

Elemental Study by Dual Instruments

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Abstract

Nature is one of the biggest fundamental resources of all living and Non-living things and it contains so many types of Physical, Chemical and Biological materials in the form of Solid, Liquid, Gases and Plasma states. The elements are intermediate substances of medicinal plants and human body which play an important role in the treatment of different diseases. Hence it is necessary to study the essential elements in medicinal plants for maintaining the life processes in plants and/or animals including human beings. India is a rich country for the use of Ayurvedic medicinal plants treatment and also the Kalyan-Karnataka districts boost an unparallel diversity of medicinal plants. The present study attempts to estimate the level of elements in Ayurvedic medicinal plants. Here, total 09 green leafy vegetable Ayurvedic medicinal plants are taken namely *Anethum graveolens*, *Colocasia*, *Coriander Coriandrum sativum*, Curry Leaves, Fenugreek, Gongura, Mentha, Scallion plant and *Spinacia oleracea* from Bidar, Kalaburagi and Yadgir districts of Kalyan-Karnataka region, which are commonly used as home remedies. The solution samples were prepared for the analytical study of medicinal plants material. The total 11 elements like Mg, Al, K, Cr, Mn, Fe, Cu, Zn, As, Hg and Pb, are determined in different family Ayurvedic medicinal plants by Flame Atomic Absorption Spectrometer (FAAS) and Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES), useful for the quantitative analysis of materials.

Keywords: Ayurvedic medicinal plants, Kalyan- Karnataka, WHO Limits, Elements and Instruments.

Introduction

The term "medicinal plants" refers only to those plants that have therapeutic qualities that can be beneficial to health, produce appropriate medications and treat a variety of illnesses in living beings. Throughout the ages, people have relied on nature for their basic needs, for the production of food, shelter, clothing, transportation, fertilizers, flavors, fragrances and medicines (Cragg and Newman, 2005). Plants have formed the basis of sophisticated traditional medicine systems that have been in existence for thousands of years and continue to provide mankind with new remedies.

Materials And Methods

Ayurvedic Medicinal plants materials:

The selected Ayurvedic medicinal plants were collected from Bidar, Kalaburagi and Yadgir districts of Kalyan-Karnataka region. In the present study, nearly 1/2 kg of fresh leaves sample were collected from the selected medicinal plants of the respective places. In this present study, total 09 Ayurvedic medicinal plant leaves samples selected by the knowledge of folk practitioners and are shown in below table.

Table1. Details of Green Leafy Vegetable Ayurvedic medicinal plants

Code	Botanical Name	Common name	Part Collected
Ans1	Anethum graveolens	Sabasi pallya	Leaves
Coa2	Colocasia	Shavi pallya	Leaves
Ccm3	Coriander Coriandrum Sativum	Kotanmbari	Leaves
Cus4	Curry Leaves	Karibenva	Leaves
Fek5	Fenugreek	Methi	Leaves
Goa6	Gongura	Fundi pallya	Leaves
Mea7	Mentha	Pudina	Leaves
Sct8	Scallion plant	Hasi ullagaddi	Leaves
Spa9	Spinacia oleracea	Palak	Leaves

		
Anethum graveolens	Colocasia	Coriander Coriandrum sativum

		
Curry Leaves	Fenugreek	Gongura
		
Mentha	Scallion plant	Spinacia oleracea

Samples Preparation:

Powder Samples Preparation

In current research, almost 1/2kg of leaf samples that were gathered and washed with distilled water. In an airtight laboratory, cleaned samples were allowed to dry at ambient temperature for 20 days. Then leaves were ground mechanically using a mixer grinder and sheaved with mesh of dimension 355 μm to get fine powder and stored in airtight polythene plastic.

Solution Samples preparation

1. Flame Atomic Absorption Spectroscopy (FAAS)

The sample solution was prepared by adopting standard instrumental sample preparation procedure i.e 1gm of powder sample of Medicinal plants + 10ml of AR grade conc.- H_2SO_4 + 90ml of Double Distilled water

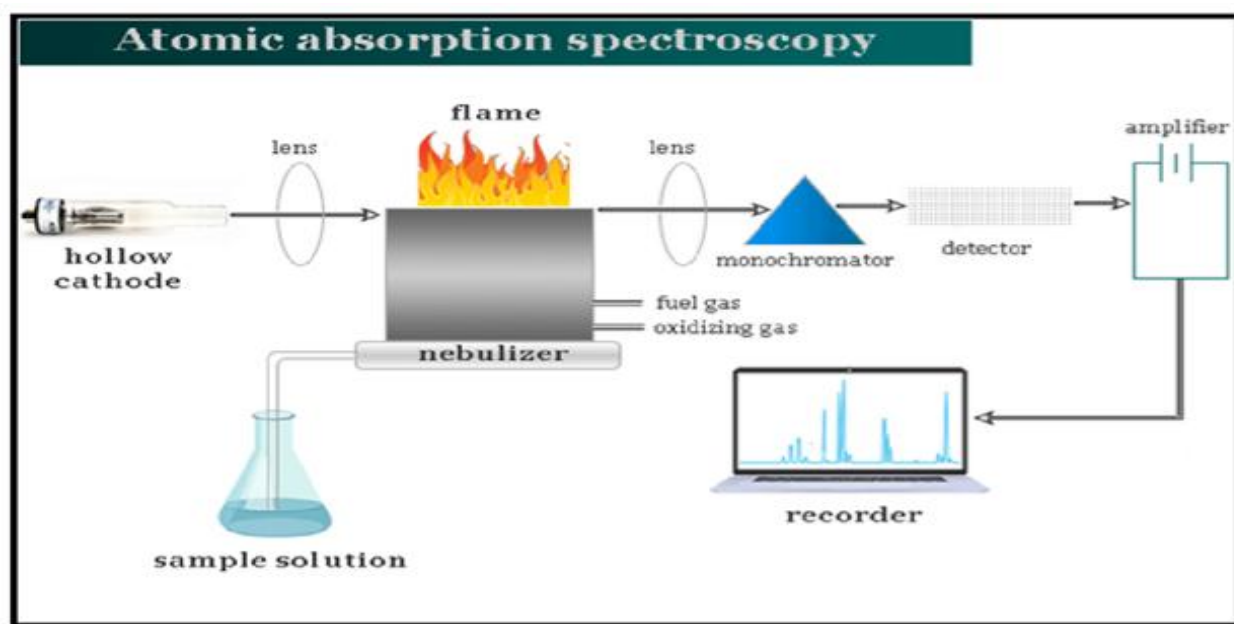
(1:10:90=100 ml) and finally 100 ml solution was subjected to the analysis of major, minor and trace elemental content.

2. Inductively coupled plasma optical emission spectrometry (ICP-OES)

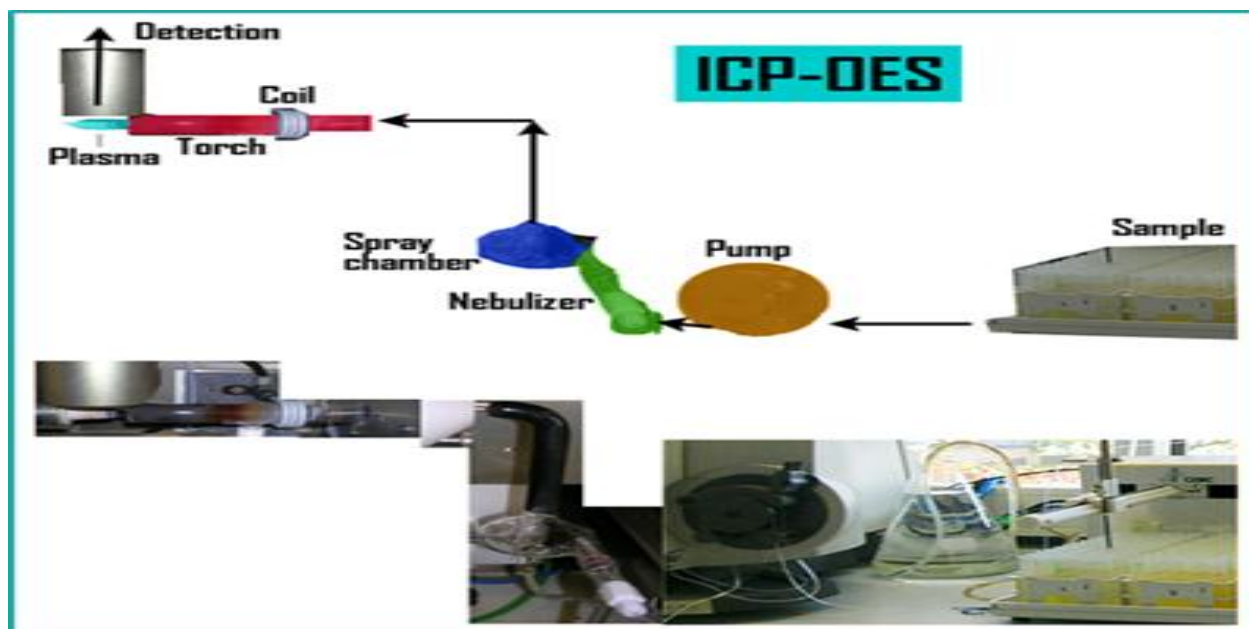
The sample solution was prepared by adopting standard instrumental sample preparation procedure i.e 0.1gm of powder sample of Medicinal plants + 5ml of AR grade Conc.-HCL + 45ml of Double Distilled water (0.1gm+5ml+45ml=50 ml) and finally 50 ml solution was subjected to the analysis of major, minor and trace elemental content..

Data Analysis:

The below figure shows schematic arrangement of **Flame Atomic Absorption spectrometry**, light of a specific wavelength is passed through the atomic vapor of an element of interest and measurement is made on the attenuation of intensity of light as a result of absorption. Atomic absorption measures the amount of light at the resonant wavelength which is absorbed as it passes through a cloud of atoms. By measuring the amount of light absorbed, a quantitative determination of the amount of element present can be made.



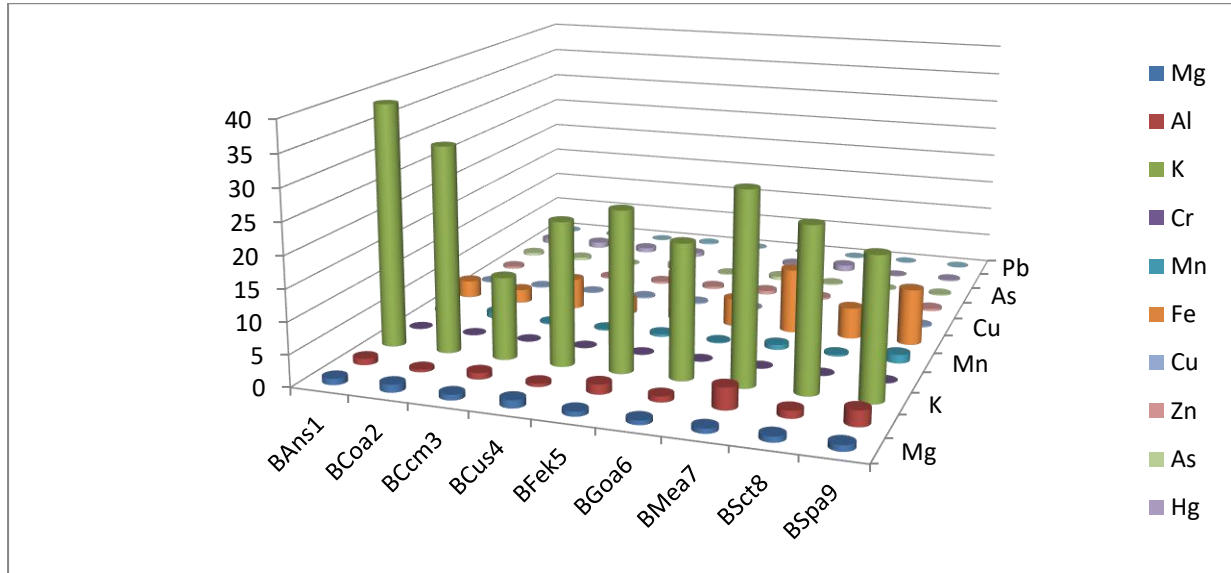
The below figure shows schematic arrangement of ICP-OES system. The instrumentation associated with an ICP-OES system is relatively simple. A portion of the photons emitted by the ICP is collected with a Lens or a concave mirror. This focusing optics forms an image of the ICP on the entrance aperture of a wavelength selection device such as a monochromator. The particular wavelength of light exiting the monochromator is converted to an electrical signal by a photodetector. The signal is amplified and processed by the detector electronics, then displayed and stored by a personal computer.



I.Elemental analysis of Drainage water green leafy Ayurvedic medicinal plants by FAAS

Table2. Essential elemental content in DRAINAGE WATER Leafy Vegetable Ayurvedic Medicinal plants (in ppm) from Bidar district FAAS

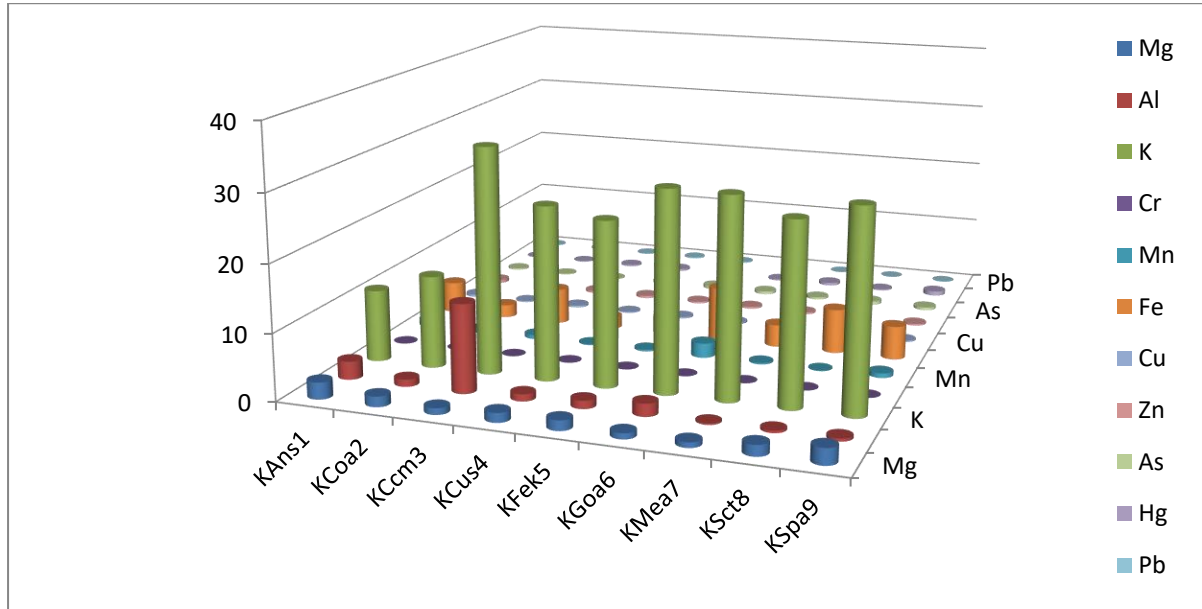
Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
BAns1	0.98	1.00	38.62	0.03	0.39	2.82	0.17	0.41	0.52	0.86	0.13
BCoa2	1.23	0.42	32.75	0.02	1.01	2.21	0.16	0.27	0.51	1.02	0.15
BCcm3	0.87	1.02	13.07	0.02	0.24	4.97	0.13	0.26	0.12	0.78	0.01
BCus4	1.25	0.52	22.66	0.01	0.23	2.46	0.23	0.39	0.98	0.68	0.20
BFek5	0.75	1.57	25.24	0.01	0.43	7.90	0.21	0.41	0.19	0.95	0.10
BGoa6	0.68	0.92	21.12	0.01	0.17	4.48	0.18	0.60	0.59	0.43	0.03
BMea7	0.75	3.44	29.97	0.01	0.80	10.33	0.22	0.36	0.22	1.05	0.02
BSct8	0.86	1.20	25.57	0.01	0.30	4.98	0.15	0.33	0.14	0.03	0.01
BSpa9	0.94	2.47	22.10	0.01	1.37	8.97	0.21	0.38	0.22	0.23	0.07



Bar graph of elemental variations in Bidar samples

Table3. Essential elemental content in DRAINAGE WATER Leafy Vegetables Ayurvedic Medicinal plants (in ppm) from Kalaburagi district FAAS

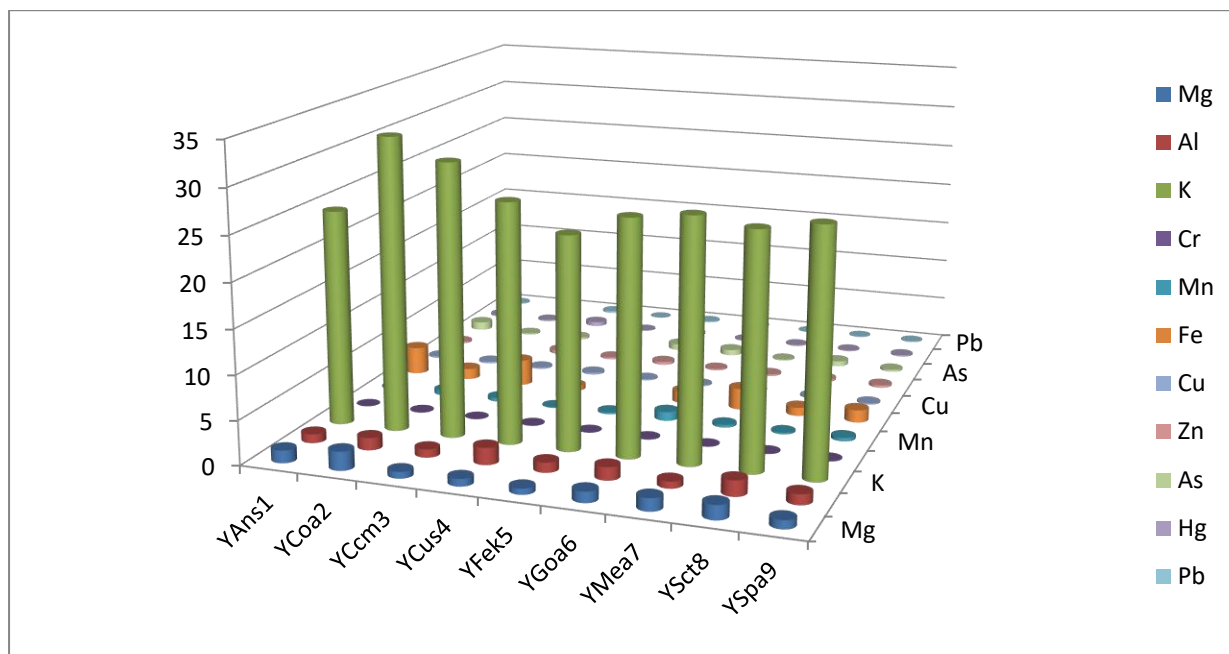
Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
KAns1	2.53	2.74	10.89	0.07	1.11	4.82	0.38	0.54	0.24	0.09	0.12
KCoa2	1.56	1.08	13.92	0.02	0.57	2.00	0.18	0.28	0.13	0.12	0.15
KCcm3	0.98	13.30	33.95	0.01	0.61	5.49	0.30	0.36	0.15	0.25	0.11
KCus4	1.43	1.06	26.04	0.03	0.16	1.85	0.16	0.39	0.34	0.34	0.16
KFek5	1.52	1.23	24.71	0.03	0.28	2.66	0.24	0.29	0.52	0.16	0.14
KGoa6	0.87	1.92	30.02	0.02	2.24	8.32	0.22	0.33	0.47	0.19	0.17
KMea7	0.78	0.23	29.88	0.04	0.24	3.42	0.21	0.30	0.35	0.45	0.02
KSct8	1.63	0.36	27.24	0.05	0.10	6.79	0.15	0.19	0.56	0.20	0.02
KSpa9	2.42	0.43	29.89	0.01	0.71	5.11	0.21	0.27	0.45	0.71	0.04



Bar graph of elemental variations in Kalaburagi samples

Table4. Essential elemental content in DRAINAGE WATER Leafy Vegetable Ayurvedic Medicinal plants (in ppm) from Yadgir district FAAS

Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
YAns1	1.42	1.01	24.44	0.01	0.15	3.18	0.19	0.23	0.98	0.25	0.15
YCoa2	2.13	1.40	33.16	0.06	0.55	1.25	0.21	0.28	0.16	0.17	0.17
YCcm3	0.75	0.92	30.84	0.01	0.41	3.00	0.17	0.43	0.28	0.52	0.23
YCus4	0.85	1.94	27.03	0.05	0.07	0.55	0.22	0.24	0.63	0.09	0.01
YFek5	0.67	1.12	23.99	0.02	0.21	2.02	0.14	0.36	0.72	0.23	0.15
YGoa6	1.23	1.48	26.42	0.06	1.03	1.36	0.14	0.18	0.67	0.10	0.12
YMea7	1.43	0.77	27.19	0.04	0.31	2.46	0.15	0.21	0.14	0.13	0.04
YSct8	1.62	1.77	26.29	0.06	0.19	0.96	0.17	0.32	0.62	0.12	0.08
YSpa9	0.95	1.17	27.32	0.06	0.40	1.44	0.15	0.30	0.25	0.18	0.11



Bar graph of elemental variations in Yadgir samples

The above tables and graphs show the trend of major, minor, trace and toxic elemental concentrations which were examined by a Flame Atomic Absorption Spectrometer.

II. Elemental analysis of Drainage water green leafy Ayurvedic medicinal plants by ICP-OES

Table 5. Essential elemental content in Drainage water Leafy Vegetable Ayurvedic Medicinal plants (in ppm) from Bidar district by ICP-OES

Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
BAns1	6.98	0.52	70.20	0.14	0.25	2.44	0.07	0.12	0.01	0.02	0.02
BCoa2	5.70	0.29	69.01	0.10	0.35	1.78	0.05	0.07	0.02	0.03	0.01
BCcm3	5.26	0.52	53.21	0.13	0.23	1.53	0.06	0.09	0.01	0.03	0.02
BCus4	12.29	0.23	58.47	0.01	0.15	0.86	0.04	0.11	0.01	0.01	0.03
BFek5	5.11	0.53	37.11	0.01	0.20	1.69	0.03	0.07	0.02	0.02	0.01
BGoa6	7.10	0.43	62.13	0.03	0.16	1.43	0.05	0.06	0.01	0.01	0.02
BMea7	6.83	0.66	85.34	0.01	0.34	2.10	0.04	0.07	0.01	0.03	0.03
BSct8	6.79	0.73	34.19	0.04	0.56	2.13	0.03	0.07	0.02	0.02	0.01
BSpa9	8.57	0.43	50.96	0.02	0.15	1.12	0.02	0.06	0.01	0.01	0.02

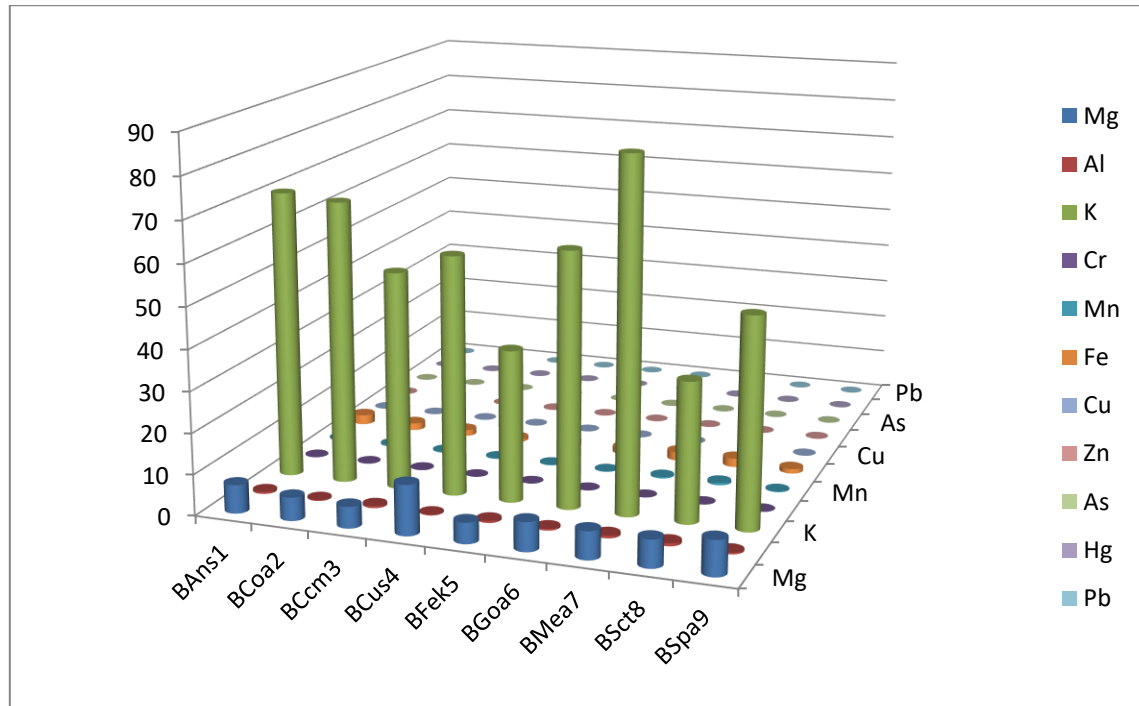
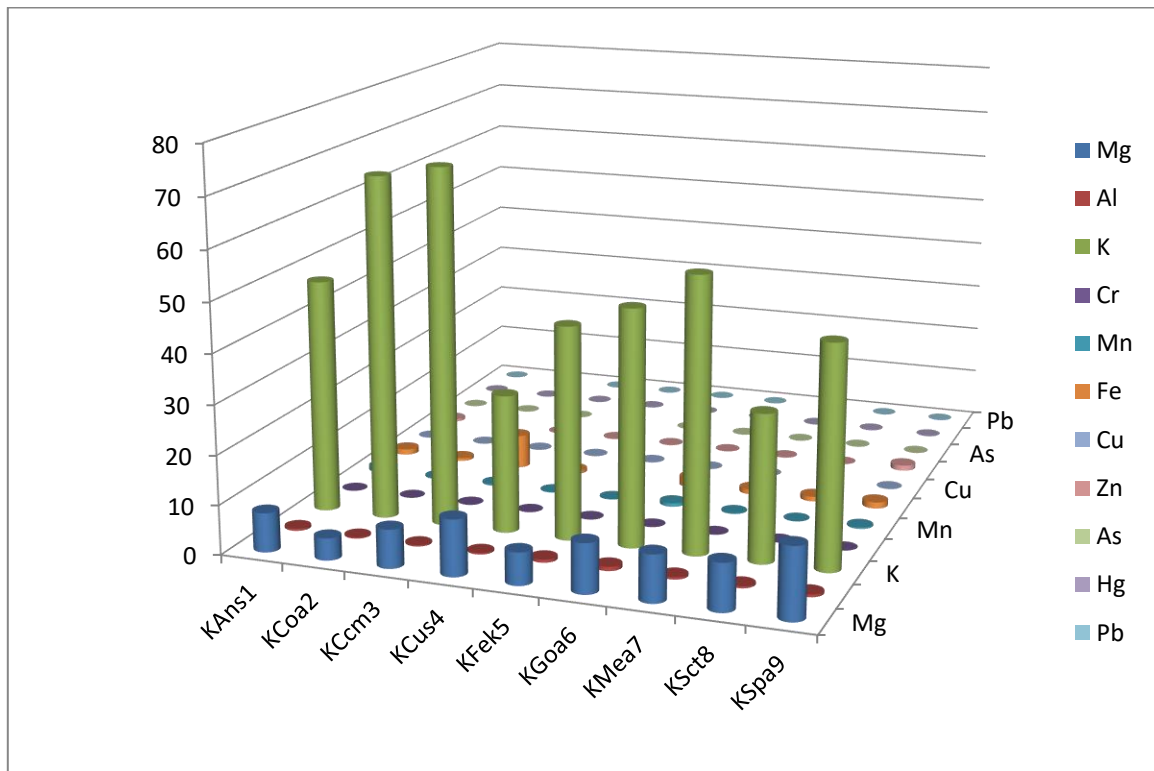


Figure: 26 Bar graph of elemental variations in Bidar samples

Table 6. Essential elemental content in Drainage water Leafy Vegetable Ayurvedic Medicinal plants (in ppm) from Kalaburagi district by ICP-OES

Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
KAns1	7.95	0.46	47.49	0.05	1.03	1.17	0.06	0.55	0.01	0.04	0.02
KCoa2	4.46	0.24	69.63	0.01	0.24	0.60	0.02	0.06	0.02	0.03	0.01
KCcm3	7.82	0.26	72.27	0.02	0.29	6.99	0.04	0.07	0.03	0.02	0.03
KCus4	11.43	0.31	27.99	0.01	0.11	0.75	0.02	0.09	0.01	0.04	0.02
KFek5	6.58	0.62	43.12	0.03	0.13	0.98	0.08	0.07	0.03	0.03	0.04
KGoa6	10.04	0.83	47.82	0.01	0.72	1.92	0.03	0.06	0.02	0.02	0.03
KMea7	9.51	0.47	55.41	0.02	0.16	1.01	0.04	0.08	0.01	0.01	0.02
KSct8	9.59	0.39	29.85	0.01	0.07	0.98	0.02	0.05	0.03	0.03	0.01
KSpa9	14.41	0.53	44.80	0.01	0.32	1.30	0.04	1.12	0.02	0.02	0.02

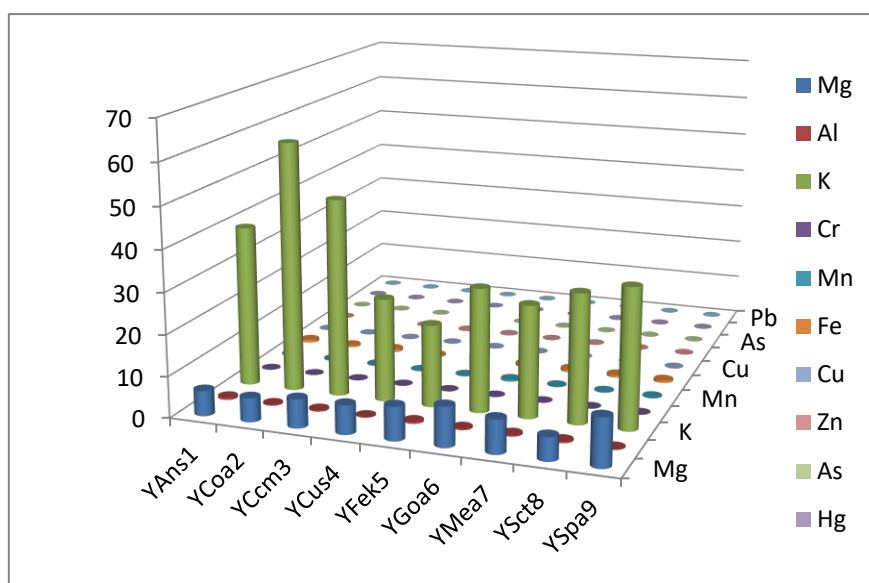


Bar graph of elemental variations in Kalaburagi samples

Table 7. Essential elemental content in Drainage water Leafy Vegetable Ayurvedic Medicinal plants (in ppm) from Yadgir district by ICP-OES

Code No.	Mg	Al	K	Cr	Mn	Fe	Cu	Zn	As	Hg	Pb
YAns1	6.10	0.52	39.12	0.03	0.13	0.65	0.03	0.08	0.01	0.02	0.02
YCoa2	5.77	0.27	60.53	0.01	0.25	0.46	0.04	0.21	0.03	0.04	0.03
YCcm3	6.98	0.32	47.83	0.02	0.20	0.74	0.02	0.15	0.02	0.02	0.02
YCus4	7.04	0.16	25.01	0.01	0.07	0.31	0.04	0.10	0.01	0.01	0.03
YFek5	8.16	0.45	19.93	0.01	0.14	0.87	0.05	0.15	0.02	0.02	0.01
YGoa6	9.64	0.31	29.97	0.01	0.42	0.60	0.04	0.06	0.03	0.03	0.02
YMea7	8.18	0.39	27.14	0.01	0.17	0.69	0.03	0.10	0.01	0.03	0.03

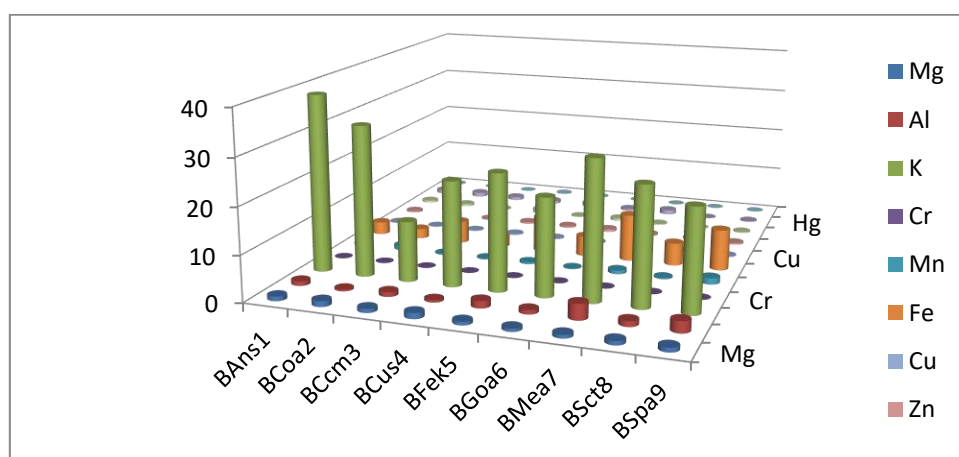
YSct8	5.67	0.36	31.23	0.02	0.16	0.58	0.03	0.09	0.02	0.03	0.01
YSpa9	11.68	0.20	33.83	0.01	0.20	0.59	0.02	0.07	0.02	0.04	0.03



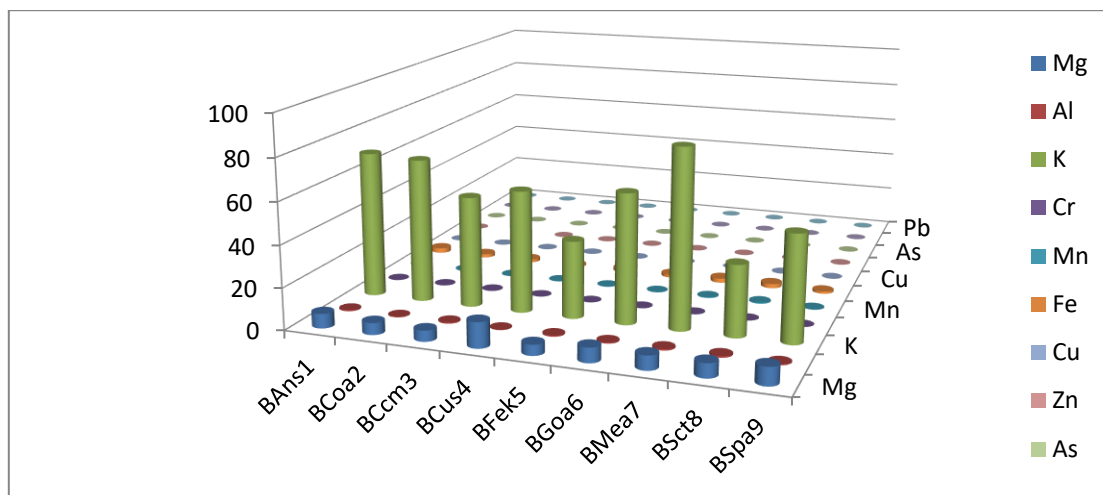
Bar graph of elemental variations in Yadgir samples

Instrumental comparison

a. Bidar Drainage Water samples

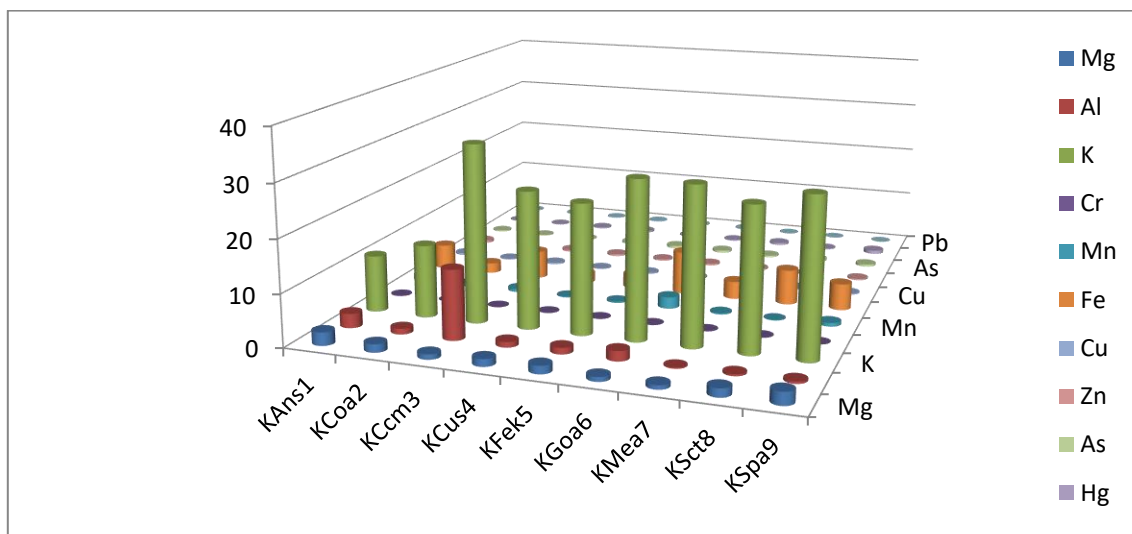


Bar graph of elemental variations in Bidar Drainage Water samples by FAAS

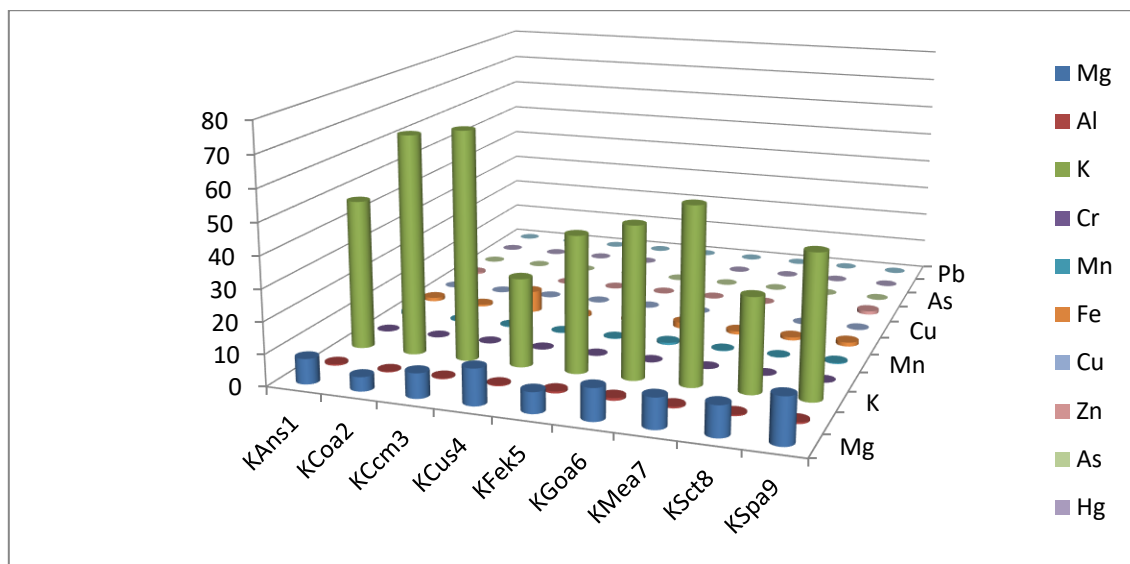


Bar graph of elemental variations in Bidar Drainage Water samples by ICP-OES

b. Kalaburagi Drainage Water samples

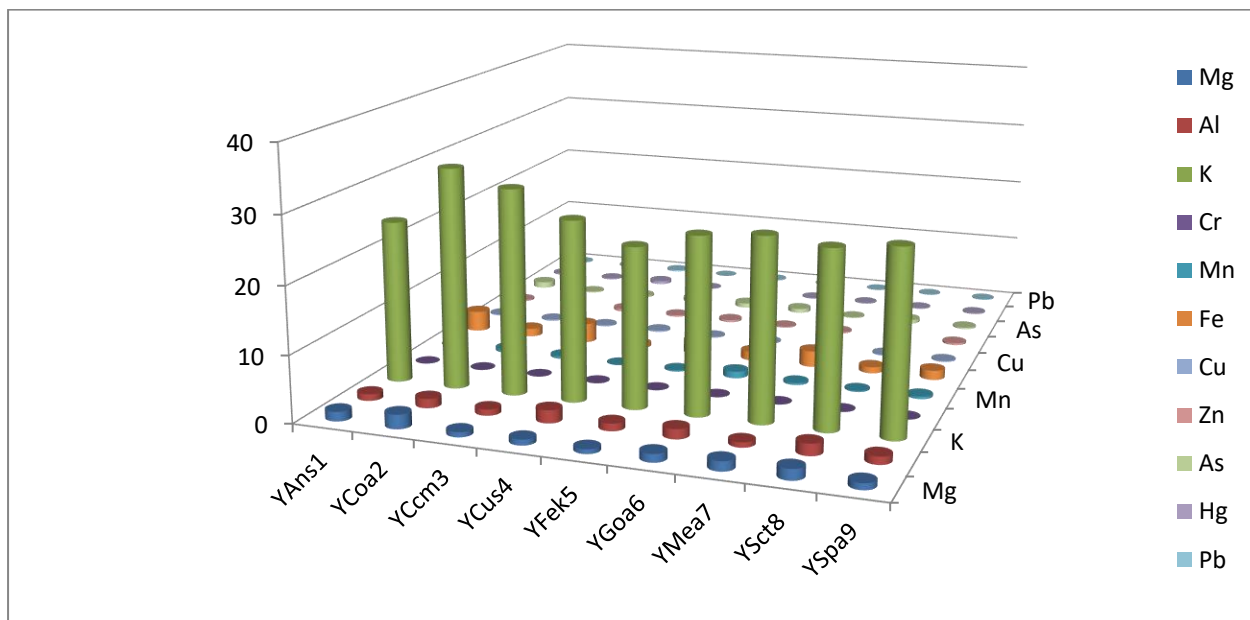


Bar graph of elemental variations in Kalaburagi Drainage Water samples by FAAS

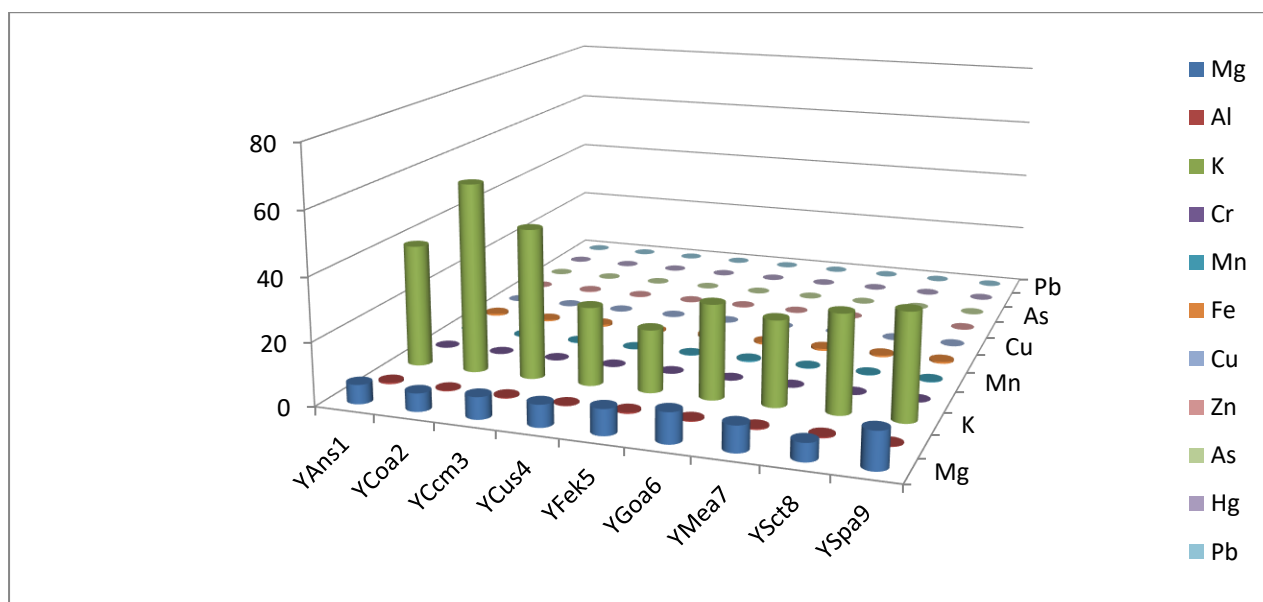


Bar graph of elemental variations in Kalaburagi Drainage Water samples by ICP-OES

c.Yadgir Drainage Water samples



Bar graph of elemental variations in Yadgir Drainage Water samples by FAAS



Bar graph of elemental variations in Yadgir Drainage Water samples by ICP-OES

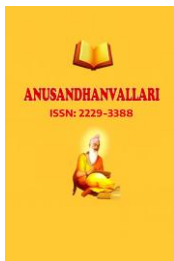
The above tables gives the detailed information regarding Eleven elemental concentrations of Nine leafy Ayurvedic vegetable medicinal plants which are collected from drainage water from Bidar, Kalaburagi and Yadgir districts respectively. The maximum abundance of Potassium (K) content is varied orderly in Bidar> Kalaburagi> Yadgir medicinal plants and second maximum abundance of Magnesium (Mg) content is varied in Kalaburagi > Bidar > Yadgir medicinal plants also third abundance of Iron (Fe) is varied in Bidar> Kalaburagi> Yadgir medicinal plants. The remaining Cr, Cu, Zn, As, Hg and Pb elemental content varied under permissible limits of WHO in all Nine leafy Ayurvedic vegetable medicinal plants.

Results And Discussion

The present work is carried out successfully on different Ayurvedic medicinal plants of Bidar, Kalaburagi and Yadgir districts of Kalyan-Karnataka *region*. All detected elements are classified as major element Magnesium (Mg), micro or trace elements viz. Manganese (Mn), Iron (Fe), Copper (Cu) and Zinc (Zn) elements, toxic elements Arsenic (As) and Lead (Pb) respectively. The resulting variations of elemental content found to be within the permissible limits of WHO/FAO, national and international board of medicinal plants. In the present study Ayurvedic medicinal plant leaf samples contain essential mineral elements and nutrients at an acceptable level; further it helps to study the phytochemical analysis. Similarly, the present studied medicinal plants contain high metabolic activity and biological process of human and medicinal plants.

Conclusion

Total 09 different Ayurvedic medicinal plants collected and examined by using high efficient fluorescence methods such as FAAS instrument and and ICP-OES. The present investigation provides information on the elemental concentrations, maximum abundance of Potassium (K) content is varied orderly manner in Bidar>



Kalaburagi> Yadgir medicinal plants and second maximum abundance of Magnesium (Mg) content is varied in Kalaburagi > Bidar > Yadgir medicinal plants. The third abundance of Iron (Fe) is varied as Bidar> Kalaburagi> Yadgir medicinal plants. The remaining Cr, Cu, Zn, As, Hg and Pb elemental content varied under permissible limits of WHO in all nine leafy Ayurvedic vegetable medicinal plants. The present study revealed the variations of elemental content from plant to plant.

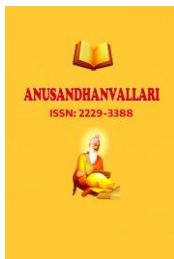
Moreover, the present analysis represents that all detected elements are shown within the permissible limits of WHO/FAO and some other standard permissible limits of medicinal plants. Present studied data is useful to the new researchers, medicinal practitioners to prepare new health drugs and promote the society. Elements with vitamins A, C, D and E improves the secondary metabolites of the medicinal plants and the human body, also helps to study the phytochemical compounds, which have some antimicrobial properties. The present analysis reveals that the surface morphology with grain size associated element will play an important role in mediating the diseases at the earliest. Accumulation of toxic elements will exceed the daily intake level and causes kidney damage, liver damage, skin cancer, neurotoxicity etc, of the human body. Symptoms are dryness of the mouth, difficulty in swallowing, nerve pain, vomiting, nausea, stomach pain and diarrhea.

This information may be helpful in the synthesis of new Ayurveda medicine drugs which can be used for the control of various diseases, also makes the body physiologically stronger against multi-drug resistance human pathogen. The profile of elements mainly depends on the geographical reproduction of water, soil and Physiological changes of environment.

The Results by FAAS and ICP-OES were comparable; however sensitivity of ICP-OES was significantly higher than that of FAAS.

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