0,42	0,419	0,429
450	0,43	0,431	0,432	0,438
480	0,437	0,441	0,442	0,449
510	0,443	0,45	0,449	0,463
540	0,448	0,462	0,458	0,473
570	0,454	0,47	0,463	0,476
600	0,459	0,475	0,468	0,48

As can be seen from the table, the optical densities of the 1:1, 1:3, and 3:1 mixtures of ailanthus and honey locust fruits in the first minute of the analysis were 0.159; 0.157; 0.155 nm, respectively, by the end of the analysis at the 10th minute the figures were increased to 0.475; 0.468; and 0.48, respectively. The graph of the change in optical density of the studied samples in a time unit of 1 min, 3 min, 5 min, and 10 min is shown in the form of a diagram in Figure 1.

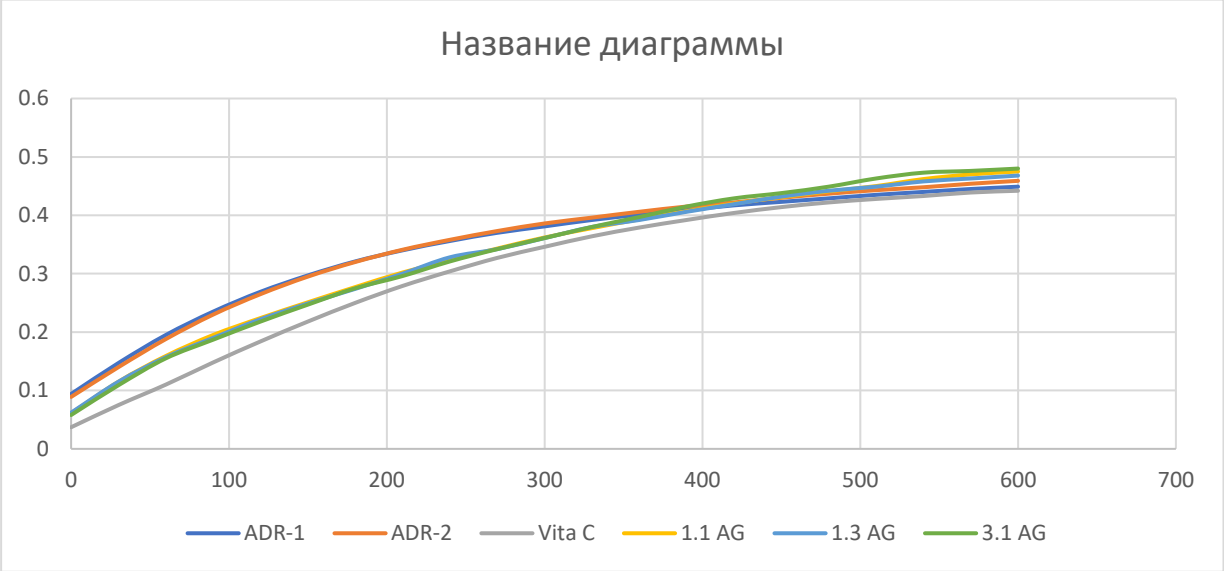


Figure 1. Graph of increase in optical density of adrenaline and added samples.

The antioxidant activity of the studied sample was calculated as a percentage (AA%) by inhibition of the adrenaline autooxidation process in a buffer medium using the following formula:

$$AA\% = \frac{(D_1 - D_2) \cdot 100}{D_1}$$

The results of calculations of the antioxidant activity of a mixture of ailanthus and honey locust fruits at different time intervals are presented in Table 2.

Table 2

Inhibition of ROS over time by aqueous extracts of plants with antioxidant activity.

Analyzed extract	AA, %		
	Ailanthus:Gleditsia 1:1 (D_2)	Ailanthus:Gleditsia 1:3 (D_2)	Ailanthus:Gleditsia 3:1 (D_2)
1-minute	15,42%	16,49%	17,55%
3-minute	13,43%	16,23%	14,06%
5-minute	6,21%	6,47%	6,47%
10-minute	-3,48%	-1,96%	-4,58%
Average	7,89%	7,44%	6,7%

The above table shows that the mixture of ailanthus and honey locust in a ratio of 1:1 has a higher antioxidant activity value of 7.89% than other ratios.

Conclusion. Evaluation of the antioxidant activity of a mixture of ailanthus and honey locust fruits grown in the Andijan region using the method of inhibiting the adrenaline autooxidation reaction shows that the antioxidant activity of the mixtures in all three proportions is not high and exhibits low prooxidant properties. It is important to note that prooxidants are also important in the human body, due to the fact that they can form oxidative stress in tumor cells, since they disrupt the adaptive antioxidant properties of cancer cells in melanoma, while increasing the effectiveness of antitumor therapy even in the late stages of the disease [11].

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