Research Article

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# ELEMENTAL ANALYSIS OF MEDICINAL PLANTS FROM NORTH KARNATAKA REGION BY AAS METHOD

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Received on: 21/04/17 Accepted on: 13/06/17

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**DOI: 10.7897/2277-4343.083153**

**ABSTRACT**

In the present investigation, the elemental concentrations in the herbal medicinal plants of different families were carried out viz., i.e *Vitex negundo*, *Punica granatum* etc, which were collected from North-Karnataka region of Yadgir district. Standard procedures were adopted for samples preparations to analyze the elemental percentage by Atomic absorption spectrometer method. In the present investigation the Calcium Concentration is highest among all medicinal plants and also the elements like Mg, Al, K, Ca, Cr, Mn, Fe, Cu, and Zn, were found in various concentrations, similarly the abundance of Si, Ti, V, Mo, and Cd were found in very low proportions as compared to the calibration graph of concentration absorptions. The data obtained from the study can be used to evaluate the potentiality of these plants in their used for herbal therapies. These elements are very necessary to build healthy bones and teeth, activates of enzymes and cells of human body.

**Keyword:** Herbal medicinal plants, Minerals and Trace elements, AAS techniques

## INTRODUCTION

The first Indian herbal medicinal plants therapies were found in 1200 BCE. As the report of WHO[1] nearly 75 to 80% population using the traditional herbal medicine for primary health care because of better cultural acceptability, better compatibility with the human body and lesser side effects. Herbal medicine is the oldest form of health care of peoples and also herbal medicinal plants used as Primary health care since there easy of accessibility nearby the home or gardens etc. and without paying any money for the purchase which grows on the sides of the cultured area. People use to help to the unhealthy people by taking them to grounds or the nati vaidya houses where in the nati vaidya expert is to apply the medicinal plants by rubbing, grinding, mixing in a systematic way and ask the patient to drink along with water/goat milk in the early morning or apply the medicine to the wounded area. Hence nati Vaidya do not know the systematic study of medicinal plants regarding its growth/soil importance/ preparations of medicine/ percentage of mixing of medicinal plants etc since it has been a practice from their elders of the house families[2,3]. This has been continuous practice in India for long time even centuries together but, still systematic study has not been carried out. Until recently uses, growth of medicinal plants and applicability have been increasing tremendously because of easy accessibility and highly economical in all respects hence its uses have been increasing tremendously over the years. As mentioned in the Ayurveda books, medicinal plants can be used to cure all the deceases including cancer/HIV/body pain/chronic deceases/malfunctioning of the organs/ stones in kidney and gallbladder etc. without any operations. Indian herbal medicinal plants /Ayurvedic medicinal plants are plants using in Ayurveda mainly for medicinal purposes [4,5]. They are back bone of Ayurveda. Charaka, Susrutha & Vagbatta are main classical text on Ayurveda, where uses, treatment & properties of medicinal plants are described in detail. The abundance of major and minor/trace elements absorbed in the plants may be studied by measuring quantities of chemical elements present in the herbal medicinal plants using Atomic Absorption Spectrometry (AAS) method. In this method atoms absorb ultraviolet or visible light and make transitions to higher energy levels. Atomic absorption method measures the amount of energy in the form of photons of light that are absorbed by the sample. A detector measures the wavelengths of light transmitted through the sample, and compares them to the wavelengths which originally passed through the sample. A signal processor then integrates the changes in wavelength absorbed, which appear in the readout as peaks of energy absorption at discrete wavelengths. In the present study 14 families herbal medicinal plant samples selected from Yadgir district which is located in North-East Karnataka region.

## MATERIALS AND METHODS

### Plant Material

The 14 different families' herbal samples were collected viz., *Vitex negundo*, *Punica granatum*, *Eucalyptus Obliqua*, *Vincarosea* etc, from some selected places of Yadgir district. The details of the collected samples are mentioned in the Table 1. Yadgir district lies in the northern part of Karnataka between 16º11' – 16º50'N latitudes and 76º17' - 77º28' E longitudes, which covers a geographical area of 5234.4 Sq.Km[6]. The district is bounded by Gulbarga district in the north, Bijapur district in west, Raichur district in south and Andhra Pradesh in the east, respectively (Figure 1). The vast stretch of fertile black soil of the district is known for crop growth of red gram and jawar. The district is a "Daal bowl" of the state. The district is also known for cluster of cement industries and a distinct stone popularly known as Malakheda Stone. Two main rivers, Krishna and Bhima, and a few tributaries flow in this region. A host of industries are running at present viz., cement, textile, leather, granite and gypsum. Associated with green vegetation, because of the rivers Krishna and Bheema are flowing in the district area, sugar factories are coming up now a days. Further,

According to the geographical study, Yadgir district has rich of Minerals which are important to the nation growth at the international level one is radioactive elements present in the granites and heavy elemental contents are found in higher concentration. According to the Indian scientific researchers a 2nd grade Uranium is available in higher percentage at Yadgir district Gogi Village, the below figures show the Yadgir district maps.

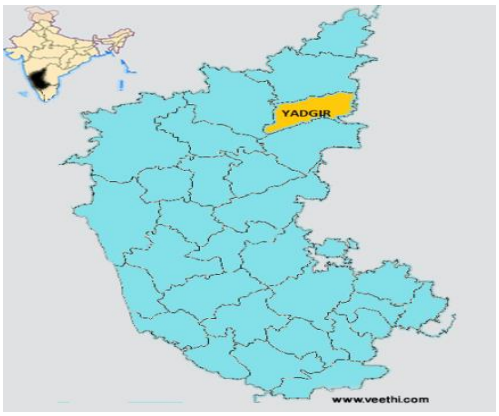



**Figure 1: Map of Yadgir in Karnataka**


**Figure 2: Yadgir districts map**

**Table 1: Details of Herbal medicinal plants collected from Yadgir District**

| S N | Botanical name | Family | Common name | Part Collected | Medicinal Uses |
|---|---|---|---|---|---|
| 01 | *Vertex negundo* | *Lamiaceae* | *Five leaved chaste tree* | Leaves | Ayurvedic, Folk, |
| 02 | *Punica granatum* | *Lythraceae* | *Pomegranate* | Leaves | The roots, leaves, flowers, rind, seeds and the reddish brown bark are used. |
| 03 | *Eucalyptus obliqua* | *Myrtaceae* | *Brown top* | Leaves | Arterial Vasodilator. Asthma |
| 04 | *Catharanthus roseus* | *Apocynaceae* | *Madagascar periwinkle,* | Leaves | Muscle pain, depression of central nervous system and wasps stings. |
| 05 | *Caltrop's gigantea* | *Apocynaceae* | *Milkweeds* | Leaves | Fever, Remedy for poisonous snake bites, Intestinal Worms |
| 06 | *Plumeria rubra* | *Apocynaceae* | *Temple Flower* | Leaves | Anti-inflammatory, Wound healing etc. |
| 07 | *Nerium indicum* | *Apocynaceae* | *Oleander* | Leaves | The leaves and flowers are cardiac tonic (tonic effect on the heart), |
| 08 | *Hibiscus rosa sinuses* | *Malvaceae* | *Red Hibiscus* | Leaves | Treatment of eczema and allergic problems, hair fall control etc. |
| 09 | *Mangifera indica* | *Anacardiaceous* | *Anacardiaceous* | Leaves | Health Promoting Effects Anti Cancer Effect |
| 10 | *Guava* | *Myrtaceae* | *Peru* | Leaves | Guava leaves and bark are used traditionally as a disinfectant antiseptic for dressing wounds and sores. |
| 11 | *Caesalpinia bonduc* | *Caesalpiniaceous* | *Gray Necker* | Leaves | As an infusion they are used for curing cerebral hemorrhages and infantile convulsions |
| 12 | *Ricinus communis* | *Euphorbiaceous* | *Castor oil plant* | Leaves | Are used in ophthalmic surgery. It is used eye drop. |
| 13 | *Lantana camara* | *Verbenaceae* | *Shrub Verbenas* | Leaves | Headaches, Fever, Flu, Colds. |
| 14 | *Citrus limon* | *Rutaceae* | *limon* | leaves | Headaches, Fever, Flu, Colds |

The collected plants parts were washed with distilled water and removed the moisture using oven at 100 $^0$C to 110 $^0$C temperatures for 30 min. The leaves and root parts of all plants made dried under shade, the dried leaves and roots of the plants were mechanically powdered using ball mill and mixture, finally sieved using meshes to get a fine power and then stored in an airtight container for analysis of the sample using different techniques.

**Sample Preparation**

The selected medicinal plant 10 gm powder sample was kept in a dried crucible, in turn which was kept in a hot oven at 250 $^0$C for 2 hours to remove the moisture content and to get a good fine powder of the sample. The material was allowed to incinerate till it became white indicating the absence of carbon, crucible was allowed to cool completely by keeping it in desiccators. The sample solution was prepared by adopting standard procedures: One gram measured medicinal plant ash sample was filled into 1:25:25=50 ratios conc.-HCL + Distilled water solution, and added 950 ml of distilled water (950+50=1000 ppm). For the analysis purposes 100 ml solution taken from 1000 ppm, for major, minor and trace elemental analysis like Mg, Al, Si, K, Ca, Ti, V, Cr, Mn, Fe, Cu, Zn, Mo, and Cd. This procedure is continued for all samples for elemental analysis.

**Instrumentation**

The Instrument used is shown in Figure 3 is a Thermo Scientific iCE 3000 Series Atomic Absorption Spectrometer different from any other atomic absorption instrument.

**Figure 3: iCE3000 series AAS**

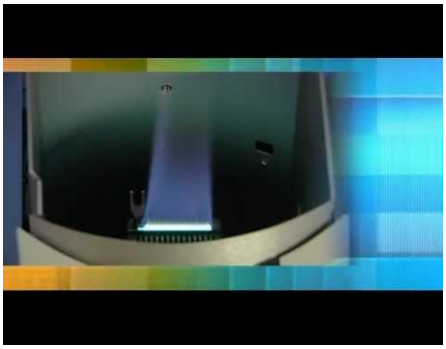


**Figure 4: Flame Optimization**

All iCE 3000 Series spectrometers are completely automatic for identification of all elementals. It is computer controlled via data station running through SOLAAR software under a Windows® operating system. Flame absorption/emission systems can be extended to graphite furnace and vapor modes by the use of the appropriate accessories. In the present work the AAS spectrometer utilizes $C_2H_2$ and $N_2OC_2H_2$ flames. When a sample solution is aspirated into a flame then sample element is changed into atomic vapor of that element, Flame contains atoms of element. The ground state atoms then absorb the radiation of specific wavelength produced by source i.e. hollow cathode lamp of that specific metal. Now, the wavelength of radiation given off by the source or lamp is similar as that of absorbed by the atoms in the flame. AAS method follows the Beer's law, which states that absorbance is directly proportional to concentration and each atomic absorption spectrophotometer possesses a light source i.e. lamp, sample cell, monochromatic, detector and output device then a signal processor integrates the changes in wavelength absorbed, which appear in the readout as peaks of energy absorption at discrete wavelengths [7,8].

## RESULT AND DISCUSSION

In this present work 14 different families of herbal medicines selected for the major, minor and trace elemental concentration studies such as Mg, Al, K, Ca, Cr, Mn, Fe, Cu, Zn, Si, Ti, V, Mo, and Cd. It is true that the variation in elemental concentration is mainly depends on botanical structure, as well as the mineral composition of the soil, in which plants are cultivated, and also other factors such as use of fertilizers, water irrigation and geological conditions of the area. The observed elemental concentration in the spectrum and estimated through the AAS method for 14 different families' herbal medicinal plants in the selected parts of the medicinal plants are presented in Table 2.

**Table 2: Elemental content in herbal medicinal plants (in mg/L) collected from Yadgir**

| Sample name | Coding | Mg | Al | K | Ca | Cr | Mn | Fe | Cu | Zn |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Major elements | | | | Minor/Trace elements | | | | |
| *Vitex negundo* | Y01 | 6.388 | 0.947 | 7.166 | 12.63 | 0.087 | 0.126 | 0.762 | 0.052 | 0.1037 |
| *Eucalyptus obliqua* | Y03 | 6.102 | 7.912 | 6.575 | 12.71 | 0.090 | 0.569 | 0.413 | 0.182 | 0.0894 |
| *Punica granatum* | Y02 | 6.543 | 2.501 | 7.234 | 12.78 | 0.084 | 0.150 | 1.668 | 0.026 | 0.0682 |
| *Guava* | Y10 | 6.601 | 1.217 | 6.889 | 13.26 | 0.094 | 0.171 | 0.668 | 0.036 | 0.0658 |
| *Citrus limon* | Y14 | 6.230 | 1.306 | 7.309 | 13.50 | 0.104 | 0.074 | 0.807 | 0.193 | 0.0593 |
| *Hibiscus rosa sinensis* | Y06 | 7.059 | 2.899 | 8.168 | 13.89 | 0.098 | 0.356 | 2.666 | 0.351 | 0.1519 |
| *Caesalpinia bonduc* | Y11 | 6.745 | 5.880 | 7.044 | 13.91 | 0.099 | 0.185 | 1.879 | 0.046 | 0.1311 |
| *Lantana camara* | Y13 | 6.872 | 2.258 | 6.889 | 14.50 | 0.097 | 0.370 | 1.474 | 0.0237 | 0.0896 |
| *Ricinus communis* | Y12 | 6.587 | 1.648 | 7.275 | 14.54 | 0.099 | 0.336 | 1.405 | 0.0124 | 0.1565 |
| *Mangifera indica* | Y09 | 6.593 | 0.889 | 6.293 | 14.54 | 0.092 | 0.615 | 0.353 | 0.0388 | 0.0635 |
| *Calotropis gigantea* | Y05 | 6.958 | 2.843 | 7.952 | 14.67 | 0.102 | 0.540 | 2.740 | 0.2206 | 0.1345 |
| *Vinca rosea* | Y04 | 7.126 | 3.047 | 7.262 | 14.73 | 0.088 | 0.689 | 2.153 | 0.0166 | 0.1180 |
| *Nerium indicum* | Y08 | 7.064 | 2.167 | 6.760 | 15.17 | 0.092 | 0.625 | 1.787 | 0.0717 | 0.0818 |
| *Plumeria rubra* | Y07 | 7.069 | 1.179 | 7.460 | 15.18 | 0.089 | 0.246 | 0.883 | 0.0095 | 0.1175 |

In Table 2, the first column gives botanical name of the plant; second column gives the coding of the sample, from 3rd to 11th columns give different elemental concentrations expressed in mg/L (PPM). An examination of the data from Table 2 indicates the abundant of major elements such as Calcium, Potassium, Manganese, Aluminum and minor elements such as Iron and Zinc content is found to be decreasing in order and the trace elements concentration like Manganese, Copper and Chromium found to be constant in the present investigation. The other elements such as Si, Ti, V, Mo, and Cd did not trace in the analysis. The above said concentrations are nearly equal concentration in all plants except few samples. In some cases like major element concentration is found to be more than the calibration concentration which is shown bar diagram and graphically form.

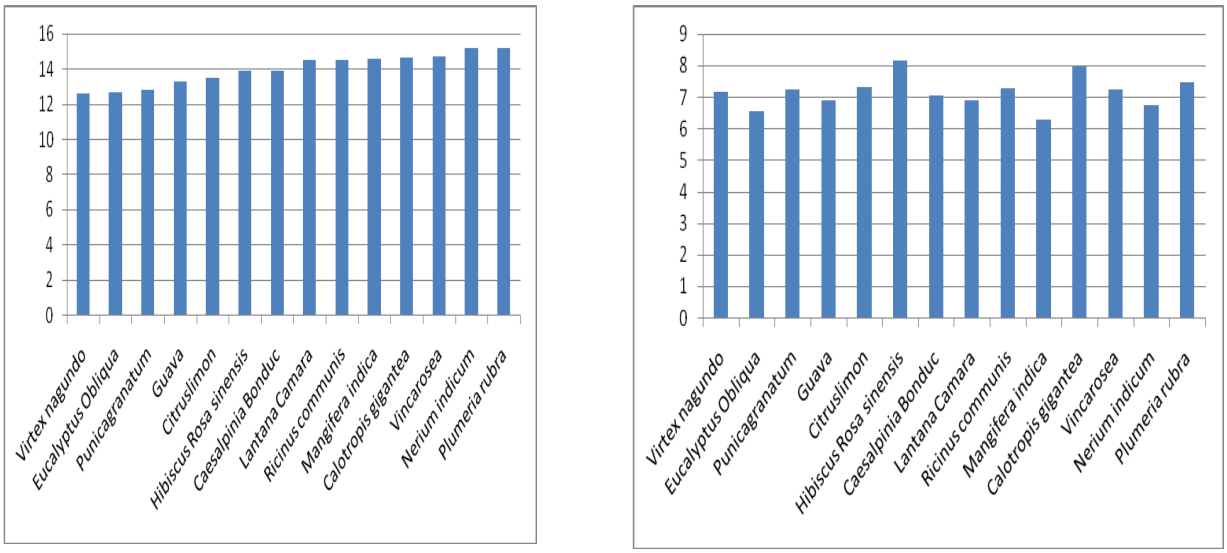



**Figure 5: Calcium and Potassium Concentration in Medical plants**

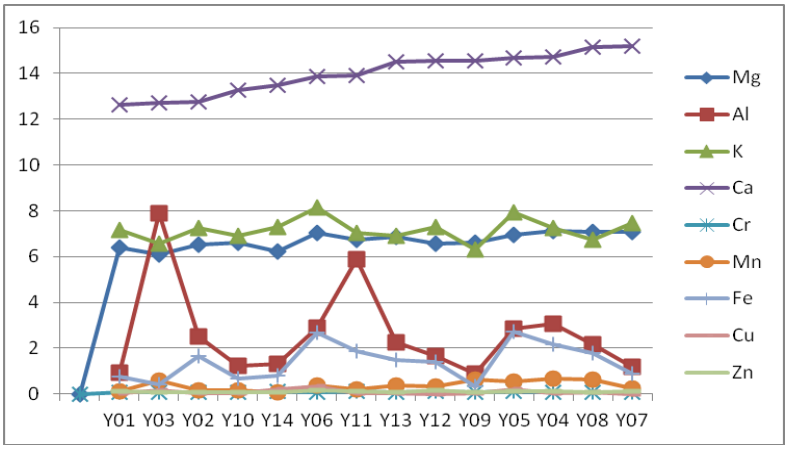
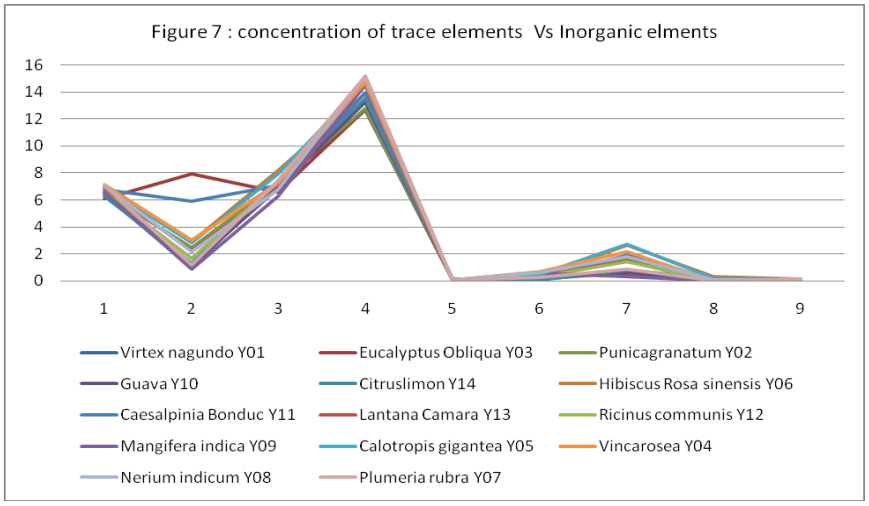



**Figure 6: Samples code Vs Concentrations of Herbal medicinal plants**



The variations of elemental concentration in all herbal medicinal plants are shown in Figures 5 and 6 respectively. From both the Figures it is classified into four groups. One group is Calcium alone, whose elemental concentration is highest in all the medicinal plants. Second group consists of elements like Magnesium and Potassium both the elemental concentration is more are less same are the second highest elemental concentration in the present investigation. The third group consists of Iron and Aluminum wherein the elemental concentration shows same variation trend seems to be more or less in the same path for both these elements. The last group consisting of zinc, copper, chromium shows more or less same concentrations in all the medicinal plant samples. It found that the calcium concentration increased so also Magnesium as well as Potassium increases proportionately as shown in the Figure 5.

The above figure 7 determining the maximum and minimum abundance of trace elements in all examined herbal medicinal plants with inorganic elements. The present research assessment given that the average elemental concentrations higher in four medicinal plants likes *Punica granatum*, *Eucalyptus Obliqua* , *Vincarosa*, *Calotropics gigantea*, which are very necessary to human health.

## CONCLUSION

Atomic absorption spectrometer (AAS) has proved to be a versatile tool to analyze biological materials like herbal medicinal plants. The data obtained from the study can be used to evaluate the potentiality of these plants in their used for Ayurvedic drugs with various combinations of plants. The data obtained in the present work will be helpful in the synthesis of new Ayurvedic drugs which can be used for the control and cure of various diseases. However, in order to develop a stronger basis for appreciating the curative effects of medicinal plants, there is a need to study the effect of soil and climatic conditions on the elemental contents of these medicinal plants. It has been demonstrated that AAS, with multi-elemental characterization over a wide range of concentration, is user-friendly instrument and requires minimum sample for analysis is an ideal instrument for such studies. Also, the detected values for elemental concentrations in plant studied are below the WHO permissible limit of levels and may not constitute a health hazard for consumers.

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**Cite this article as:**

Santosh Teerthe and B. R. Kerur. Elemental analysis of medicinal plants from North Karnataka region by AAS method. Int. J. Res. Ayurveda Pharm. 2017;8(3):104-108 http://dx.doi.org/10.7897/2277-4343.083153

Source of support: Nil, Conflict of interest: None Declared