



DETERMINATION OF TOMATO SEED FLOVONOIDS

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Annotation

In this article, information about the Tomato (*Solanum lycopersicum*) plant, its chemical composition, medicinal value, and the amount of water-soluble vitamins in Tomato seeds determined by high-performance liquid chromatography, and its physicochemical properties and spectral characteristics are discussed. .

Key words

Tomato (*Solanum lycopersicum*), glucose, fructose, proteins, organic acids, pectin, starch, lycopene substance, choline substance, blood, cholesterol, immune, Digidro quercitin, Luthionine, Rutin, Seneroside, Quercitin and others.

INTRODUCTION

Today, it is difficult to imagine the table of our people without vegetables and dairy products. For this reason, great attention is being paid to the cultivation of vegetables and fruit products in the republic in the following years. As a result, the population's interest in vegetable crops and their cultivation is increasing. This, in turn, is an important source of filling our markets with a variety of vegetable products, as well as improving the material well-being, lifestyle and healthy diet of families, ensuring that their free time is occupied with useful work. It is known that it depends on the agriculture of each country and the level of food supply. Due to the planned expansion of the area of vegetable crops in our country, more and more vegetable products are grown. Today, at a time when the shortage of food products in the markets of some countries is threatening, our President Sh. The instructions of M. Mirziyoyev and the government of the republic on the further development of the industry make the issue of increasing and exporting vegetable-polished products the main task. Decision PQ-3978 of the President of the Republic of Uzbekistan "On additional measures to increase the efficiency of the export of fruit and vegetable products to foreign markets" published on October 17, 2018 and the Cabinet of Ministers of the Republic of Uzbekistan in the republic Decision No. 935 dated November 20, 2018, "On additional measures to increase the volume of



fruit and vegetable processing in 2019-2020" is also dedicated to this area. It says, among other things: "On the basis of efficient use of household and homestead plots, great attention is being paid to the issues of increasing the production of fruit, grapes, vegetables, sugar, and leguminous products and increasing the volume of exports. At the same time, the analysis of the commissioning of new facilities for the processing (drying) of fruit and vegetable products grown in households and farm plots shows the need to further develop activities in this direction and implement new projects in some districts of the republic. is doing.

THEORETICAL PART

Tomato (Latin: *Solanum lycopersicum*) is an annual, perennial herb in tropical climates. It is widely cultivated as a vegetable crop. While the name tomato is used in scientific terminology, in Uzbekistan both the plant and the fruit are called tomato or "pamildori" (among the people). Tomato comes from the Italian word *pomo d'oro*, which means "golden apple". It is called tomato in English, Japanese, Korean, *shu fan qie* in Chinese, *arbe a tomates*, *tomate arbustive* in French, *tomatobaum*, *zbaumtomate*, *baumtomatenstrauch* in German, and *tomate* in Spanish. It first came from the American continent. It later spread throughout the world after the Spanish colonized the Americas. Nowadays, many varieties of tomatoes are grown in different countries of the world. Tomatoes are eaten both raw and as an ingredient in various dishes and salads or drinks. A tomato plant can usually grow up to 1-3 meters in height. The stem is loose, often spreading on the ground and growing on other plants. The root system of a tomato is extremely branched, penetrates deep (up to 150 centimeters) layers of soil and can grow up to 1.5-2.5 meters in diameter. When there is enough moisture, the roots easily appear from all parts of the stem, so tomatoes can be propagated not only by seeds, but also vegetatively. The stem of a tomato is herbaceous, grows upright or lying down, has strong or weak branching, and grows from 30 centimeters to 2-3 meters, depending on the type of stem. Depending on the structure of the stem and leaves, tomatoes are divided into 3 types: the stem with a stem is thick, less branching, even with the fruits standing upright; stem without a stem is thin, strongly branched, the fruit lies down under the influence of its weight; potato-like large-leaved. Also, the tomato stem is divided into determinant (the main stem and side branches grow moderately and end with the formation of flowers) and indeterminate (the main stem differs in strong growth, the side branches can grow up to 2-3 meters when removed). Determinant tomato varieties are grown in the open field, while indeterminate varieties are mainly grown in greenhouses. The flowers are bisexual, small, yellow, usually 5-7 petals. There are 5-6 pinnae, located in a conical shape. In most cultivars, the flower seed is located inside a cone of pollinators, which makes the tomato crop 95% self-pollinating. In some varieties or

in unfavorable weather conditions (warm temperatures), the seed beak is located above the pollinators, in which the tomato flowers can be pollinated by outside insects or wind. The fruit is two-, three- and multi-chambered, berry-like. Fruits weigh from 50 to 1000 grams; the color can be red, pink, yellow, purple, white and even black; the shape can be round, round-flat, pear-shaped, plum-shaped. The seeds are small, flat, pointed, hairy, yellow-gray in color, 1000 seeds weigh 2.5-4.0 grams, and remain viable for 4-6 years. Tomato is a heat-loving plant. For its normal growth and development, the temperature is 20-25°C, the relative humidity of the air is 40-65%. When the temperature drops below 15°C, growth slows down, at 0-1°C it stops growing, and at 1-2°C the plant dies. Extremely high temperature (35 °C) has a negative effect on the growth and development of tomato plants. Such a tomato is a light-loving plant, and when it is grown in the shade, the stem grows long and slow, and does not produce fruit. Tomato seed and finished product Fig. 1. [1-6]



Figure 1. Tomato seeds and finished products

Today, tomato is one of the most widely cultivated vegetable crops in the world due to its valuable and dietary properties. To date, more than 1,000 different varieties of tomatoes have been created, and they are grown in open and protected areas (for example, in greenhouses). Currently, about 4.4 million hectares (2009) are planted in the world, and 153 million tons of gross crops are grown. The main tomato growing countries are China (45.4 million tons), USA (14.14 million tons), India (11.15 million tons), Turkey (10.7 million tons), Egypt (10.0 million tons). Tomato is considered one of the main vegetable crops in Uzbekistan, and 40-45% of the total area of vegetable crops is tomato. In 2010, tomatoes were grown on 75,000 hectares in Uzbekistan. 70% of the gross harvest is processed, 10-15% is sold in the local market, and 15-20% is exported. Tomatoes are popular vegetables that are grown and eaten all over the world because of their nutritional benefits. The purpose of this study was to determine the chemical composition (dry matter,



soluble solids, titratable acidity, vitamin C, lycopene), taste. The results of the analysis showed that during ripening the amount of soluble solids increases by an average of two times in all analyzed varieties; The highest content of vitamin C and lycopene was found in tomatoes at the red stage of the Sunstream variety and the highest total acidity expressed as citric acid g 100 g⁻¹ was observed at the pink stage (variety Sakura) or breaking stage (variety Sunstream and Mathew). significantly affects tomatoes.[4-5]

Vegetables are one of the main types of food due to their deliciousness, nutritional value and medicinal properties. The nutritional value of vegetables is determined by the amount of carbohydrates, proteins, fats and other substances in them. The biochemical composition of vegetables consists mainly of water (60-90%), and dry matter is cucumber, tomato -4-7%, root vegetables - 11-17%, green peas - 24%, garlic -35%. Therefore, the nutritional value of vegetables is not high. One kg of most consumed vegetables has 150-400 kcal or 600-1700 kj. Vegetables as food cannot satisfy the body's energy needs, but the importance of their flavonoids is high. Flavonoids are a large group of natural compounds that are a product of benzopyrone (chromone) and have a phenyl-propane-phenyl skeleton consisting of C₆-C₃-C₆ carbon atoms. Because the first flavonoid isolated from plants was yellow, this group of compounds was named flavonoids (derived from the Latin word flavum - yellow).[7-8]

Flavonoids are widespread in nature and are found in almost all higher plants. In particular, members of leguminous plants (Fabaceae), Asteraceae (Compositae), Celery plants - Apiaceae (Umbelliferae) and other families are rich in flavonoids. This group of compounds is dissolved in the cell sap of all organs of plants, and accumulates in small amounts in some organs (for example, underground organs and stems), up to 44 % in the flowers and leaves of plants (in the flower of Japanese sophora). Flavonoids are mainly accumulated in the greatest amount during the period of flowering of plants, and then they decrease. Pure flavonoids (glycosides and aglycones) isolated from plants are colorless or golden and yellow crystalline substances. Glycosides of flavonoids are well soluble in alcohol and poorly soluble in cold water. It is insoluble in ether, chloroform and other organic solvents, and its aglycones are soluble in alcohol, ether and acetone. Flavonoids dissolve well in boiling water and redeposit after cooling. The color of anthocyanins and their aglycones - anthocyanidins - depends on the pH of the solution (or cell sap). Usually, this group of compounds is red, pink, golden under acidic conditions, and purple, blue, and blue under alkaline conditions. Flavonoids mainly have the effect of vitamin P, reducing the permeability and fragility of blood vessels. The sum of flavonoids of some plants has laxative and diuretic properties. Pure flavonoids and preparations of their sum, as well as medicinal preparations made from plants and



products containing flavonoids, are used for the treatment of other diseases caused by vitamin P deficiency and impaired permeability of blood vessels, as well as lowering blood pressure, calming , heart (cardiotonic) and some cancers, used as a laxative and diuretic. [9-11]

DISCUSSION OF RESULTS

The amount of flavonoids in tomato seeds was determined using the high-performance liquid chromatography (HPLC) method. 5-10 g of tomato seeds are taken out on an analytical balance and placed in a 300 ml flat flask. 50 ml of 70% ethanol solution is added to it. The mixture was heated at 70-80°C under vigorous stirring for 1 hour, equipped with a magnetic stirrer, reflux condenser, and then stirred at room temperature for 2 hours. The mixture is cooled and filtered. 25 ml of 70% ethanol is added to the remaining part and re-extracted 2 times. The filtrates were combined and filled to the mark with 70% ethanol in a 100 ml volumetric flask. The resulting solution is spun in a centrifuge at a speed of 6000-8000 rpm for 20-30 minutes. The resulting solution was taken from the upper part for analysis. Working solutions of flavonoids with a concentration of 1 mg/ml were prepared. For this purpose, 50.0 mg of each flavonoid standard was withdrawn on an analytical balance and dissolved in 70% ethanol in a 50 mL volumetric flask and filled to the mark.

Acetate buffer system and acetonitrile were used as an eluent to determine the amount of flavonoids in tomato seeds using HPLC. Chromatography conditions:- Chromatograph Agilent-1200 (equipped with an autodoser);-Column Exlipse XDB C 18 (obraschenno-faznyy), 5 µm, 4.6 x250mm; -Diode matrix detector (DAD), 254 nm, 272 nm identified; - Flow rate 0.8ml/min; - Eluent phosphate buffer: acetonitrile: 0-5 min 95:5, 6-12 min 70:30, 12-13 min 50:50, 13-15 min 95:5, thermostat temperature 30 0C, 10 µl injected amount.

First, a working standard solution was prepared in the chromatograph, then a solution prepared from tomato seeds was introduced, and the amount of flavonoids was determined by comparison. (Figure 2)

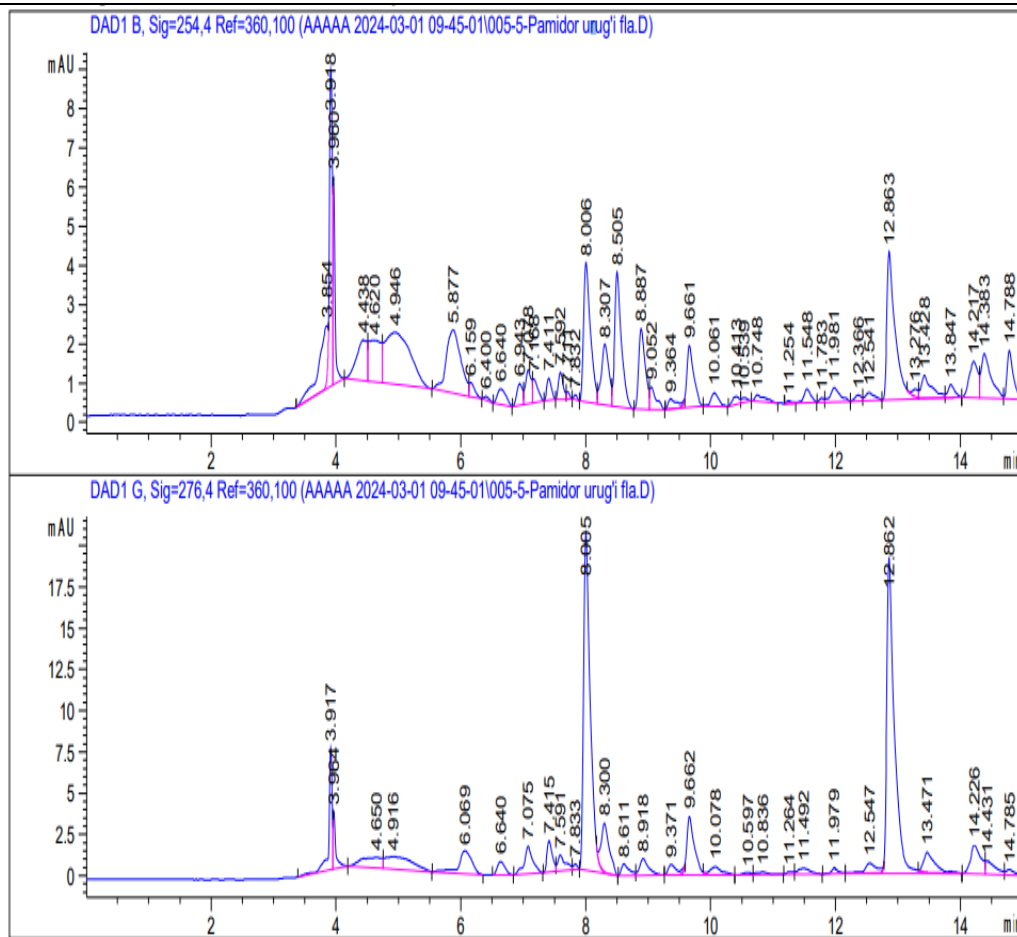


Figure 2. Chromatography of a solution prepared from tomato seeds to determine the amount of flavonoids in tomato seeds.

When the amount of flavonoids was studied using the high-performance liquid chromatography (HPLC) method, it was seen from the chromatographs that tomato seeds contained Digidro quercitin = 6.98 mg., Luthionine = 2.85 mg., Rutin = 33.51 mg., Seneroside = 0.98 mg. Quercitin = 11.22 mg. was found to be present in quantity.

CONCLUSION:

When the content of flavonoids in tomato seeds was studied using the high-performance liquid chromatography (HPLC) method, Digidro quercitin = 6.98 mg., Luthionine = 2.85 mg., Rutin = 33.51 mg. , Seneroside =0.98 mg. Quercitin = 11.22 mg was found.

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