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Research Article

ICP-AES/ICP-MS ELEMENTAL ANALYSIS OF *TULIPA SYSTOLA* STAPF. GROWING IN KURDISTAN REGION IRAQ

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ABSTRACT

The genus *Tulipa* (Liliaceae) is of great economic, horticultural, esthetical, ecological, conservational, and taxonomic interest. *Tulipa systola* Stapf. collected in Kurdistan Region which uses by local people for pain killing and the present study conducted ICP-AES/ICP-MS technique for analyzing 65 elements (Minor, Major and Heavy metals) from Roots, Leaves and Flowers of Tulip. Results shown that some elements (Ni, Rb, U, V, W and Th) are present in significant amounts.

Keywords: *Tulipa systola*, Elemental analysis, ICP-AES/ICP-MS.

INTRODUCTION

Mineral elements are inorganic substances found in all tissues of the body and fluids. These represent comparatively smaller portion of the diet as compared with major nutrients. Even though mineral elements yield no energy, they are necessary for several biological processes that are essential to life. These mineral elements may be broadly classified as macro (major) or micro (minor) elements based on their daily requirement. The importance of mineral elements is well recognized in human, animal and plant nutrition as their deficiencies in the nutrition can cause a variety of characteristic diseases/disorders[1]. Man and other animals are exposed daily to numerous elements, in varying forms and levels, through food (feed), water, and other FDA-regulated products. Major essential elements include C, H, O, N, S, Ca, P, K, Na, Cl, and Mg. C, H, O, N, and Smake up the bulk of the elemental constituents of plants and animals, and are the major components of the organic substances in tissues. Fe, Zn, Cu, Co, Mn, I, Mo, Cr, Se, F, (B for plants) have identified functions meeting the definition of essential elements in animals including man[2]. In the last few decades, the determination of minerals and trace elements is important to enhance production efficiency in plants and foods. The various elements transfer to the food chain of humans is significantly affected by the geological origin of the soils and the ground water basin as well as the living area of the flora and the drinking water reservoir. Some of the trace elements including iron, manganese, zinc and copper are essential micronutrients with a variety of biochemical functions in all living organisms. However, the benefits of these micronutrients may be completely reversed if present at high concentrations. Some heavy metals particularly cadmium and lead, not essential elements for human nutrition, on the other hand, have been considered serious soil and environment pollutant due to their potential toxicity at low concentrations. In addition, uranium and potassium40 which is radioisotope of its element get into the flora and are comprehensively stored in young plants[3]. In recent years, with enhanced awareness of the importance of trace elements on health, an increasing numberof reports on the level of trace elements in human biological material traditional medicines have been published[4] and their roles in traditional medicine such as India[5], Nigeria[6], Pakistan[7] and Morocco[8]. The levels of many elements in the living organisms are governed by metabolic processes, like active transport or excretion. Pattern recognition of metabolically government levels of known food might reveal deficiencies or contaminations till respective diseases[9]. One of the basic reasons for monitoring thelevels of toxic metals in vegetables was the dramatically increased environmental pollution in recent years. A number of techniques were applied for elemental analysis of a wide spectrum of matrices, including colorimetric, polarmetry, voltmetry, X-ray fluorescence analyses, neutron analyses, capillary electrophoresis, complexometry, electro thermal atomic absorption spectrometry, inductively coupled plasma - optical emissionspectrometry (ICP-OES)[10].

The genus *Tulipa* (Liliaceae) is of great economic, horticultural, esthetical, ecological, conservational, and taxonomic interest. It has attracted a great deal of attention from the Dutch Tulipomania of February 1637 until the export and tourism of today. It is undoubtedly the unofficial national flower of The Netherlands. Tulips occur naturally in temperate regions ranging from the southern Balkans to Siberia and west China, North Africa (Algeria), the east Mediterranean, the Near East Iran, Israel, Jordan and Turkey[11]. In the present study 65 elements were analyzed in (*Tulipa systola* Stapf.) by applyingICP-AES/ICP-MS technique.

MATERIAL & METHODS

Plant material

Tulipa systola Stapf. was collected in April 2014 from (Korek Mountain) which belongs to Rewanduz district - Erbil / Kurdistan region from northern Iraq. The materials were identified and classified by the botanist Dr.Abdullah Shukur from University of Salahaddin Erbil-Iraq. A voucher specimen was deposited at Education Salahaddin University Herbarium (ESUH), Kurdistan. The plant raw materials (Roots, Leaves and Flowers) were washed and air-dried under shade at room temperature (20-25^{o}C). After drying, the plant parts were separately grounded into fine powder using a laboratory grinding mill, to provide homogeneous powder for the analysis. Powdered materials were stored in dark bottles and maintained at room temperature until required.

Prepared dried plant sample (1.0g) is cold digested for approximately 8 hours in nitric acid**,** samples are then heated gradually up to 115 degree Celsius for approximately 2.5 hours**.** Samples aresubsequently cooled and brought up to volume with hydrochloric acid resulting solutions are mixed thoroughly and analysed by ICP-AES (Agilent 725-ES Radial) and ICP-MS (Agilent 7700x).Analytical results are corrected for inter-element spectral interferences.

Setting parameters; Power [kW] 1.2, Plasma flow [l/min]15, Auxiliary flow [l/min]1.50, Nebulizer flow [l/min] 0.85, Nebulizer Cyclonic type, Replicate read time [s] 10, Number of replicates 3, Instrument stabilization delay [s] 30, Rinse time [s] 60, Sample uptake delay [s] 10, Pump rate [rpm] 15.

RESULT AND DISCUSSION

Traditional medicines, including Chinese medicines and Indian Ayurvedic medicines, have become more popularas alternative and supplementary remedies in recent years.Toxic metals or metalloids such as lead, mercury, and arsenic,are frequently found in traditional medicines, justifiablyraising public concerns. For therapeutic purposes, some traditionalmedicinal recipes used metals, such as mineral arsenicals and chromials, for hundreds of years as intentionaladditives, either as the presumed main active ingredient or asan auxiliary agent to assist the efficacy of the given recipes. However, arsenic is a known multi-site human carcinogen and has many other profound toxic effects following both acute and chronic exposure. Depending on its oxidation state chromium can be also a highly toxic substance. For vitamins, macro- and microelements but also of some metals for which international standard levels have been established. The World Health Organization (WHO) has stipulated maximum levels of cadmium (0.3 mg/kg) and lead (10 mg/kg) in medicinal plant materials which regulated by World Health Organization (WHO). Minor elements (B, Ca, Co, Cu, Fe, Ga, In, K, Li, Mg, Mn, Na, P, Se, Tl, V, Zn) and heavy metals (Ag, Al, As, Cd, Cr, Ni, Pb, Sr) were determined in *Tulipa systola* Stapf. However some rear elements such as (U; TR 0.079, TL 0.071 and TF 0.138 ppm), (V; TF 9ppm), (W; TR 97ppm) and (Rb; TF 6.48ppm) were found in significant levels as shown in the Table 1.

Many factors such us underground water, soil, air pollution and/or the toxicity of the plant itself may affect the elemental content, *Tulipa systola* in Kurdistan region endemic to Safin and Korek mountains, places for several year heavy weapon war between Kurdish militant peshmerga and first Golf war between Iraq and Iran, Iraqi Government airplanes drop chemical weapons on the towns and planting huge mine fields in the mountains; the area that *Tulipa S.* for the present study were collected from. However presence of radioactive elements such as Uranium cannot concluded just by one factor, sometimes multi factor affects variety and portions of some elements, the traditional use of Tulip for pain killing is a starting point but on the other hand recorded toxicity of tulip roots by local people is a point of more interest for further phytochemical investigation, elemental analysis of the soil itself that could be another factor.

Table 1: Minor, Major and heavy metal elemental content of TR;*Tulipa S.* Roots, TL; Leaves and TF; flowers in ppm. LOD; Limit of Detection in ppm.

Elements	Sym bol	LOD (ppm)	Tulipa systole elemental content in (ppm)		
			TR	TL	TF
Aurum	Au	0.0002	0.0007	0.0003	0.0009
Palladium	Pd	0.001	<0.001	<0.001	<0.001
Platinum	Pt	0.001	0.001	0.001	0.001
Silver	Ag	0.001	0.012	0.007	0.014
Aluminum	Al	0.01	0.04	0.16	0.42
Arsenic	As	0.05	3.50	2.18	4.06
Boron	B	10	10	10	20
Barium	Ba	0.1	2.5	7.2	17.9
Beryllium	Be	0.01	0.02	0.07	0.16
Bismuth	Bi	0.001	0.085	0.108	0.079
Calcium	Ca	0.01	0.16	0.94	2.09
Cadmium	Cd	0.002	0.054	0.158	0.731
Cerium	Ce	0.003	0.481	2.27	5.18
Cobalt	Co	0.002	0.240	0.988	2.54
Chromium	Cr	0.5	1.6	6.2	15.5
Cesium	Cs	0.005	0.054	0.123	0.335
Copper	Cu	0.01	4.00	6.35	8.80
Dysprosium	Dy	0.005	0.027	0.131	0.347
Erbium	Er	0.003	0.014	0.066	0.173
Europium	Eu	0.003	0.009	0.042	0.099
Iron	Fe	0.001	0.042	0.167	0.443
Gallium	Ga	0.01	0.11	0.42	1.01
Gadolinium	Gd	0.005	0.034	0.167	0.410
Germanium	Ge	0.005	0.027	0.041	0.058
Hafnium	Hf	0.002	0.010	0.030	0.064
Mercury	Hg	0.001	0.015	0.013	0.017
Holmium	Ho	0.001	0.005	0.026	0.066
Indium	In	0.005	<0.005	0.007	0.007
Potassium	K	0.01	0.59	1.77	2.21
Lanthanum	La	0.002	0.210	1.005	2.27
Lithium	Li	0.1	0.4	1.5	3.1
Lutetium	Lu	0.001	0.001	0.009	0.022
Magnesium	Mg	0.001	0.074	0.277	0.425
Manganese	Mn	1	13	49	108
Molybdenum	Mo	0.01	0.10	0.24	0.60
sodium	Na	0.001	0.041	0.038	0.052
Niobium	Nb	0.002	0.091	0.166	0.310
Neodymium	Nd	0.001	0.243	1.155	2.53
Nickel	Ni	0.04	1.65	7.17	17.40
Phosphorus	P	0.001	0.116	0.251	0.228
Lead	Pb	0.01	1.00	1.43	2.99
Praseodymiu m	Pr	0.003	0.054	0.272	0.612
Rubidium	Rb	0.01	1.42	4.18	6.48
Rhenium	Re	0.001	0.002	0.001	<0.001
Sulfur	S	0.01	0.07	0.19	0.22
Antimony	Sb	0.02	0.13	0.13	0.21
Scandium	Sc	0.01	0.08	0.28	0.74
Selenium	Se	0.1	<0.1	<0.1	<0.1
Samarium	Sm	0.003	0.050	0.247	0.562
Tin	Sn	0.01	0.03	0.05	0.12
Strontium	Sr	0.02	2.43	11.95	34.3
Tantalum	Ta	0.005	<0.005	0.005	<0.005
Terbium	Tb	0.001	0.005	0.025	0.063
Tellurium	Te	0.02	<0.02	<0.02	<0.02
Thorium	Th	0.002	0.042	0.124	0.257
Titanium	Ti	0.001	0.001	0.003	0.007
Thallium	Tl	0.002	0.016	0.023	0.059
Thulium	Tm	0.001	0.002	0.010	0.025
Uranium	U	0.005	0.079	0.071	0.138
Vanadium	V	1.00	1.00	4.00	9.00
Tungsten	W	0.01	97.0	36.9	7.30
Yttrium	Y	0.003	0.140	0.768	1.925
Ytterbium	Yb	0.003	0.011	0.056	0.143
Zinc	Zn	0.1	16.2	32.1	41.3
Zirconium	Zr	0.02	0.27	1.10	2.34

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REFERENCES

1. Dileep N, Rakesh KN, Junaid S, Ramesh Kumar KA, Prashith Kekuda TR and Vinayaka KS. Elemental analysis (ICP-OES) and anticariogenic activity of leaf and bark of *Fahrenheitia Zeylanica* (Thew.) Airy.ActaChim. Pharm. Indica 2013; 3(4):255-260.
2. Ora Laboratory Manual, FDA Office of Regulatory affairs 2013; 4(6): 2-13.
3. Hicsomniz U, Ozdimer C, Cam S, Ozdimer A and Serap SE. Major-Minor element analysis in some plant seeds consumed as feed in Turkey. Natural science 2012;4(5):298-303.
4. Mahmoud Badran, Azizah Ismail, Reda Morsy and Tarek Elnimr. Critical evaluating for five digestion methods using ICP-MS. J Pharm Sci Innov. 2014;3(1):30-34 http://dx.doi.org/10.7897/2277-4572.031101Rao PU. Chemical composition and biological evaluation of debitterized and defatted neem (*Azadirachta indica*) seed kernak cake. Chemical J. American oil chem. Society 1987; 64: (9), 1348-1351.
5. Anjorin TS, Ikokoh P and Okolo S. Meniral composition of Moringa Oleifera Leaves, Pods and Seeds from two regions in Abuja, Nigeria. Int. J. Agrical. Biol. 2010; 12(3): 431-434.
6. Muhammad A, Muhammad QH and Abdul Samad M. A study on elemental content of medicinally important species of *Artemisia* L. (Asteraceae) found in Pakistan. Journal of Medicinal plant Research 2010; 4(21):2257-2263.
7. Imeluane B, Tahri M, Elbastroiui M, Aouinti F and Elbachiri A. Mineral contents of some medicinal and aromatic plants growing in Eastern Morocco, J. Mater. Environ. Sci.2011;2(2): 104-111.
8. Sager M. Analysis of less bioactive elements in green plants, food and feed samples (Sc-Y-La-Ce-Rb-Cs-Ti). Ecological chemistry and Engineering 2010; 17(3): 290-295.
9. Dospatliev L, Kostadinov K,Mihaylova G and Katrandzhiev N. Determination of Heavy metals (Pb-Zn-Cd and Ni) in Eggplant. Trakia journal of Sciences 2012; 10(2): 31-35.
10. Veldkamp JF and Zonneveld BJM. The infrageneric nomenclature of *Tulipa* (Liliaceae), Plant syst. evol. 2012; 298:87-92.

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