ISSN PRINT 2319 1775 Online 2320 7876

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Elemental Composition and X-Ray Diffraction Studies of Medicinal Plant

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ABSTRACT:

Multi-element analysis was performed on the nano- and micro-scale surface morphology of selected useful medicinal plant species belonging to the Moraceae family (eg *Ficus Racemose Linn*.) using field emission scanning electron microscopy, energy dispersive X-ray spectroscopy (FESEM-EDS), and X-ray diffraction (XRD) to understand the elemental degradation of medicinal herbs used in the Dharwad and Gadag districts of the Northeast Karnataka region… Medicinal plants from the Moraceae family were selected for this study. The samples were thoroughly analyzed by FESEM detailed nano-micrograph and elemental content specific gravity percentage and XRD and EDX analysis. World Health Organization (WHO) recommended values for elemental concentrations of Mg, Al, Si, S, Cl, K, Ca, Mn, Fe, Cu, and Zn were estimated from all collected medicinal plants by FESEM morphology. the plant contains fine, irregularly shaped particles with an average diameter of 20-50 mm). XRD analysis of samples showed similar diffraction patterns with two broad maxima attributed to amorphous forms, suggesting the coexistence of both amorphous and crystalline mineral phases, thus this sample is semi-crystalline in nature, which may be of taxonomic significance. According to current research, the collected medicinal plants have a good metabolism and micronutrient absorption, both of which are important for the development of new Ayurvedic, herbal and pharmaceutical drugs for various diseases.

Keywords: Elements, Field emission scanning electron microscope and Energy dispersive X-ray spectroscopy method, X ray Diffraction, an Ayurvedic medicinal plant.

INTRODUCTION:

India has an ancient heritage of traditional medicine. Medicinal plants play the most important role in traditional medicine[1]. Mineral elements usually make up a small proportion of the total combination of most plant materials and total body weight, but still had a therapeutic physiological significance, especially in the body metabolism. To confirm the therapeutic use of Ficus Racemosa L. in modern medicine, several Indian scientists and researchers have studied the pharmacological effects of ethanolic, methanolic and aqueous extracts of various parts of this plant during the last decades[2]. These pharmacological studies and their various formulations may have established a scientific basis for this plant's therapeutic uses. Trace, major, minor, and heavy elements all play important roles in

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medicinal plants and the human body for a healthy person's biological activity. [3.4.]. Given the World Health Organization's (WHO) permissible limits, it is critical to investigate baseline information on the type of elemental contents available in medicinal plants of a specific area/region. The importance of scanning electron microscopes (SEM) in drug standardisation cannot be overstated. Due to its limited availability, high operational costs, and lack of expertise, SEM is gaining traction slowly. The current study uses SEM-EDX to investigate the micromorphology of *Ficus Racemosa Linn*. The importance of trace elements in plant drugs in various medicinal systems, as well as the various techniques used to estimate them, were thoroughly discussed. Energy Dispersive X-ray Analysis (EDX) is gradually making inroads into drug standardization. Here we examined the samples by XRD to study the amorphous and crystalline phases that are present in Moraceae species. The variation of the elemental composition within the species using EDS helped to support the findings of XRD.

MATERIALS AND METHODS:

2.1 Collection of Medicinal Plants

Fig. 1 displays photographs of medicinal plants from the Moraceae family, including Ficus Racemose Linn, that were gathered in the Dharwad and Gadag Districts. For analysis, 1 kg samples of both young and mature bark were collected from various locations throughout the Northeast Karnataka region.

2.2 Study Area

The Northeast Karnataka region, which makes up about 30% of Karnataka and 50% of the North Karnataka region, is home to large-scale mining operations that produce minerals like manganese, iron, gold, and uranium. In addition to these operations, the region also houses large-scale cement plants and thermal power plants. The study area's latitudes are between 15°10' and 19°45' North and its longitudes are between 75°10' and 78°45' East. The current study includes Gadag and Dharwad districts. Here, where soils specific to the region are naturally available, Dharwad soil is red-black, and Gadag soil is black, red, and medium-black.

2.3 Collection of Medicinal Plants

The images of Moraceae family medicinal plants such as Ficus Racemosa Linn, bark collected from Dharwad and Gadag are shown in Fig. 1. Fresh and mature bark samples (each of 1 kg samples) were collected from different places of Dharwad and Gadaga Districts of Northeast Karnataka region for analysis purposes..

2.4 Sample Preparation:

The collected leaves of plant samples were washed with distilled water to remove clay, sand, and dust; the cleaned samples were dried in the airtight laboratory at room temperature for 30 days. The dried leaves of the plants were mechanically powdered using a mixer grinder and

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finally sheaved with a mesh of size 355 µm to get a fine powder and then stored in an airtight container. 10 mg of fine powder was taken and prepared in a pallet of 1 cm2 disk, and the sample was coated with 15 nm thick gold layers for contact purposes these samples were kept for about 30 min one at a time subjected to elemental analysis. . The Powder sample was directly coated on carbon tape and then the sample was coated with 15 nm thick gold layers and then analyzed the major, minor and trace elemental analysis like C, O, Mg, Al, Si, S, Cl, K, Ca, Cr, Mn, Fe, Cu, and Zn. This procedure is continued the same for the elemental analysis of all the samples.

Dried samples of bark were finely powdered for XRD analysis. The mineral phases were studied using Philips diffractometer (PW1840), HT generator (PW1729) and Chart recorder (PW8203A). Samples were run from 10 to 80° 2θ at 3°/min scan speed with Cu Kα radiation (λ = 1.541838A).

2.5 Data Analysis:

Energy Dispersive X-ray Spectroscopy (EDS OR EDX) is an Oxford Instrument that has a built-in Nanoparticle size analyzer and 250 Microanalysis System (EDS), Inca 250 ED has Penta FET® Peltier cooled SDD Detector with 130eV resolution at 5.9 keV x-rays, the unit has a precision capability for Quantitative, Qualitative, mapping and high the ID Voltage power supply to the sampler. This instrument is used for the quantitative analysis of the elements present in the samples.

RESULTS AND DISCUSSION:

The maximum elemental composition of medicinal plants was found in between 20µm to50µm of grains size and the surface morphology of Moraceae families' medicinal plants was arranged in a compact crystalline layer studied by the absorption fluorescence method of SEM-EDX instruments. The surface morphology and energy spectra of medicinal plants are shown in `s. 4 and 5, it is electron image of two medicinal plant leaves, and the size of the particles lies between 1 µm and 200 nm in the energy range from 1 KeV to 12 KeV of X-ray energies emitted from K and L shell of the elements present in the plant (Fig. 4)

The present investigation found that the elemental concentration of all four analyzed medicinal plants was determined below permissible limits. The elements like C, O, Mg, Al, K, Cr, Mn, Fe, Cu, and Zn, the order of average concentrations of elements are, and Ca here know that the elemental content is very high. The below table1 shows the details of elemental content in medicinal plant bark parts studied and collected from Dharwad and Gadag districts places. These medicinal plants are in good alignment with human health for the treatment of fever, cold, head pain, dengue, joint pain, diabetes, snake bit, etc, every medicinal plant medicine can take to the body with the perfect knowledge and suggestion of experts.

In the present study, Ficus Racemose Linn consist of crystalline calcium carbonate as a mineral and an amorphous phase. in the present study have shown evidence for these phases

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through XRD and EDS data. It is evident that using EDS the mineral composition and the purity of crystalline structure were confirmed by X-ray Diffraction analysis[26]

Medicinal Plants Images:

Figure 1: Ficus Racemose Linn

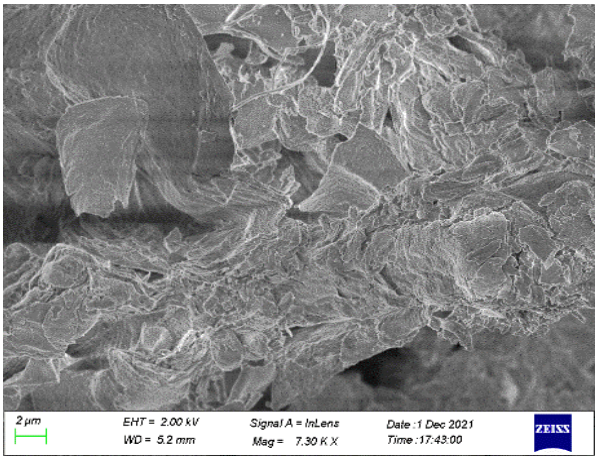

Figure 2: SEM images of Gadag

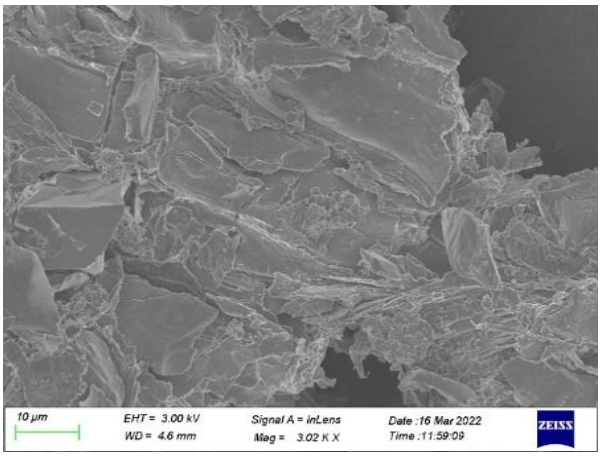

Figure 3: SEM images of Dharwad

SEM Images of *Ficus racemose Linn*

Table 1: Percentage composition of elements and Sum Spectrum

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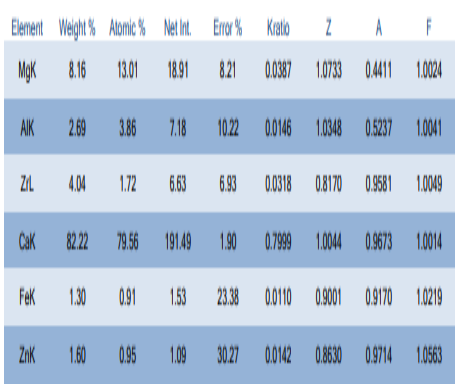
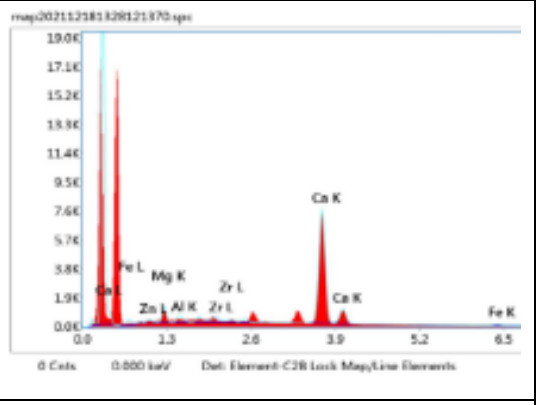
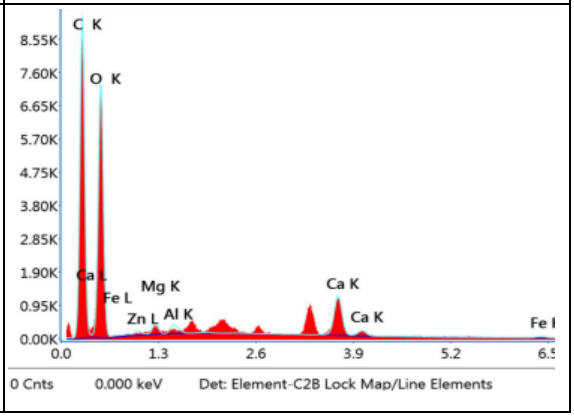
Dharwad districts		
Gadag District		

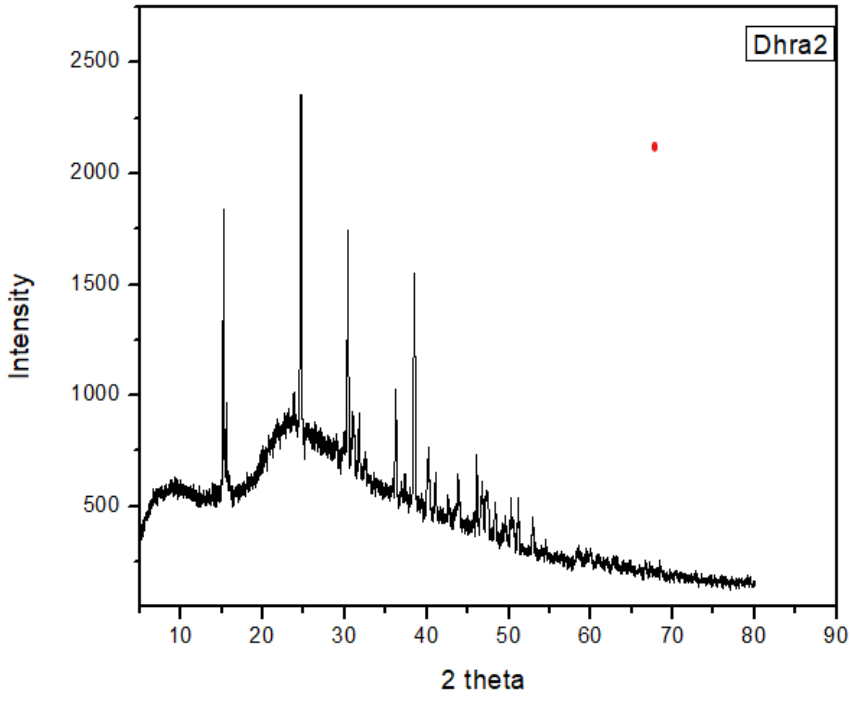


Figure 4: XRD Spectra of *Ficus racemose Linn* in Dharwad District

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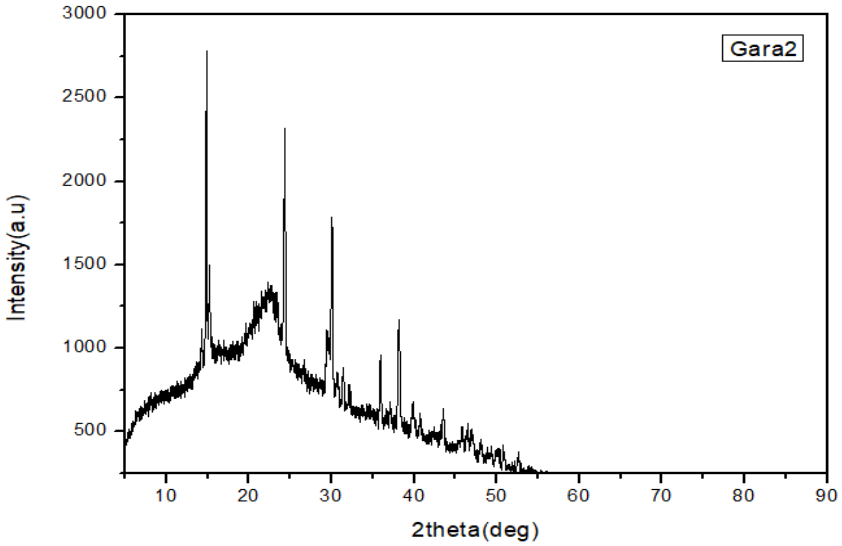

Figure 5: XRD Spectra of *Ficus Racemose Linn* collected in Gadg Districts

CONCLUSION:

The medicinal plants were collected from Dharwad and Gadag districts. The above Table 1 shows the estimated concentration of elements available in the samples of 2 districts, From the SEM analysis, it is found that the surface morphology of plants with grain sizes 20 to 50 microns are found in all the samples. The analysis reveals that surface morphology with grain size associated with elemental analysis will play important role in medicating the diseases. In Table 1 elemental content of Ca varies from 35 percent to 49 percent which is acceptable by the international bodies and is true for other elements like O, Mg, Al, Cl, K, Ca, Mn, Fe, Cu, and Zn compared with others. It may be concluded that the elemental concentrations vary from one region to another region in the northeast -Karnataka region and daggering information on the particle size gives the morphological arrangement of the particle. This information may be helpful in the synthesis of new Ayurvedic medicine drugs which can be used for the control of various diseases. Concentrations of various elements depending on the locality of the environment and soils, in the present case estimation of C, O, Mg, Al, Si, S, Cl, K, Ca, Cr, Mn, Fe, Cu, and Zn concentrations are found to be rich in elemental concentration in all bark samples which are also well within the permissible limits. The samples in the study show phases of amorphous and crystilline in nature hemce the Ficus Racemosa Linn sami crystalline in nature . calcite and minor reflections from calcium oxalate crystals which are co-existing in the sample . The presence of different forms of calcium crystals can be of taxonomic importance. Also, these biominerals play an important role in gathering and scattering of light to manage photosynthetic processes and protect against herbivores.

Conflict of Interests:

The authors declare no conflicts of interests.

Authors' Contributions:

ISSN PRINT 2319 1775 Online 2320 7876

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All authors read and approved the final manuscript.

Funding:

None.

Acknowledgment:

The authors express their sincere gratitude to Dr . Santosh , for his constant encouragement and support. The authors would like to thanks USIC, Gulbarga University Kalaburagi and IIT Mumbai for providing the instruments.

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