

O'ZBEKISTON RESPUBLIKASI
OLIV TA'LIM, FAN VA INNOVATSIYALAR VAZIRLIGI
FARG'ONA DAVLAT UNIVERSITETI

**FarDU
ILMIY
XABARLAR-**

1995-yildan nashr etiladi
Yilda 6 marta chiqadi

2-2023

**НАУЧНЫЙ
ВЕСТНИК.
ФерГУ**

Издаётся с 1995 года
Выходит 6 раз в год

XURMO O'SIMLIGI (DIOSPYROS KAKI) TARKIBIDAGI MAKRO VA MIKROELEMENTLARINI ZAMONAVIY INDUKTIV-BOG'LANGAN PLAZMALI MASS-SPEKTROMETRIYA USULI BILAN ANIQLASH

ОПРЕДЕЛЕНИЕ МАКРО- И МИКРОЭЛЕМЕНТОВ В ХУРМЕ ВОСТОЧНОЙ (DIOSPYROS KAKI) СОВРЕМЕННЫМ МЕТОДОМ МАСС-СПЕКТРОМЕТРИИ С ИНДУКТИВНО-СВЯЗАННОЙ ПЛАЗМОЙ

DETERMINATION OF MACRO AND MICRO ELEMENTS IN THE DATE PLANT DIOSPYROS KAKI BY THE MODERN METHOD OF MASS-SPECTROMETRY WITH INDUCTIVELY COUPLED PLASMA

Ibragimov Alijon Aminovich¹ Amirova Toyiraxon Sheraliyevna² Isakova Shahnoza Shuhratovna³

¹Ibragimov Alidjan Aminovich

– dr. chem. Sciences, Professor, Department of Chemistry Ferghana State University, Republic of Uzbekistan, Fergana.

²Amirova Toyiraxon Sheraliyevna

– PhD, the senior lecturer, Department of chemistry, Fergana State University.

³Isakova Shahnoza Shuhratovna

– Ferghana State University graduate student of.

Annotatsiya

Xurmo o'simligini bargi va mevasi namunalarning elementlar tarkibi birinchi marta batafsil ICP-MS AT 7500 uskunasida induktiv bog'langan plazma mass-spektrometriya usulida o'rganildi. Xurmo o'simligini bargi va mevasi tarkibida 42 ta element miqdoriy aniqlandi. O'simlik bargida 39 element "Shokolad"navli xurmo mevasida 40 element, "Limon" xurmo mevasida 39 element borligi ko'zatladi. Element miqdori uning massasi ortishi bilan kamayishining tabiiy tendensiyasi ko'rsatilgan. Xurmo (Diospyros) o'simligini mevasi tarkibidagi og'ir elementlar miqdori juda oz miqdorda ekanligi kuzatildi.

Аннотация

Элементный состав образцов листьев и плодов растения Хурма восточная детально изучен впервые методом масс-спектрометрии с индуктивно-связанной плазмой на приборе ICP-MS AT 7500. В листьях и плодах хурмы количественно определено 42 элемента. Было обнаружено, что в листьях растения содержится 39 элементов, в плодах сорта "шоколад"-40 элементов, а в плодах сорта "лимонный"(с вяжущим вкусом) - 39 элементов. Показана естественная тенденция количества элемента уменьшаться с увеличением массы. Было замечено, что количество тяжелых элементов в плодах растения очень мало.

Abstract

The element composition of persimmon leaves and fruits samples for the first time was studied in detail by mass spectrometry with inductively coupled plasma on ICP-MS AT 7500. A total of 42 elements were quantified in persimmon leaves and fruits. It was found that 39 elements were present in the leaves, 40 elements in the "chocolate" variety fruits and 39 elements in the lemon variety fruits (with astringent taste). The natural tendency of the amount of the element to decrease with increasing mass is shown. It has been observed that the amount of heavy elements in the fruits of the date plant is very low.

Kalit so'zlar: *Diospyros, makroelementlar, mikroelementlar, mass- spektrometriya, IBP MS, Agilent Technologist.*

Ключевые слова: *Diospyros, макроэлементы, микроэлементы, масс-спектрометрия, ИСП МС, Agilent Technologist.*

Key words: *Diospyros, macroelements, microelements, mass-spectrometry, ICP MS, Agilent Technologist.*

INTRODUCTION

Persimmon (*Diospyros*) is a subtropical tree or shrub belonging to the persimmon family. Native fruit tree. About 500 species are found in tropical and subtropical regions. The palm tree is planted in China, Japan, Mediterranean countries, Australia, USA, Caucasus, Central Asia and Uzbekistan. The height of the tree is up to 8-12 m, the trunk is round or pyramidal [1]. It lives 100-400 years, sometimes even more, but it bears good fruit up to 50-60 years. It tolerates cold up to 15-20°C, it is a light-loving plant. The leaf is large ovate, dark green on top, hairy on the back, arranged in a row, turns reddish before shedding [2].

KIMYO

Scientific [3] and summary [4] articles devoted to the study of the chemical composition of persimmons have been covered in detail by Spanish and Portuguese scientists. In particular [3], the authors studied three types of dates and obtained excellent results. According to their information, the amount of macro- and microelements in this plant may change slightly seasonally. Iron 1.5-2.3 mg/kg, copper 2.6-2.8 mg/kg, zinc 1.1-6.9 mg/kg in the 2017 season. Calcium 150-366mg/kg, Magnesium 136-209mg/kg from macroelements. Potassium 2512-3491 mg/kg. It should be noted that the differences in quantity are very large. However, in the 2018 season, it was found that the differences were not so big. In fact, the mineral components of the plant are mainly related to the soil composition. Perhaps a lesser contribution can be made by the ability of the plant to assimilate salts. But these two factors are the same. For other reasons, the amount of water can change the ratio of components, as scientists have analyzed wet fruit.

MATERIAL AND METHODS

Determination of mineral content. The fruit of the date tree was collected for the sample from the region of Baghdad district of Fergana region. In the fall, the fruits of the plant are picked and dried in a cool place. In order to determine the elemental composition of the samples, a mass spectral analysis was performed on the ICP-MS (inductively coupled plasma mass spectrometry method) AT 7500 equipment [5].

Preparation of the object for analysis: plant fruit samples were studied for comparison. Samples of 30 g of "Chocolate" persimmons and 25 g of "Lemon" persimmons are weighed on an electronic scale and finely ground. After grinding, 30 mL of concentrated nitric acid was added to the flasks and allowed to stand for 30 minutes until a clear solution was obtained. The obtained solutions were then filtered into 100 ml flasks and half of the flasks were filled with distilled water.

Diospyros fruit samples prepared above were analyzed in the semiquantitative analysis mode "Semiguan" in an inductively coupled plasma mass spectrometer. Device parameters: plasma power 1200 W, integration time 0.1 sec. Instrument calibration and quantitative calculations were performed based on the Agilent Technologist multi-element calibration standard (44 elements).

Analysis of obtained results table 1 presents the results of quantification of 41 elements. Arranged in ascending order of mass.

Table 1**The content of elements in the persimmon plant, mg/kg**

No	Element's name and sequence number	"Chocolate" persimmon fruit.	"Lemon" persimmon fruit
1	Li (3)	0,016	0,141
2	Be (4)	0,010	0,008
3	B (5)	5,987	1,427
4	Na (11)	38,809	97,965
5	Mg (12)	95,568	569,334
6	Al (13)	27,991	321,750
7	Si (14)	1,459	4,093
8	P (15)	0,000	0,000
9	S (16)	81,640	61,289
10	K (19)	1607,731	1035,369
11	Ca (20)	1522,460	10527,452
12	Ti (22)	0,082	4,631
13	V (23)	0,045	1,167
14	Cr (24)	0,180	0,070
15	Mn (25)	1,150	6,259
16	Fe (26)	29,646	367,755
17	Co (27)	0,112	0,117
18	Ni (28)	0,450	26,014
19	Cu (29)	0,404	5,009
20	Zn (30)	0,967	6,219
21	Ga (31)	0,059	0,119

22	Ge (32)	0,001	0,002
23	As (33)	0,003	0,017
24	Se (34)	0,224	0,288
25	Rb (37)	0,462	0,223
26	Sr (38)	2,523	25,675
27	Zr (40)	0,015	0,100
28	Nb (41)	0,000	0,003
29	Mo (42)	0,129	0,035
30	Ag (47)	0,005	0,004
31	Cd (48)	0,013	0,023
32	In (49)	0,000	0,000
33	Sn (50)	3,082	2,561
34	Sb (51)	0,001	0,094
35	Cs (55)	0,001	0,000
36	Ba (56)	1,017	1,706
37	Ta (73)	0,003	0,003
38	W (74)	0,001	0,000
39	Re (75)	0,000	0,000
40	Hg (80)	0,180	0,127
41	Pb (81)	0,201	3,142
42	Tl (81)	0,005	0,004
43	Bi (83)	0,003	0,004
44	U (92)	0,013	0,024

*In parentheses - sequence number of element in periodic table

Analysis of the persimmon obtained for the elements listed in Table 1 shows that Ca > K > Mg > Al > Fe > Na > S > Si > Sr > Zn are present in the highest amounts. Among the macroelements (Table 2), Ca > K > Mg > S > Na prevails. Among trace elements, it was observed that Fe > Al > B > Sn > Sr were abundant. The fruit of the persimmon plant was brought as a sample from the zone of Baghdad district and the quantitative composition of the main elements was compared.

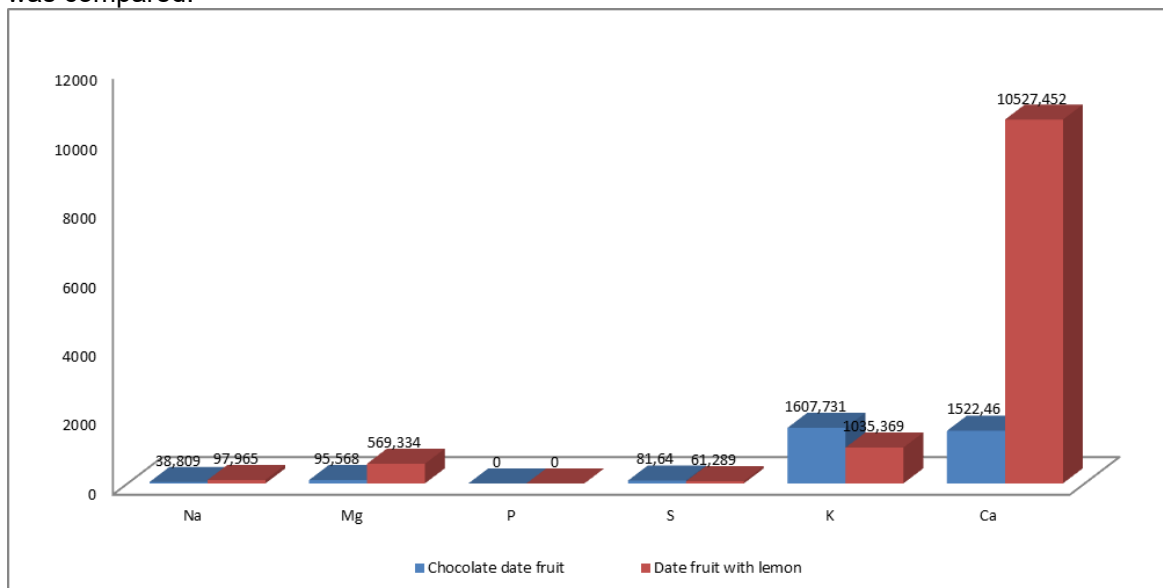


Figure 1. Composition diagram of macroelements of fruits of persimmon (Diospyros) plant.

KIMYO

Composition of macronutrients: Chocolate persimmon (*Diospyros*) fruit contains K 1607.731 mg/kg, Ca 1522.460 mg/kg, Mg 95.568 mg/kg, S 81.64 0 mg/kg, Na 38.809 mg/kg. It was found that the amount of macroelements in lemon persimmon fruit is Ca 10527.452 mg/l, K 1035.369 mg/l, Mg 569.334 mg/l, Na 97.965 mg/l, S 61.289 mg/l.

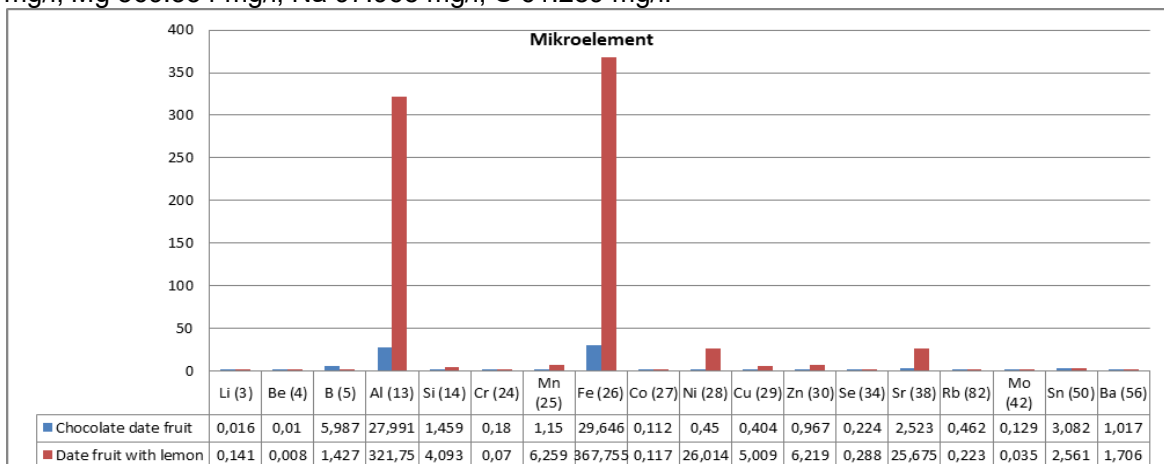


Figure 2. Composition diagram of microelements of the fruits of persimmon plant (*Diospyros*).

Composition of microelements Chocolate persimmon (*Diospyros*) fruit Fe 29,646 mg/kg, Al 27,991 mg/kg, B 5,987 mg/kg, Sn 3,082 mg/kg, Sr 2,523 mg/kg. The amount of trace elements in the lemon persimmon (*Diospyros*) fruit is Fe 367,755 mg/l, Al 321,750 mg/l, Ni 26,014 mg/l, Ti 4,631 mg/l, Si 4,093 mg/l.

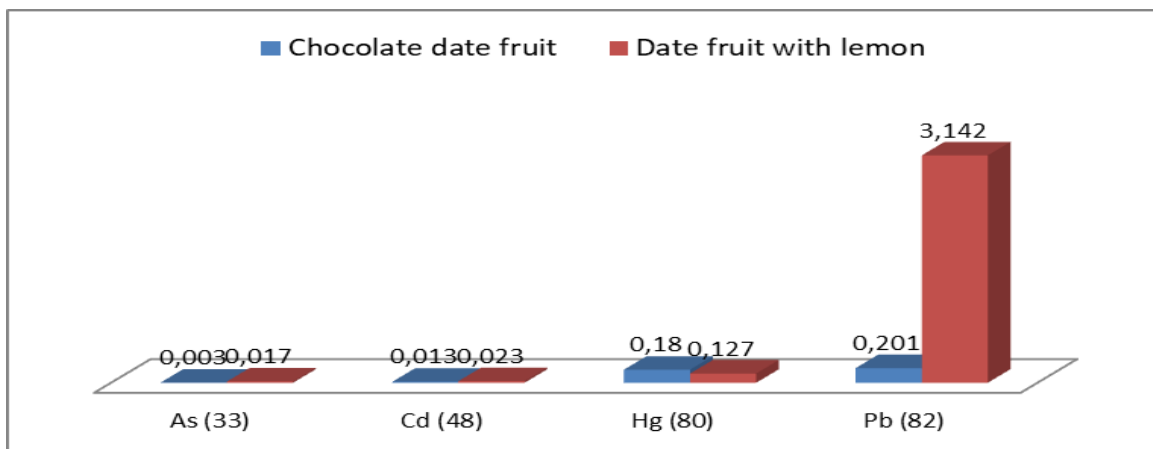


Figure 3. Composition diagram of heavy elements of fruits of persimmon (*Diospyros*) plant.

Conclusion: Thus, for the first time, the elemental composition of Baghdad samples of persimmon fruit was studied in detail. In this case, ICP-MS AT 7500 instrument using inductively coupled plasma mass spectrometry method was used. 41 elements were quantitatively determined in the fruit of persimmon. It was observed that there are 40 elements in the persimmon fruit of the "Chocolate" variety and 39 elements in the "Lemon" variety persimmon fruit. The natural tendency of the amount of an element to decrease with increasing mass is shown. It was observed that the amount of heavy elements (Table 3) in the fruit of the persimmon plant (*Diospyros*) is very small.

LIST OF REFERENCES

1. Kulkov O. P., Mukhamedzyanov Sh. 3, Subtropical plants of Uzbekistan, T., 19681. (Kulkov O. P., Muxamedzyanov Sh. 3, O'zbekistonning subtropik o'simliklari, T., 1968)
2. Zhivotinskaya S., Vostochnaya khurma v Uzbekistane, T., 1989.

3. Laura Domínguez Díaz, Eva Dorta, Sarita Maher, Patricia Morales, Virginia Fernández-Ruiz, Montaña Cámara and María-Cortes Sánchez-Mata. Potential Nutrition and Health Claims in Deastringed Persimmon Fruits (*Diospyros kaki* L.), Variety 'Rojo. Brillante', PDO 'Ribera del Xúquer'. *Nutrients* 2020, 12, 1397.

4. Rosa Direito, João Rocha, Bruno Sepodes and Maria Eduardo-Figueira. From *Diospyros kaki* L. (Persimmon) Phytochemical Profile and Health Impact to New Product Perspectives and Waste Valorization. *Nutrients* 2021, 13(9), 3283.

5. Smirnova E.V., Zarubina O.V. Determination of macro- and microelements in biological standard samples of plant and animal origin by inductively coupled plasma mass-spectrometry // modern methods of analysis of substances and materials: Mass spectrometry. Standard samples No. 3, 2014, pp. 45-57. [Published in Russian].

6. Abbasova D., Ibragimov A. Opredelenie soderjaniya khimicheskikh elementov v *Ephedra equistina* BUNGE s ispolzovaniem neutronno-aktivatsionnogo analiza. *Universum: Chemistry and biology: Sci. Journ.* 2020. No. 8 (74), p. 36-39. (Аббасова Д., Ибрагимов А. Определение содержания химических элементов в *Ephedra equistina* BUNGE с использованием нейтронно-активационного анализа. *Universum: Chemistry and biology: Sci. Journ.* 2020. № 8 (74), p.36-39.)