



DETERMINATION OF MINERAL ELEMENTS IN THE FRUIT OF HIBISCUS ESCULENTUS L.

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Abstract

This article presents information on the chemical composition and medicinal uses of the fruit of *Hibiscus esculentus* L., as well as the determination of the amount of mineral elements in its content.

Keywords: *Hibiscus esculentus* l, mineral elements, potassium, iron, calcium, phosphorus, magnesium, zinc,

Introduction

In our country, large-scale measures are being taken to ensure food security of the population, fully satisfy the demand for vegetable products, and expand the diversity of vegetable products. It is recommended to plant vegetable species that are distinguished by early maturity, high yield, and resistance to various pests and diseases in the cultivated areas of our republic. *Hibiscus esculentus* L. is one of such plants. It is natural that this unique and promising plant will play an important role in providing the population of our country with vitamin-rich vegetables, raw materials for industry, and nutritious fodder for livestock in the near future.[1-2].

The importance of vegetable products lies in the fact that they are invaluable for a healthy lifestyle and contain sufficient amounts of vitamins, enzymes, proteins, carbohydrates, and mineral salts necessary for the normal development and functioning of the human body.[2].





Although a number of vegetable species are used in our republic, there are many non-traditional varieties in the world that have valuable properties for human health, are rarely consumed by our people and are rarely grown by our farmers, such as arugula, broccoli, lettuce, artichoke and okra. Therefore, in order to increase the diversity of vegetables, the study of new vegetable crops, the localization of promising species and varieties, the development of technologies for their cultivation, and the organization of seed production are among the urgent issues of today. The introduction of high-yielding, disease-resistant, high-quality and rich in valuable substances varieties of this vegetable species, which is new to the soil and climatic conditions of our country, the creation of new varieties and the development of technologies for their cultivation will allow us to further expand the range of vegetable crops that are the basis of a healthy diet in the country. Therefore, the study of the composition of the vegetable crop *Hibiscus esculentus* L. is relevant [1-5].

THEORETICAL PART

Hibiscus esculentus L. is an annual plant belonging to the hibiscus family. It grows up to 2.5 m tall. It resembles a gooseberry in appearance and flowering. The rosette is a simple, branched, 150-200 cm tall, covered with sparse and sharp hairs, which cause a tingling sensation when touched. The flowers are single, with a rounded base and wide teeth. The central root is long, it goes deep into the spine, the outer part is brown, with dark transverse stripes, the body is white. The flowers are hermaphrodite, blind, brown, ovate, arranged in axils of the leaves, short, seed-bearing, long fibers. The pumpkin is a bird, the outer serals fall early, the inner one is divided lengthwise after flowering. The petals are light yellow, with a dark red spot on the back. The fruit is a blind-seeded, elongated capsule, consisting of 5 strong convex ribs, pointed at the apex, reaching 5-10 cm in length, divided lengthwise. From the outside, it is covered with dense, hard gray-white hairs. The seeds are olive-green to dark green. It blooms in July-August, and bears fruit in August-September. Its homeland is East Africa. Varieties are divided into vegetable and fiber groups. Fiber varieties are grown in India, Africa, and the USA. Unripe gooseberry fruits are used as a vegetable green for liquid dishes and salads. The fruit contains 3% protein, 0.5% fat, 8% carbohydrates, and ripe seeds contain 18% oil. The fruit can be eaten raw, cooked, fried, and canned. The stem yields a white, coarse fiber; artificial coffee is made from roasted seeds. It is grown mainly as a vegetable crop in tropical and subtropical countries, North America, Southern Europe, Transcaucasia, Crimea, southern Ukraine, and partly in Central Asia. The appearance of the okra plant and its fruit is shown in Figure 1.[3-7].





Figure 1. Appearance of *Hibiscus esculentus* L. seed and fruit

The fruit of *Hibiscus esculentus* L. contains a large number of active substances with diuretic, hypotonic, and antioxidant properties. It contains mucilage - hexoses, galacturonic acid, methylpentoses, pentoses, proteins, vitamins B₆, C, A, E, and K, potassium, iron, calcium, phosphorus, magnesium, zinc, and the seeds contain astringent. The fruit contains 3% protein, 0.5% fat, 8% carbohydrates, and the ripe seeds contain 18% oil.[8-9].

In medicine, *Hibiscus esculentus* L. has a laxative, antirheumatic, diaphoretic, and diuretic effect and is used for the treatment of asthma, bronchitis, and stomach and intestinal diseases. It is widely used in the diet for regulating blood sugar levels, cardiovascular diseases, atherosclerosis, and hypertension. The juice of the roots is used externally in Neral to treat cuts and wounds, and the leaves are used as a sedative[4-9]. Plants have the ability to absorb all the elements listed in the periodic table from their natural environment in small or large quantities. However, only 19 of these elements have been identified as being of great importance to plants and cannot be replaced by other elements. These are carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur, potassium, calcium, magnesium, iron, manganese, copper, zinc, molybdenum, boron, chlorine, sodium, silicon, and cobalt. Of these, 16 are classified as mineral elements. Because carbon, hydrogen and oxygen are taken up by the plant in the form of CO₂, O₂ and H₂O. Plants take up water and all mineral elements from the soil through the roots. Mineral substances are found in the soil solution, in humus, in the composition of organic and inorganic compounds and adsorbed on soil colloids. The absorption of ions depends not only on the plants themselves, but also on the concentration of this ion in the soil, its mobility in the soil, and soil reactions. Four elements make up 95 percent of the elements in the body of plants: carbon, hydrogen, oxygen, and nitrogen. These elements are also called organogens. Because they form the basis of organic substances (proteins, fats, carbohydrates) in the plant body. Mineral elements are divided into three groups based on their quantity in the plant body: 1) macroelements; 2) microelements; 3) ultramicroelements. 1) Macroelements include all elements (N, P, K, Ca, Na, Mg) whose amount in plants is more than 10-2



percent. 2) Microelements include elements in the composition of plants in amounts of 10⁻³ - 10⁻⁵ percent (Mn, B, Cu, Zn, Mo, etc.). 3) Ultramicroelements include elements in the composition of plants in very small amounts (10⁻⁶ percent or less) and whose function is not determined (Ce, Se, Ca, Ng, Ag, Au, etc.). [8-10].

DISCUSSION OF RESULTS

To determine the amount of macro and microelements in the fruit of *Hibiscus esculentus* L., samples of the fruit of the plant grown in the experimental plot of Tashkent State Agrarian University were taken and studied in the Laboratory of Complex Compounds of the Institute of Bioorganic Chemistry named after Acad. O. S. Sadikov of the Academy of Sciences of the Republic of Uzbekistan. To determine the amount of mineral elements in the fruit of okra, ICP atomic emission spectrometers of the Shimadzu ICPE-9800 series were used to determine various elements in various samples and water samples. The sample to be analyzed was prepared in a liquid state, usually as a solution of mineral acid. The solid sample material was previously dissolved by appropriate decomposition processes, and the mixed matrix was removed by special separation methods. The liquid sample was processed according to the appropriate dilution strategy, depending on the concentration of the elements to be determined. To verify the accuracy of the analysis results, data analysis of standard sample materials was used. After the analysis of the results, depending on the fragmentation method, the type of sample material, and the element concentration in the sample, the following elements were determined: Li, Be, B, Na, Mg, Al, Si, K, Ca, Sc, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zn, Rb, Sr, Y, Zr, Cd, Sn, Ba, Pb, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu. The results of the device were automatically determined on the computer screen and the results are presented in Table 1.



Table 1 Content of mineral elements in the fruit of *Hibiscus esculentus* L.

Nº	Element	Amount of elements mg/kg	Nº	Element	Amount of elements mg/kg	Nº	Element	Amount of elements mg/kg
1	Li	4.05	21	As	<0,10	41	Gd	0,009
2	Be	<0.05	22	Se	<0,50	42	Tb	<0,01
3	B	5.49	23	Rb	20,3	43	Dy	<0,01
4	Na	1085	24	Sr	132	44	Ho	<0,01
5	Mg	7927	25	Y	0,408	45	Er	<0,01
6	Al	114	26	Nb	0,286	46	Tm	<0,01
7	P	10849	27	Mo	1,70	47	Yb	<0,01
8	K	41461	28	Ag	0,134	48	Lu	<0,01
9	Ca	16880	29	Cd	<0,10	49	Hf	<0,05
10	Sc	0.178	30	Sn	<0,10	50	Ta	<0,01
11	Ti	29.3	31	Sb	0,074	51	W	<0,05
12	V	0.231	32	Te	<0,30	52	Re	<0,01
13	Cr	5,39	33	Cs	0,044	53	Pt	<0,05
14	Mn	57,2	34	Ba	36,2	54	Au	<0,05
15	Fe	162	35	La	0,071	55	Tl	<0,01
16	Co	0,462	36	Ce	0,143	56	Pb	1,43
17	Ni	4,25	37	Pr	0,016	57	Bi	<0,01
18	Cu	17,3	38	Nd	0,065	58	Th	0,025
19	Zn	54,6	39	Sm	0,012	59	U	0,063
20	Ga	<0,10	40	Eu	0,016			

According to the results of the study, the quantitative composition of 48 chemical elements was determined in the fruit of the okra vegetable crop. It was shown that the fruit of *Hibiscus esculentus* L. is rich in a number of macro- and microelements important for the human body. In particular, the content of the following elements in the fruit of the plant was found to be relatively higher than in others: K (41461) P (10849) Ca (16880) Al (114) Mg (7927) S (871.768) Na (1085) Si (424.395) Ti (293) Mn (57.2) Ni (4.25) Cu (17.3) Zn (54.6) Ba (36.3) Sr (132) Rb (20.3) Li (4.05).

There are requirements for the content of certain heavy metal salts in herbal medicines worldwide, which have different values in different countries. In the international food safety hygiene standards, this indicator includes 7 elements, including Hg, Cd, Pb, As, Co, V and Mo. However, in most foreign countries, this indicator includes 8-10 elements. According to the Food Safety of the Russian Federation, they consist of 4 elements - Hg, Pb, As, Cd [8-10].

In the Republic of Uzbekistan, the amounts of 4 heavy metals, such as Pb, Cd, Hg and As, were also determined, and their amounts in the composition of BFQ prepared on



the basis of plant substances did not exceed (Pb-5.0; Cd-2.0; Hg-1.0 and As-3.0 mg/kg), respectively [8-10].

According to the results of the study, the amounts of heavy metal ions, such as Pb; Cd; Hg and As, in the fruit of *Hibiscus esculentus* L. were Pb-1.43; It was determined that Cd-<0.10; Hg-0.0 and As-<0.10 mg/kg did not exceed, which is in accordance with the International Food Safety Hygienic Standards.

CONCLUSION

1. When studying the content of mineral elements in the fruit of *Hibiscus esculentus* L, it was determined that 59 elements were found in it, and the following elements were found to be in higher amounts than other elements: K (41461) P (10849) Ca (16880) Al (114) Mg (7927 mg/kg) S (871.768 mg/kg) Na (1085 mg/kg) Si (424.395 mg/kg) Ti (29.3 mg/kg) Mn (57.2 mg/kg) Ni (4.25 mg/kg) Cu (17.3 mg/kg) Zn (54.6 mg/kg) Ba (36.3 mg/kg) Sr (132 mg/kg) Rb (20.3 mg/kg) Li (4.05 mg/kg).

2. Pb; Cd; It was found that the amount of heavy metal ions such as Hg and As did not exceed Pb-1.43; Cd-<0.10; Hg-0.0 and As-<0.10 mg/kg, respectively, which corresponds to the international hygienic standards for food safety.

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