The Austrian Journal of Technical and Natural Sciences, No 7–8
ISSN 2310-5607

PREMIER Publishing
ppublishing.org

DOI:10.29013/AJT-24-7.8-14-17

ANALYSIS OF THE QUANTITY OF MICRO AND MACRO ELEMENTS IN THE ALHAGI MAURORUM PLANT GROWN IN THE KASHKADARYA REGION BY MASS SPECTROMETRY (ICP-MS) METHOD

Baltabaev Ulugbek Narbaevich [2], Kholmurodov Bahodir [1], Sa'dullayeva Shahribonu [1], Nasriddinov Jaloliddin [1], Choriyev Abdusattor [2]

[1] Tashkent Chemical Technology Institute of Shahrisabz branch. Republic of Uzbekistan. Shahrisabz

[2] Tashkent Chemical Technology Institute. Republic of Uzbekistan. Tashkent

Cite: *Baltabaev U. N., Kholmurodov B., Sa'dullayeva Sh., Nasriddinov J., Choriyev A. (2024). Analysis of the Quantity of Micro and Macro Elements in the Alhagi Maurorum Plant Grown in the Kashkadarya Region by Mass Spectrometry (Icp-Ms) Method. Austrian Journal of Technical and Natural Sciences 2024, No 3–4.* https://doi.org/10.29013/AJT-24-7.8-14-17

Abstract

A review of the literature on the significance of Alhagi maurorum and its importance was carried out. The amount of macro and microelements in the upper parts of Alhagi maurorum, i.e., seeds and leaves, was determined and analyzed using inductively coupled plasma mass spectrometry (ICP-MS) for 61 elements. According to the results, the amount of P, K, Ti, Cr, Ni, Cu, Zn, and Rb elements is higher in the seed part of Alhagi maurorum than in the leaf part, and in the leaf part, Li, Be, B, Na, Mg, Al, Ca, Sc, V, Mn, Fe, Co, Ga, As, Se, Sr, Y, Zr, Nb, Mo, Ag, Cd, In, Sn, Cs, Ba, Ce, Pr, Nd, Sm, Eu, The abundance of Gd, Dy, Re, Pb, Th, and U elements was determined. It was observed that the amount of other elements is close to each other.

Keywords: *Alhagi maurorum, micro and macro elements, coupled plasma mass spectrometry, ISPMS, grain, leaf, and seed of Alhagi maurorum plant*

Introduction

Alhagi maurorum is a wild herb with many medicinal properties. Belongs to the kingdom Plantae, order Fabales, family Fabaceae, and genus Alhagi. Since ancient times, people have used Alhagi maurorum to treat many ailments related to the respiratory, liver, cardiovascular, gastrointestinal, immune, and genitourinary systems. (Awaad Amani A.S., Maitland D.J., Soliman G.A., 2006).

The anti-infective effects of Alhagi maurorum extract (AME), a traditional Middle Eastern medicinal plant, on biofilm-forming Proteus mirabilis isolates were investigated by in vitro adhesion assay in cell culture and agar overlay assay using Janthinobacterium lividum (ATCC12472). Mainly, AME reduced biofilm formation in P. mirabilis by targeting genes, and AME showed anti-P. mirabilis and anti-QS activity (Arezoo, Mirzaei., Bahram, Nasr, Es-

fahani., Mustafa, Ghanadian., Sharareh, Moghim., 2022).

Literature Review

The phytochemical composition of the ethanol extract of Alhagi maurorum root was studied using gas chromatography-mass spectroscopy (GC–MS). 32 chemical compounds identified in A. maurorum root extract with medicinal benefits, and anti-inflammatory, antibacterial, and anti-cancer effects have been identified (Mohammed R. K., Noor, Alzahraa, Dheaa, Abd-alkadhemand, 2022).

Dehydroquercetin, rutin, quercetin, lutein, and seneroside substances belonging to the class of flavonoids were analyzed by chromatography of leaves, stems, and seeds of Alhagi maurorum. These flavonoids are natural antioxidants. The above-ground parts of Alhagi maurorum leaves, stems and seeds have been recommended for general use (Kholmurodov B. B., 2023).

The chemical composition and mineral content of the bread samples with Alhagi maurorum powder, based on the analysis results, showed that the Alhagi maurorum powder contains a large amount of protein and raw fiber, in addition to some important minerals such as calcium, phosphorus, and iron. Alhagi maurorum powder increased fiber, ash, and lipids and decreased moisture, protein, and carbohydrates. The addition of Alhagi maurorum powder improved the nutritional content but decreased the intake (wad, Allah., Usama, El-Sayed, Mostafa., I. M., Abd, El-Razik., W., K., Abou, El, Ahmed, 2022).

Minerals are an important component of our body. They perform a variety of functions, including building materials for our bones, influencing muscle and nerve function, and regulating the body's water balance. They are also a component of hormones enzymes and other biologically active compounds. Some minerals also play an important role in the optimal functioning of the immune system. This applies to both the innate defense system and adaptive immunity. Accordingly, mineral supply may affect susceptibility to infections, but it also affects the development of chronic diseases. (Calder P. C., Carr A. C., Gombart A. F., Eggersdorfer M., 2020).

Methods

The mineral content of the Alhagi maurorum plant grown in the Kashkadarya region of the Republic of Uzbekistan in terms of dry mass was analyzed in the central laboratory of JSC "Uzbek Geological Research".

In the process of sample preparation, an exact sample of 0.0500–0.5000 g of the tested substance is weighed on an analytical scale and transferred to Teflon autoclaves. The autoclaves are then filled with an appropriate amount of purified concentrated mineral acids (nitric acid (n/s) and hydrogen peroxide (n/s)). The autoclaves are sealed and placed in a Berghofc microwave digester using MWS-3+ software or a similar microwave digester. Depending on the type of the studied substance, the decomposition program is determined, and the degree of decomposition and the number of autoclaves are indicated (up to 12 pieces).

After disintegration, the contents of the autoclaves are quantitatively transferred to 50 or 100-ml volumetric flasks, and the volume is adjusted to the mark with 0.5% nitric acid.

The detection of the substance under study is carried out using an ISPMS device or a similar optical emission spectrometer device with an inductively coupled argon plasma. The optimal wavelength of micro- or macroelements to be detected in the detection method is indicated, at which they have maximum emission.

Results and discussion

After receiving the information, the actual quantitative composition of the substance in the test sample is automatically calculated by the device and entered in the form of mg/kg or μg / g with error limits – in RSD%.

Based on the results of the analysis, the amount of P, K, Ti, Cr, Ni, Cu, Zn, and Rb elements is more in the seed part of Alhagi maurorum than in the leaf part, and in the leaf part, compared to the seed part, Li, Be, B, Na, Mg, Al, Ca, Sc, V, Mn, Fe, Co, Ga, As, Se, Sr, Y, Zr, Nb, Mo, Ag, Cd, In, Sn, Cs, Ba, Ce, Pr, Nd, Sm, Eu, The abundance of Gd, Dy, Re, Pb, Th, and U elements was determined.

Table 1. *Quantification of micro and macroelements in Alhagi maurorum plant using inductively coupled plasma mass spectrometry (ICP-MS)*

№	Element	Measurement range of detectable elements	Amount, mg/kg	
			Alhagi maurorum seed	Alhagi maurorum leaf
1	**Lithium (Li)**	0.05–4000	2.10	3.80
2	**Beryllium (Be)**	0.05–4000	< 0.05	< 0.05
3	**Boron (B)**	0.10–4000	480	1200
4	**Sodium (Na)**	0.004–11%	1400	4200
5	**Magnesium (Mg)**	0.004–11%	6400	14000
6	**Aluminum (Al)**	0.002–20%	190	320
7	**Phosphorus (P)**	—	8000	2400
8	**Potassium (K)**	0.008–30%	20000	11000
9	**Calcium (Ca)**	0.005–28%	45000	100000
10	**Scandium (Sc)**	0.10–4000	0.160	0.230
11	**Titanium (Ti)**	0.0006–9%	3.90	2.50
12	**Vanadium (V)**	0.10–4000	< 0.10	0.150
13	**Chromium (Cr)**	1.0–4000	1.30	1.20
14	**Manganese (Mn)**	0.002–10%	40.0	77.0
15	**Iron (Fe)**	0.006–30%	410	890
16	**Cobalt (Co)**	0.10–4000	0.300	0.430
17	**Nickel (Ni)**	1.0–4000	5.30	3.30
18	**Copper (Cu)**	1.0–4000	13.0	2.60
19	**Zinc (Zn)**	1.0–4000	94.0	86.0
20	**Gallium (Ga)**	0.10–4000	0.180	0.200
21	**Arsenic (As)**	0.10–4000	1.10	1.60
22	**Celine (Se)**	0.50–4000	< 0.50	< 0.50
23	**Rubidium (Rb)**	0.10–4000	5.90	1.20
24	**Strontium (Sr)**	0.10–4000	230	570
25	**Yttrium (Y)**	0.10–4000	< 0.10	< 0.10
26	**Cerconium (Zr)**	—	0.017	0.025
27	**Niobium (Nb)**	0.005–4000	0.008	0.008
28	**Molybdenum (Mo)**	0.10–4000	0.170	0.380
29	**Silver (Ag)**	0.05–10.0	< 0.05	< 0.05
30	**Cadmium (Cd)**	0.005–4000	0.010	0.007
31	**Indium (In)**	—	< 0.005	< 0.005
32	**Tin (Sn)**	0.10–10	< 0.10	0.100
33	**Antimony (Sb)**	0.10–4000	< 0.10	< 0.10
34	**Tellurium (Te)**	0.30–4000	< 0.30	< 0.30
35	**Cesium (Cs)**	0.02–4000	< 0.02	0.030
36	**Barium (Ba)**	0.10–4000	4.60	17.0
37	**Lanthanum (La)**	0.50–4000	< 0.05	< 0.05
38	**Seriy (Ce)**	0.04–4000	< 0.04	0.100
39	**Prasidiom (Pr)**	0.01–4000	0.010	0.031
40	**Niodymium (Nd)**	0.01–4000	0.038	0.110
41	**Samaria (Sm)**	0.01–4000	< 0.01	0.027
42	**European (Eu)**	0.01–4000	0.006	0.011
43	**Gadolinium (Gd)**	0.01–4000	< 0.01	0.020
44	**Terbiy (Tb)**	0.01–4000	< 0.01	< 0.01

№	Element	Measurement range of detectable elements	Amount, mg/kg	
			Alhagi maurorum seed	Alhagi maurorum leaf
45	**Dysprosium (Dy)**	0.01–4000	< 0.01	0.018
46	**Holmi (Ho)**	0.01–4000	< 0.01	< 0.01
47	**Erbium (Er)**	0.01–4000	< 0.01	< 0.01
48	**Thulium (Tm)**	0.01–4000	< 0.01	< 0.01
49	**Ytterby (Yb)**	0.01–4000	< 0.01	< 0.01
50	**Luticius (Lu)**	0.01–4000	< 0.01	< 0.01
51	**Gafnium (Hf)**	0.05–4000	< 0.05	< 0.05
52	**Tantalum (Ta)**	0.04–4000	< 0.04	< 0.04
53	**Tungsten (W)**	0.08–4000	< 0.08	< 0.08
54	**Rhenium (Re)**	0.01–4000	< 0.01	0.014
55	**Platinum (Pt)**	0.05–4000	< 0.05	< 0.05
56	**Gold (Au)**	0.05–4000	< 0.05	< 0.05
57	**Thallium (Tl)**	0.01–4000	< 0.01	< 0.01
58	**Lead (Pb)**	0.1–4000	0.860	1.30
59	**Bismuth (Bi)**	0.1–4000	< 0.01	< 0.01
60	**Thorium (Th)**	0.01–4000	0.016	0.034
61	**Uranus (U)**	0.01–4000	0.029	0.074

Conclusion

It was found that the calcium element is in the highest concentration in the plant. As a result of the analysis, it was found that the Niobium element is stored in the smallest amount.

References

Awaad Amani A. S., Maitland D. J., Soliman G. A. Antiulcerogenic activity of Alhagi maurorum // Pharmaceutical biology. 2006.– T. 44.– No. 4.– P. 292–296.

Arezoo, Mirzaei., Bahram, Nasr, Esfahani., Mustafa, Ghanadian., Sharareh, Moghim. (2022). Alhagi maurorum extract modulates quorum sensing genes and biofilm formation in Proteus mirabilis. Dental science reports. Doi: 10.1038/s41598-022-18362-x

Mohammed R. K., Noor, Alzahraa, Dheaa, Abd-alkadhemand. (2022). Determination of Active Phytochemical Compounds of Alhagi Maurorum using Gas Chromatography-Mass Spectroscopy (GC–MS). Iraqi journal of science. Doi: 10.24996/ijs.2022.63.1.10

Kholmurodov B. B. *et al.* 2023. *IOP Conf. Ser.: Earth Environ. Sci.* 1284012008. DOI: 10.1088/1755-1315/1284/1/012008

Awad, Allah., Usama, El-Sayed, Mostafa, I. M., Abd, El-Razik., W., K., Abou, El, Ahmed. (2022). Effect of Alhagi Maurorum Powder (Camel Thorn) on Some Chemical and Sensory Properties of Toast Bread. Mağallat¨ Dirāsāt wa Buḥūṯ Al-Tarbiyyat¨ Al-Nawʿiyyat¨. Doi: 10.21608/jsezu.2022.253043

Calder P. C., Carr A. C., Gombart A. F., Eggersdorfer M. Optimal Nutritional Status for a Well-Functioning Immune System Is an Important Factor to Protect against Viral Infections. *Nutrients*. 2020;12:1181. Doi: 10.3390/nu12041181. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

submitted 15.07.2024;
accepted for publication 29.07.2024;
published 28.09.2024

Contact: bahodirxolmurodov1994@gmail.com