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ADMIXTURE OF CONSTITUENTS IN MEDICINAL PLANTS USING EMISSION-SPECTROMETRY TECHNIQUE

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ABSTRACT

The knowledge of medicinal plant medicine in India it is originated from villagers, elders, farmers, healers and tribalism for health care system. Nowadays, increased scientific interest and consumer demand, have promoted the development of herbal and Ayurvedic drug products as dietary supplements. Here the elements are very intermediate substances of medicinal plants and human body which play an important role in the treatment of different disease. Hence it is essential to study the essential elements in medicinal plants for maintaining the life processes in plants and/or animals including human beings. The present profile Apocynaceae family plants such as *Catharanthus roseus, Caltrop's gigantean, Plumeria rubra, and Nerium indicum* leaves parts collected from different places of Gulbarga/ Kalaburagi district of Hyderabad- Karnataka commonly used as medicine in the traditional health care system for the treatment of various ailments. The Preparation of the sample is done by adopting a standard procedure and estimated the macro and micro nutrients using ICP-AES Techniques. The obtained concentrations of 12 Essential elements such as Mg, Al, Si, S, Cl, K, Ca Cr, Mn, Fe, Cu and Zn are within the permissible limits of WHO in all studied medicinal plants. The present investigation shows the variations of Mg, Al, Si, K, Ca and Mn were found in high concentrations while compare to S, Cl, Cr, Fe, Cu, and Zn, these are good supplements elements for the study of Chemical constituents and Photochemical activity of the present medicinal plants. The medicinal usages of these herbs were discussed in the light of above results for treatment of different diseases.

KEYWORDS: Medicinal plants, Elements, Karnataka, WHO/FAO limits, ICP-AES technique.

INTRODUCTION

The environment factors like temperature, soil moisture, soil nutrients, light, air pollutants, humidity, soil structure and pH are affecting directly or indirectly on all livings things and medicinal plants. According to the WHO the activity of macro and micro Nutrients were play an important role in medicinal plants growth. Further, according to the WHO, 75-80% of world population relies on traditional medicine for primary health care by plant materials. So, in India, the Herbal or Ayurvedic medicine is one of the oldest medical systems, i.e., collections, processing and preparation medicinal plant drug products which will contribute a major part of each year to the national economy growth.[1,2,3,4] Present study area considered is Hyderabad Karnataka region which is situated in the north-east part of the Karnataka state and falls within the geographical region of north maiden. In this study 4 same family herbal (Jedi butte), Ayurvedic medicinal plants *Catharanthus roseus, Caltrop's gigantean, Plumeria rubra, and Nerium indicum* are used as mane madhu, herbal and Ayurvedic medicines to cure different diseases like' cancer, diabetic, inflamentary, arises through imbalance in vata, pita, kapha kamale, dog bait etc. These medicinal plant parts were collected from different places of Kalaburagi district situated in northern part of Karnataka between 76°.04' and 77°.42 east longitudes, and 17°.12' and 17°.46' north latitude, covering an area of 10,951 km² and the predominantly it is soil type is black.[5,6] The method of characteristics study of macro and micro Nutrients is carried out by the most widely and commonly used technique of elemental analysis, providing acceptable levels of precision and accuracy, viz., Inductively coupled plasma atomic emission spectrometry (ICP-AES).[7,8,9] The estimation and study of permissible limits and quality control of trace, Heavy and Toxic elemental concentrations in medicinal plants is given by WHO/FAO.[10,11,12] It is an Emission spectrophotometric technique for measuring quantities of chemical elements present in samples, by determining wavelengths are emitted by sample and by determining

their intensities intern which gives qualitative and quantitative elemental analysis of medicinal plants.[13,14]

MATERIALS AND METHODS

Catharanthus roseus (CR), Caltrop's gigantean (CG), Plumeria rubra (PR), and Nerium indicum (NI) these four plants were collected in the Kalaburagi taluk of Kalaburagi District, Karnataka. India. The collected 4 same family medicinal plant leaves samples were washed with distilled water and made to dry at room temperature in air control laboratory. The dried leaves of the plants were mechanically powdered using mixer grander and finally sheaved with mesh of size 355µm to get a fine power and then stored in an airtight container. 10 mg of fine powder taken for solution preparation added in 1 ml of nitric acid and kept for 20 minutes to diffuse till solution becomes clear. The prepared solution added with 20 ml distilled water and kept for 5 minutes for dilution. Finally 3 ml solution was taken from 20 ml prepared solution for analysis of macro and micro Nutrients.

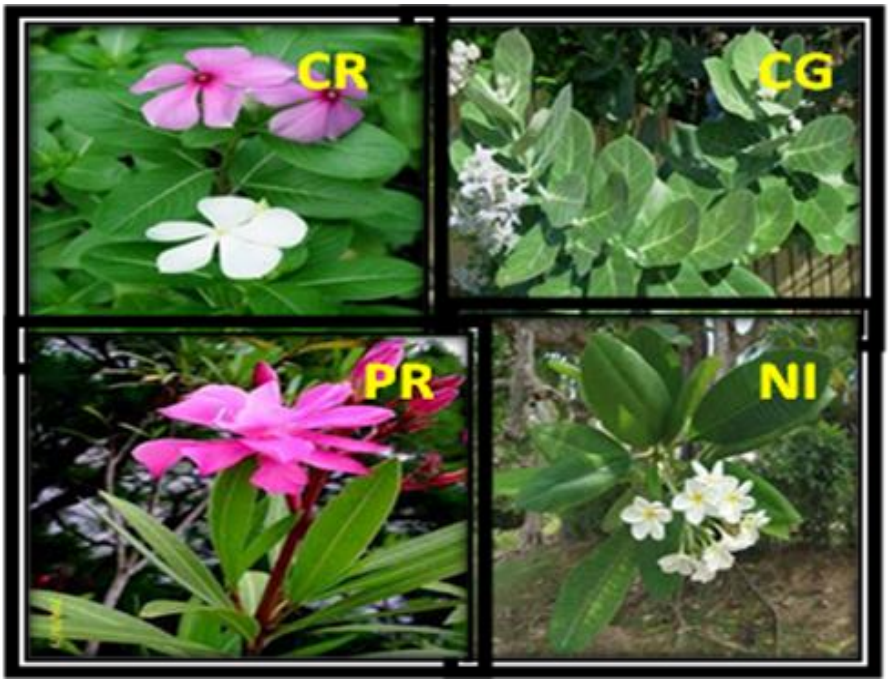

Fig. 1: Collected Medicinal plant Images.

Fig. 2: ICP-AES Instrument.

The figure 1 is the images of collected medicinal plants namely *Catharanthus roseus (CR), Caltrop's gigantean (CG), Plumeria rubra (PR), and Nerium indicum (NI)* and the instrument used for analysis is shown in figure 2.

The SPECTRO Analytical Instrument of Inductively Coupled Plasma - Atomic Emission Spectrometry (ICP-AES) is an emission spectrophotometer, works on the principle that excited electrons emit energy at a given wavelength as they return to ground state after excitation by high temperature Argon Plasma. The fundamental characteristic of this process is that each element emits energy at specific wavelengths peculiar to its atomic character. The energy transfer of the electrons when they fall back to ground state is unique characteristic of each element, as it depends upon the electronic configuration of the orbital. The energy transfer is inversely proportional to the wavelength of electromagnetic radiation. $E = hc/\lambda$ ... (where h is Planck's constant, c the velocity of light and λ is wavelength), and hence the wavelength of emitted light is also unique in nature. Although each element emits energy at multiple wavelengths, in the ICP-AES technique it is most common to select a single wavelength (or a very few) for a given element. The intensity of the energy emitted at the chosen wavelength is proportional to the amount (concentration) of that element in the sample being analysed. Thus, by determining which wavelengths were emitted by a sample and also by determining their respective intensities, the analyst can qualitatively and quantitatively find the elements from the given sample relative to a reference standard. The wavelengths used in AES ranges from the upper part of the vacuum ultraviolet (160 nm) to the limit of visible light (800 nm). Hence in principal ICP-AES which analyze the samples from atomic number range from Magnesium (Z=11) to Lead (Z=82). As such this instrument suits the needs of micro, macro and trace elemental analysis of medicinal plants of this region which covers the all atomic energy range including the supplements and cacogenic elements.

RESULTS AND DISCUSSION

Table 1 show Macro and Micro Nutrient concentrations, determined through ICP-AES of the 4 same family medicinal plant samples. The first column gives the element name with increasing atomic number and second to fifth columns gives the elemental concentrations of the four medicinal plants. From the table 1 it is observed that the variation of macro elemental concentrations is higher than micro elemental concentrations. Analysis of the present data revealed that Ca found to be highest concentration compared with all other medicinal plants. The descending order of the concentration of the Macro and Micro Nutrient in the medicinal plants studied is Ca> K> Mg> Si>Al> Cr> Mn> Zn> Cu> Fe>S, >Cl. The content of the Ca recorded in the medicinal plants were in the range of (9 mg/l to 24 mg/l); the highest concentration of the Ca was found in *Plumeria rubra (PR)*. The concentration of the K recorded in the present study ranged from (6 mg/l to 19 mg/l) with *Plumeria rubra (PR)* containing the highest concentration. Similarly, Mg is also found to be with appreciable amount in the range of (3 mg/L to 6 mg/L) in the medicinal plants and the highest concentration found in *Plumeria rubra (PR)*. Al was recorded to be present in varying concentrations in all the medicinal plants samples in the range of (0.9 mg/L to 3 mg/L) with the highest concentration recorded again in *Plumeria rubra (PR)*. In the present study, Micro Nutrients (Cr> Mn> Zn> Cu> Fe>S>Cl) were also detected in the selected four medicinal plants with varying concentration in the ranges of (0.01 mg/L to 2 mg/L). From the experimental concentrations of different element, it can be seen that *Nerium indicum(NI)* contains maximum concentration of Macro Nutrients like Mg, Al, Si, K, Ca and the Micro Nutrients like S, Cl, Cr, Mn, Fe, Cu, Zn compare to other three medicinal plants which are shown in below figure 3. The macro nutrients are found in higher concentration in *Plumeria rubra (PR)* while comparing all other plants shown in figures 3. According to the world health organization (WHO) the elemental permissible limits are very essential for consumption of these types of medicinal plant drugs. The observed concentrations of elements are found to be within the permissible limits of WHO which are shown in last column of the Table 1. From the table 1, it is shown that the supplementary elements like Copper and Zinc alternatively increasing and decreasing takes place in studied same family medicinal plants but the Iron found to be decreasing in elemental concentrations. These supplementary elements intermediate to the biological process of human body which is human system, brain, muscle, growth of blood cells etc.

Table 1: Concentrations of Elements in studied Medicinal plants (ppm).

Code no	GCar1	GCag2	GPlr3	GNei4	WHO Limits
Mg	3.91	3.75	5.14	4.16	**35**
Al	1.21	0.95	1.58	2.54	**12.6**
Si	8.36	7.13	8.74	6.23	**1**
S	0.15	0.21	0.19	0.14	**1**
Cl	0.09	0.05	0.06	0.04	**1**
K	8.47	17.43	18.19	6.57	**70.01**
Ca	18.5	17.47	23.38	16.73	**36.61**
Cr	0.75	0.34	1.43	1.24	**2**
Mn	0.08	0.25	1.23	1.65	**2**
Fe	0.09	0.08	0.09	0.01	**20**
Cu	0.06	0.08	0.11	0.87	**3**
Zn	0.45	0.44	0.71	0.17	**27.4**

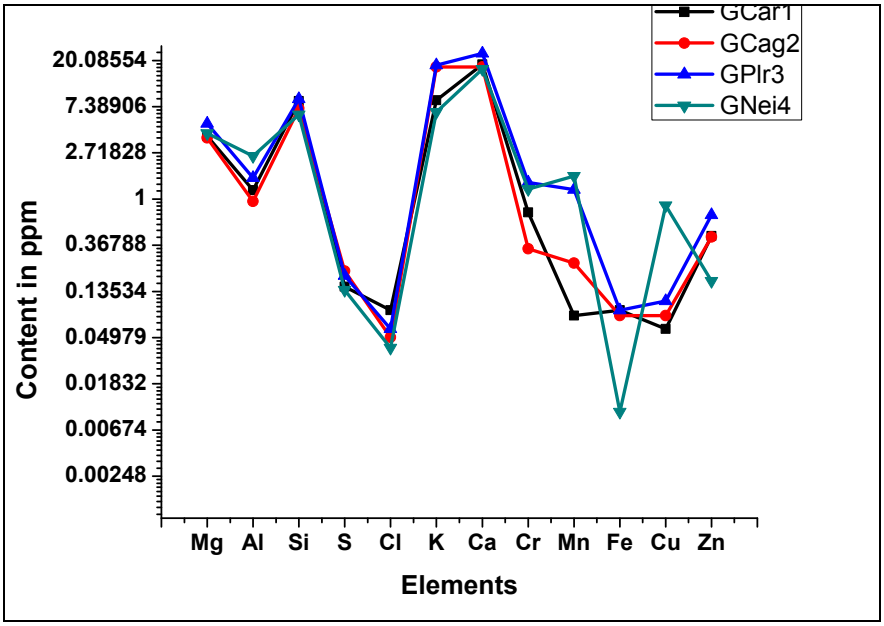

Fig. 3: Graphical variations of Elements in studied Medicinal plants.

From figures 3 it is shown that the significant variations of elemental compositions in analysed medicinal plants, here macro elements found in higher concentrations as compare to micro elements in all studied medicinal plants material. From the figures it is clear that the nine elements are estimated within the range 0.01 to 10 mg/L in Nerium Indicum medicinal plants except three medicinal plants. Mmaximum concentrations of macro nutrients were detected in *Catharanthus roseus (CR), Caltrop's gigantean (CG) and Plumeria rubra (PR) as* shown in figure 3 but the highest concentrations of micro nutrients are determined only in Nerium Indicum medicinal plants. Hence from this study one can decide that if a patient has deficiencies of kind of elements in his/her metabolism activities then it is advisable from such research work that it may be recommend for consumption of such medicinal plants for treatment to overcome the deficiencies. From this study it is also noticed that elemental content and biological activity depends on physical variation of environment and geography of the collected sample region.

CONCLUSIONS

The Atomic Emission Spectrometry is a good analytical technique for physical and chemical research of the different natural samples. From this present study concluded that the concentrations of various macro and micro nutrients in the medicinal plants of same family depend on the composition of the soil, water and environment. The concentrations of Elements like Mg, Al, Si, K, and Ca are higher than the S, Cl, Cr, Mn, Fe, Cu, and Zn. The data or concentrations of elements in analyzed medicinal plants are shown under the permissible limits as per the recommendation of FAO/FDA/WHO etc. Using these data the Ayurvedic doctor/medicinal practitioner may recommend the consumption of the medicinal plant in the form of pills/pallets/tablets/juice type so that the patient can overcome the deficiencies of particular kind element/s and he/she will attain the normal activity over a period of time. The studied medicinal plants have many medicinal properties like bitter, acrid, analgesic, aphrodisiac, anticancer, stomachic, febrifuge, diuretic astringent, emetic, expectorant, cardio tonic, etc. Present studied data it is useful to the new researchers, medicinal practioners to prepare new healthy drugs which helps and promote the society.

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