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DETERMINATION OF MAJOR AND TRACE ELEMENTS OF TRADITIONAL MEDICINAL PLANTS OF GULBARGA REGION

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ABSTRACT

The elemental analysis was carried out for 13 different traditional medicinal plants are known to occur naturally and abundant in Gulbarga of North Karnataka region using Atomic Absorption Spectrophotometer (AAS) technique. A total of 12 elements were measured in the collected traditional medicinal plants; out of these 12 elements, the concentration of Ca, K, Mg and V was found to be in the range of Ca[52-80 mg/L], K[6-20 mg/L], Mg[6-7.5 mg/L] and V[0.4 – 1.5 mg/L], while the other elements such as Al, Mn, Fe, Cu, Zn, Cd, Mo, and Ti were less than 1 mg/L. The results were compared and correlated with multi-elemental analysis technique i.e., Scanning Electron Microscopy-Energy Dispersive x-ray Spectroscopy (SEM-EDX) for the confirmation of presence of elements in the collected medicinal plants. The results of SEM-EDX also confirmed the determined elements and are at the same level. The data obtained from the study can be used to evaluate the potentiality of these plants and also in deciding the dosage of Ayurvedic drug for the treatment of various diseases.

Keywords: Traditional Medicinal Plants, Trace elements, AAS technique and SEM-EDX.

INTRODUCTION

The traditional medicinal plants play an important role in the traditional medicine system. According to the survey reported by World Health Organization (WHO), about 80% of the world's population consumes traditional medicinal plants in direct and indirect ways to treat their diseases. Medicinal plants have been using for curing and preventing of the various diseases. The curing and prevention property of the medicinal plants depends on their chemical composition. The level of the elements in the plants varies by the characteristics of the soil

and also environmental conditions [1, 2, 3, 4 and 5]. During the past decade, it has seen a significant increase in the use of traditional medicine due to their minimal side effect, availability and acceptability [6].

Essential major and trace elements in traditional medicinal plants have been investigated by many researchers to strengthen the importance of elemental analysis with respect to human health. The human body requires a number of elements to maintain a good health. Several attempts have been made to determine the elemental compositions of traditional medicinal plants using different elemental analysis techniques from many countries all over the world [7, 8].

In the present study, 13 different traditional medicinal plants were selected from Gulbarga of North Karnataka region which are known to occur naturally and in abundant in this region. These traditional medicinal plants are used to prevent and cure various diseases by the local traditional practitioners (NatiVaidhya). Hence an attempt has been made to determine the elemental constituents of the selected traditional medicinal plants using AAS technique. This technique measures the concentrations of elements. Atomic absorption is so sensitive that it can measure down to ppb (parts per billion) or ppm (parts per million) of a gram (μg dm^{-3}or 10^{-6}) in a sample. The technique makes use of the wavelengths of light specifically absorbed by an element present in the sample. They correspond to the energies needed to promote electrons from one energy level to another, i.e., higher energy level. Atomic absorption spectroscopy has many uses in different areas such as clinical analysis, Environmental analysis, Pharmaceuticals, Industry, Mining and Agriculture [9, 10]. SEM-EDX, among the various analytical techniques used for elemental analysis, is highly qualified for the identification and the quantification of different elements in various samples of biological and environmental importance [11]. Besides, a powerful tool for such analysis the method is non-destructive and is more advantageous in multi-elementary analysis compared to other existing methods such as ICP-AES, ICP-MS, AAS and INAA.

Materials and Methods:

Sample Collection:

Table.1 shows the profile of the selected traditional plants collected from Gulbarga of North Karnataka region. About a few kg of each plant material was collected and then collected materials were washed in deionized water to eliminate contamination due to dust and environmental pollution. The washed plant materials were dried in shade for a months and then grinded to a fine powder which was further used for the major and trace elemental analysis.

Sample preparation for elemental analysis:

A 10 gm of powder was taken in a silica crucible and then kept in an oven for 2-3 hours at 250-350° C to get ash. The obtained ash was used for preparation of solution. The solution was prepared by mixing of concentrated HCL, double distilled water and 1gm of ash in the ratio 25: 25:1. The mixed solution was then stirred for few minutes; it was then filtered using watt man filter paper 41. A 950 ml of double distilled water was added to the filtered solution to make it 1000 ml solution. The same procedure was repeated for all other plant material samples [12]. The obtained solutions were finally used

for the measurement of trace elemental analysis using AAS technique.

Determination of elements:

The elements such as Mg, Al, K, Mn, Fe, Cr, Ca, Cu, Zn, Cd, Si, Mo, V and Ti in the plant samples were analyzed using atomic absorption spectrophotometer. It is manufactured by Thermo Scientific™ with a model No. iCETM-3000 series and it is equipped with dedicated flame, furnace or combined flame and furnace option. Air – C2H2 and N2O- C2H2 flame was used for determination elemental content. The absorption wavelength for the determination of each element with its linear working range and correlation coefficient were calibrated for the analysis.

RESULTS & DISCUSSION

The botanical as well as local name of the plant, part used, coding of the samples and medicinal uses are listed in Table 1. Table. 2 show the measured elemental concentration of the traditional medicinal plant collected from Gulbarga of North Karnataka region.

Calcium (Ca)

The concentration of Ca is found in all the collected medicinal plants and the concentration of calcium is highest when compared to all other elements. The presence of high amount of the calcium concentration in medicinal plants could be due to the fact that the soil of this region. Gulbarga of North Karnataka region contains maximum amount of calcium in the soil and the same one is reflected in the medicinal plants. The level of calcium is varied from 52 – 80 mg/L in all samples. The levels of concentration are also verified by considering the SEM-EDX results. It helps in preventing and curing all bone related issues. It also helps to repair worn out cells, strong teethe in humans, building of RBCs and body mechanism. Therefore it has been extensively used for treatment of various diseases.

Potassium (K)

The concentration of potassium (K) is found in all collected medicinal plants and it is the second dominant element when compared to all other elements. The presence of high amount of the K concentration in medicinal plants could be due to botanical structure as well as the mineral composition of the soil and also other factors like use of fertilizers, water irrigation and geological conditions of the region. The level of K is varied from 6 – 20 mg/L in all samples. The results of SEM-EDX technique also show the presence of potassium element at higher level which can be seen in figure 2.

Magnesium (Mg)

The concentration of Magnesium (Mg) is found in all collected medicinal plants and it is the third dominant element when compared to all other elements. The level of Mg is varied from 6 – 7.5 mg/L in all samples. The presence of Magnesium element is also reflected in SEM-EDX and its concentration level is in accordance with the AAS technique which can be seen in figure 2. Magnesium works with calcium to help transmitting nerve impulse in the brain. Magnesium has calming effect and works on the nervous system of those peoples, suffering from depression. In blood its quantity is 2-4mg/100ml [19]. Magnesium has an important role in the phosphorylation reactions of glucose and its metabolism. Its deficiency has been implicated in

insulin resistance, carbohydrate intolerance, dyslipidemia and complications of diabetes.

Vanadium (V)

The concentration of Vanadium (V) is found in all collected medicinal plants and it varied from 0.4411– 1.4762 mg/L in all collected samples. Vanadium affects carbohydrate metabolism including glucose transport, glycolysis, glucose oxidation, and glycogen synthesis [13]. At a dose of 100 mg/day vanadyl sulfate improves insulin sensitivity [14]. It is possible mechanism of action in glycemic control is thought to be primarily insulin mimetic with up regulation of insulin receptors.

The other elements such as Al, Mn, Fe, Cu, Zn, Cd, Mo, and Ti were also determined in the present study but the concentration of these elements is found to be comparatively less. The above said elements were compared and correlated with SEM-EDX and are found to be similar. Figure 3, shows the concentration few major and trace elements of Datura metal L. (Solanaceae).The variation in elemental concentration is mainly attributed to the differences in botanical structure, as well as in the mineral composition of the soil in which the plants grow. Other factors which are also responsible for variation in elemental contents are preferential absorbability of the plant and climatological conditions [18]. These determined elements are very essential for the human health. These elements are within the permissible limits and help to prevent and cure various diseases. From this study it is also verified that the medicinal plants viz., Murrayakoenigii, Lawsoniainermis, Datura metal, Acalyphaindica, , Mirabilis jalapa, Gymnemasylvestre and Tylophoraindica contains trace elemental concentration of copper and zinc along with major and other trace elements, which are the required nutrients for the metabolism as per the recommendations of WHO [15-17].

Tables and Figures:

Table 01: Profile of the traditional medicinal plants and their medicinal uses

S.No	Botanical name	Local name	Coding	Part	Medicinal use
1	*Abutilonindicum*(L)	*Tutti Vibutigida*	TU	Leaf	Diuretic, infected skin and dysentery.
2	*Murrayakoenigii*(L.) Sprenge	*Karibevu*	KA	Leaf	Anti-diabetic, antioxidant, antimicrobial, anti-inflammatory and hair treatments
3	*Tinosporacordifolia*	*Amrita balli*	AM	Leaf	Immune booster, general tonic, Chronic fevers, Upper respiratory,
4	*Lawsoniainermis*L (Lythraceae),	*Madarangi,*	MA	Leaf	Jaundice, amoebic dysentery and sore throats.
5	*Datura metal* L. (Solanaceae),	*Unmatta*	UN	Leaf	Rheumatism, Asthma, control of dandruff.
6	*Adathodavasica*Nees. (Acanthaceae),	*Adusoge*	AD	Leaf	Cough,Spiny outgrowths of piles to control bleeding.

7	*Acalyphaindica*L. (Euphorbiaceae)	*Kuppigida*	KU	Leaf	Constipation, Scabies, Eczema, asthma and Urinary problems.
8	*Plumbagozeylanica*L (Plumbaginaceae),	*Bili chitramula*	BI	Root	Pile, elephantiasis and rheumatic pain.
9	*Balanitesroxburghii*Planch. (Simarubaceae)	*Ingudi*	IN	Leaf	Jaundice, intestinal worm infections, leukoderma, psychiatric disorders.
10	*Barleriaprionites*L. (Acanthaceae),	*Mullugoranti*	MU	Leaf	Scabies, respiratory diseases, tooth ache and joint pains.
11	*Mirabilis jalapa*L. (Nyctaginaceae),	*Sanjemallige*	SA	Leaf	Wound healing, abscesses and inflam-mation.
12	*Gymnemasylvestre* Asclepiadaceae)	*Kodapatri*	KO	Leaf	Diabetes, metabolic syndrome, weight loss and cough.
13	*Tylophoraindica (Asclepiadaceae)*	*Aadumuttadaballi*	AA	Root & Leaf	Cough, asthma, bronchitis, dysentery, diarrhea, wounds, ulcer, hemorrhoids, malignant tumor, and leukemia

Table 02: Concentration of elements (in mg/L) in the traditional medicinal plants collected from Gulbarga.

S. No	Botanical name	Coding	Mg	Al	K	Mn	Fe	Ca	Cu	Zn	Cd	Mo	V	Ti
1	*Abutilonindicum(L)*	**TU**	7.4817	0	18.0794	0.1074	0.3072	76.5954	0	0.1948	0.0036	0.5314	0.4411	0
2	*Murrayakoenigii (L.) Sprenge*	**KA**	7.0280	0	17.1518	0.2419	3.1464	73.7779	0.0460	0.0744	0.0188	0.1639	0.7094	1.7325
3	*Tinosporacordifolia*	**AM**	6.9069	0	19.5953	0.4677	0.5291	71.9977	0	0.0374	0.0073	0	0.8477	0.6597
4	*LawsoniainermisL (Lythraceae),*	**MA**	7.2817	0	12.2685	0.2539	1.4574	78.2088	0.0135	0.0853	0.0008	0	1.4401	0
5	*Datura metal L. (Solanaceae),*	**UN**	7.1855	0	20.0802	0.2233	1.0544	80.4063	0.0055	0.0761	0.0132	0	0.9752	0
6	*AdathodavasicaNees. (Acanthaceae),*	**AD**	7.0582	0	15.2156	0.2117	1.8310	78.9519	0	0.1354	0.0213	0	1.1739	0
7	*AcalyphaindicaL. (Euphorbiaceae)*	**KU**	7.2165	1.3896	17.0668	0.2415	4.0092	78.3728	0.0066	0.1316	0.0086	0	1.2996	2.5503
8	*PlumbagozeylanicaL (Plumbaginaceae),*	**BI**	7.5361	0.5786	18.1869	0.2481	1.0217	53.1360	0	0.0938	0.0002	0.2650	1.3024	0.6345

9	*Balanitesroxburghi iPlanch. (Simarubaceae)*	**IN**	6.9488	0.6873	6.1536	0.1606	0.4761	76.8192	0	0.0401	0	0.5987	1.3179	1.8217
10	*BarleriaprionitesL. (Acanthaceae),*	**MU**	7.4221	0.2443	18.8229	0.0847	0.9937	79.0460	0	0.0618	0.0143	0.6544	1.3929	3.9378
11	*Mirabilis jalapaL. (Nyctaginaceae),*	**SA**	7.5132	2.4991	18.2589	0.1931	0.7003	78.5445	0.0054	0.0993	0.0104	0.7266	1.2874	3.4799
12	*Gymnemasylvestre (Retz.) R.Br.exSchult. (Asclepiadaceae)*	**KO**	7.1939	3.0792	16.8841	0.5515	1.2741	70.6604	0.0138	0.0729	0.0046	0.6493	1.4762	3.7741
13	*Tylophoraindica (Asclepiadaceae)*	**AA**	6.7428	2.3862	13.2819	0.2265	0.3803	72.4958	0.0397	0.0826	0.0097	0.5273	1.5403	0.7607

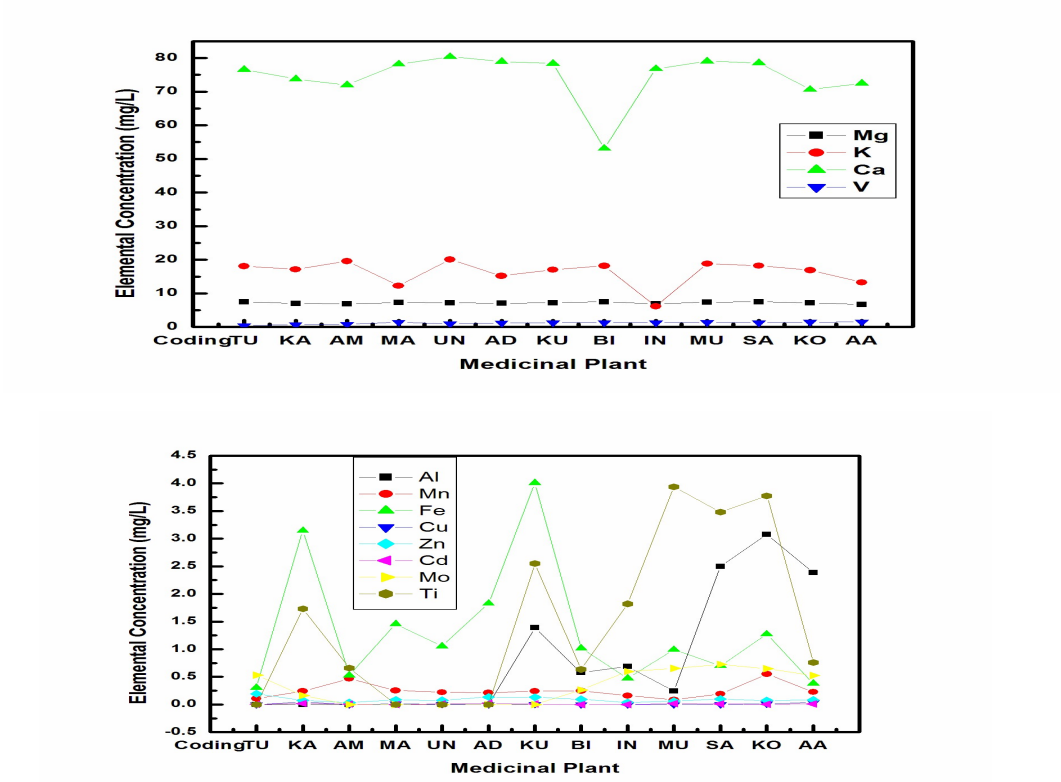

Fig. 1: Elemental concentration versus medicinal plants

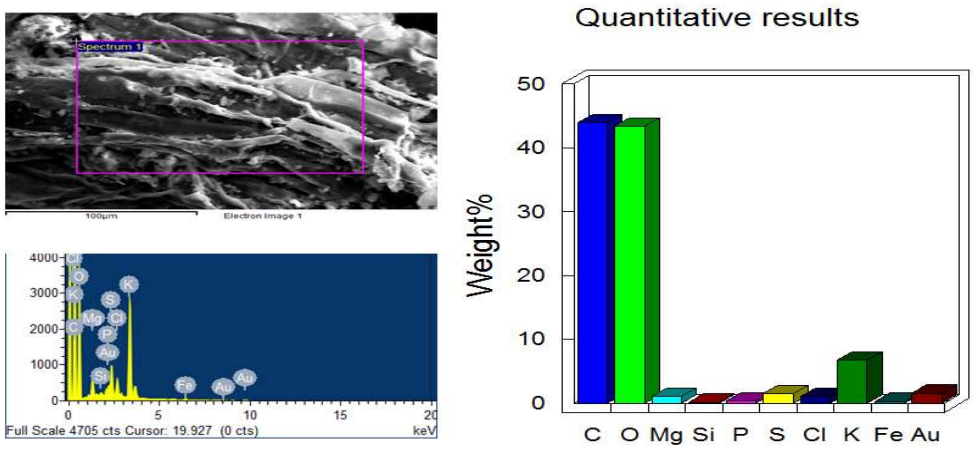

Fig. 2: SEM-EDX for Datura metal L. (Solanaceae)

CONCLUSIONS

The present study of an elemental analysis of the medicinal plant reveals the presence of various elements but the concentration of the elements are at different levels reflecting the impact of natural processes. This variation in elemental concentration in the medicinal plants is mainly attributed to the differences in botanical structure, mineral composition of the soil and the climatic conditions in which the plants grow. The data obtained from the study can be used to evaluate the potentiality of these plants and also in deciding the dosage of ayurvedic drug prepared from these plants in the treatment of various diseases.

REFERENCES

1. Lozak, A., Soltyk, K., Ostapczuk,P.,Fijalek, Z. Determination of selected trace elements in herbs and their infusions, The Science of the Total Environment, 2002 Apr 22;289(1-3):33-40.
2. World Health Organization, WHO Guidelines on Good Agricultural and Collection Practices (GACP) for Medicinal Plants, WHO Press, Geneva, Switzerland 2003.
3. World Health Organization, Monographs on Selected Medicinal Plants, Vol.1-3, WHO Press, Geneva, Switzerland 2007.
4. World Health Organization, Quality Control Methods for Medicinal Plant Materials, WHO Press, Geneva, Switzerland 1998.
5. World Health Organization, Traditional Medicine Growing Needs and Potential - WHO Policy Perspectives on Medicines, No. 002, May 2002
6. O P Raut, R Acharya, R Gupta, S K Mishra and R Sahoo et., Internatioinal Journal of Applied biliogy and pharmaceutical technology, Vol. 4, Issue - 1. A (2013)
7. Santoshkumar S Teerthe, Mohanraj Pattar, Sharanabasappa and B R Kerur, Elemental Contents in Ayurvedic Medicinal plants Using AAS Technique, JI. Of Instrum.Soc. of India, (2017),45(2), 110-112, 2015. ISSN: 0970-9983.
8. R. Subramanian P. Subbramaniyan and V.Raj, Determination of some minerals and trace elements in two tropical medicinal

plants, Asian Pacific Journal of Tropical Biomedicine (2012), S 555-S 558
9. R Subramanian, S Gayathri, C Rathnavel, V Raj, Analysis of mineral and heavy metals in some medicinal plants collected from local market, Asian Pacific Journal of Tropical Biomedicine(2012) 2 (1), S74-S78
10. Dushenkov V, Kumar PBAN, Motto H, Raskin I, Rhizofiltration: The Use of Plants to Remove Heavy Metals from Aqueous Streams, Environmental Science Technology (1995) Vol. No. 29, Pages 1239-1245.
11. Ramamurthy N and Kannan S. Romanian, SEM-EDS analysis of soil and plant (Calotropisgigantea Linn) collected from an Industrial village, Cuddalore Dt, Tamil Nadu, India, J Biophys 2009; 19(3): 219-226.
12. Santosh T, Mohanraj P, Sharanabasappa and B. R. Kerur, Accumulation of Elements in Homemade Herbal Medicinal plants, International Journal of Pure & Applied Physics. (2017)Vol. 13, No. 1, PP.50-53.
13. Ngugi P, Njagi J, Kibiti C, Maina D, Ngeranwa J, et al. (2012) Trace elements content of selected Kenyan anti-diabetic medicinal plants. Int J Curr Pharm Res 4: 39-42.
14. O'Connell B Select vitamins and minerals in the management of diabetes. Diabetes Spectra(2001) 14: 133-148.
15. Hunt, J.R. Bioavailability of Fe, Zn and other Trace Minerals for Vegetarian Diets. Am. J. Clin. Nutr. 1994,78: 633-39.
16. Thunus L, Lejeune R. Handbook on Metals in Clinical and Analytical Chemistry. Marcel Dekker, New York, 1994.
17. World Health Organization, Quality Control Methods for Medicinal Plant Materials, WHO Press, Geneva, Switzerland1998.
18. Ram Lokhande , Pravin Singare , MahadeoAndhale. Study on Mineral content of Some Ayurvedic Indian Medicinal Plants by Instrumental Neutron Activation Analysis and AAS Techniques. HEALTH SCIENCE JOURNAL, (2010), VOLUME 4, ISSUE 3.
19. David M. Greenberg, Salvatore P. Lucia, Myrtle A. Mackey and Elma V. Tufts. The magnesium content of the plasma and the red corpuscles in human blood. J. Biol. Chem. 1933, 100:139-148.

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