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SCIENTIFIC VALIDATION OF GANDHAGA SARKKARAI THROUGH SEM-EDAX AND XRD ANALYSIS

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ABSTRACT

Metals have been using in Siddha traditional medicine since many years ago. The aim of the study is to standardize *Gandhaga Sarkkarai*, a Siddha herbo metallic preparation through modern techniques. SEM, EDAX and XRD analysis were done in this study. The results revealed the average particle size as 100 nm. Presence of elements such as silicon, sulphur, aluminium, iron, calcium, potassium, sodium and chlorine have been revealed through EDAX. XRD study revealed that Sulphur is the key element in the sample. Hence, the drug *Gandhaga Sarkkarai* is standardized.

KEYWORDS: Gandhaga Sarkkarai, SEM, EDAX, XRD.

INTRODUCTION

Since prehistoric times, humans have used natural products, such as plants, animals, microorganisms, and marine organisms, in medicines to alleviate and treat diseases. According to fossil records, the human use of plants as medicines may be traced back at least 60,000 years.[1,2,3] Traditional medicines exists in World Health Organization (WHO) stresses the importance of the qualitative and quantitative methods for characterizing the samples, quantification of the biomarkers and/ or chemical markers and the fingerprint profiles. If a principle active component is known, it is most logical to quantitate this compound. Where active ingredients contributing to therapeutic efficacy are known botanical preparations

should be standardized to these compounds. Where the active ingredients are not yet known a marker substance which should be specific for the botanical could be chosen for analytical purpose.[4] Standardization of herbal medicines is the process of prescribing a set of standards or inherent characteristics, constant parameters, definitive qualitative and quantitative values that carry an assurance of quality, efficacy, safety and reproducibility. It is the process of developing and agreeing upon technical standards. Specific standards are worked out by experimentation and observations, which would lead to the process of prescribing a set of characteristics exhibited by the herbal medicine. Hence standardization is a tool in the quality control process.[5] *Gandhaga Sarkkarai* is a Siddha herbo-mineral preparation mentioned in *Siddha* text *Anuboga vaithiya navaneetham*, Part VI, indicated for *Megam (syphilis), Premegham, Kiranthi, Purai (Whole Abscess), Kai kaal kudaichal (Joint pain).*[6]

MATERIALS AND METHODS

Collection of raw drugs

Gandhagam was purchased from a well reputed country shop in Parrys, Chennai. *Karisalai and Vellai vengayam* were freshly collected from Tambaram sanatorium, Tamilnadu.

Identification and Authentication of the drug

Mineral drug was authenticated by Dr.M.Suresh Gandhi, Department of Geology, University of Madras, Chennai. Herbal drugs were identified and authenticated by Dr. D. Aravind M.D(s), Botanist, National Institute of Siddha, Tambaram Sanatorium, Chennai.

SEM-EDAX anlalysis

The particle size of the *Gandhaga Sarkkarai* was determined by using High resolution scanning electron microscopy (HR SEM). The Experimental Procedure was done at Department of Material Science, Madurai Kamaraj University, Madurai-21.

A Scanning Electron Microscope (SEM) is a type of electron microscope that produces images of a sample by scanning the surface with a focused beam of electrons. The electrons interact with atoms in the sample, producing various signals that contain information about the sample's surface topography and composition. The electron beam is scanned in a raster scan pattern, and the beam's position is combined with the detected signal to produce an image. It is a powerful and mature technique in the examination of materials, widely in metallurgy, geology, biology and medicine.

The Quanta 200 FEG Scanning Electron Microscope (SEM) is a versatile high resolution scanning electron microscope with three modes of operation namely, High vacuum (HV) mode for metallic (electrically conducting) sample, Low vacuum (LV) mode for insulating, ceramic, polymeric (electrically insulating), Environment scanning electron microscope (ESEM) for biological samples.

Apart from giving the high resolution surface morphological images, the Quanta 200 FEG also has the analytical capabilities such as detecting the presence of elements down to boron on any solid conducting materials through the Energy Dispersive X-ray spectrometry (EDX) providing crystalline information from the few nanometer depth of the material surface via electron back scattered detection (BSD) system attached with microscope and advanced technological PBS (WDS) for elemental analysis. EDX analysis is useful in identifying materials and contaminants, as well as estimating their relative concentrations on the surface of the specimen. The EDX analysis system works as an integrated feature of a scanning electron microscope (SEM) and cannot operate on its own without the latter.

The primary electron beam interacts with the sample in a number of key ways. Primary electrons generate low energy secondary electrons, which tend to emphasize the topographic nature of the specimen. Primary electrons can be back scattered which produces images with a high degree of atomic number (Z) contrast. Ionized atoms can relax by electron shell-to-shell transitions, which lead to either X-ray emission or Auger electron ejection. The X-ray emitted are characteristic of the elements in the top few μm of the sample and are measured by the EDX detector.

Resolution: 1.2 nm gold particle separation on a carbon substrate.
Magnification: From a min of 12 X to greater than 1,00,000 X.
Application: To evaluate grain size, partical size distributions, material homogeneity and inter metallic distributions.

A representative portion of *Gandhaga Sarkkarai* was sprinkled on to a double side carbon tape and mounted on aluminium stubs, in order to get a higher quality secondary electron image for SEM examination.

The horizontal line in the right corner of the micrograph corresponds to micro in length would be given. A comparison could be made between the length of the particles visible in the micrograph with this line and the length of the particles was calculated.

X-Ray Diffraction

The X-ray powder diffraction test was carried out for *Gandhaga Sarkkarai* as per the standard procedure. The Experimental Procedure was done SAIF, IIT Madras, Chennai-36. X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. It is a compact advanced instrument. When X-rays falls over a crystal, it diffracts in a pattern characteristic to its structure. A diffraction pattern plots Intensity against the angle of detector. Diffraction occurs when light is scattered by a periodic array with the range of order, producing constructive interference at specific angles. The pattern contains information about the atomic arrangement in crystal. Amorphous materials like glass do not have periodic array with long range order, so they do not produce any significant diffraction pattern.

RESULTS AND DISCUSSION

The VEGA TESCAN 3 instrument is used with tungsten filament to image the samples. The SEM imaging of the *Gandhaga Sarkkarai* sample shows that the particles are small and in the range of less than 100 nm as shown in Fig. 1. The particles are aggregate and individual particles are seen on the top of the clusters. The particle size is low because of the grounding for more than 6 hours for 4 days. EDAX analysis shows the elements present in the sample as shown in Fig. 2. Table 1 represents the weight and atomic percentage of sample. The presence of silicon Si, Aluminum Aland Iron Fe is 23% is due to the usage of Kaiyanthangari charu and Venniramana Vengaya charu. The presence Calcium, Potassium, sodium and chlorine is minimum and may be from Nellikai Gandhagam juice. The carbon and oxygen is presence due to the calcination process.

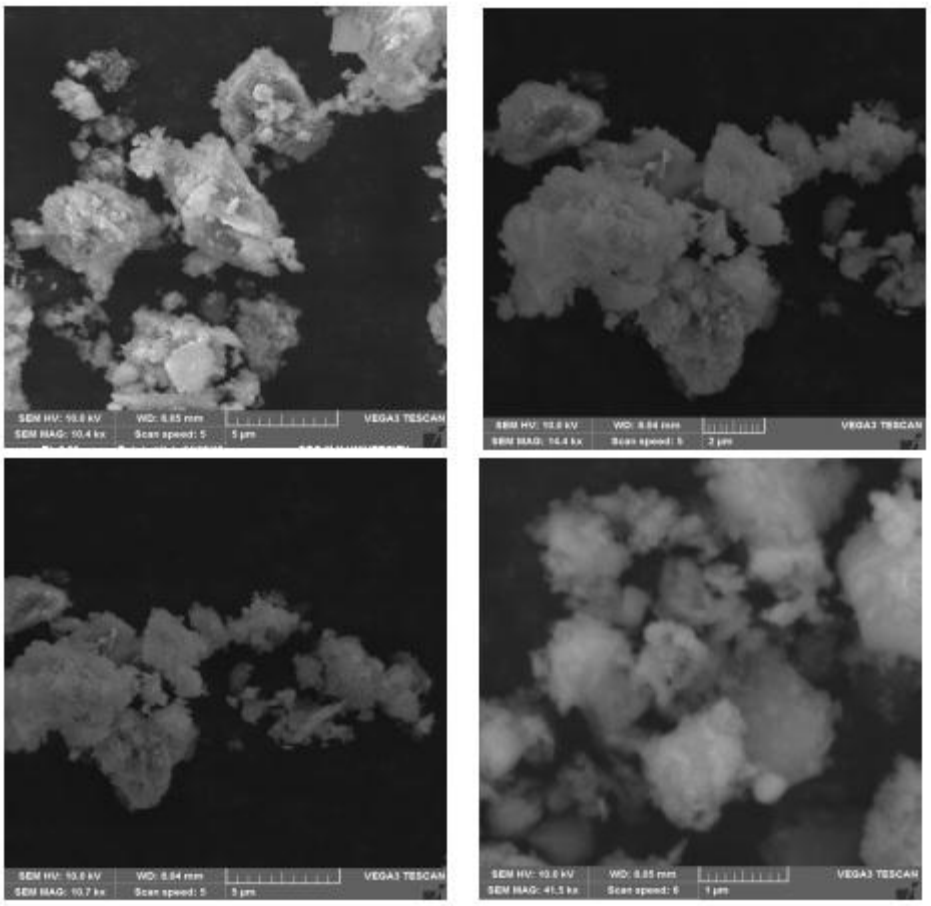

Figure 1: SEM (Scanning Electron Microscope) image of Gandhaga sarkkarai.

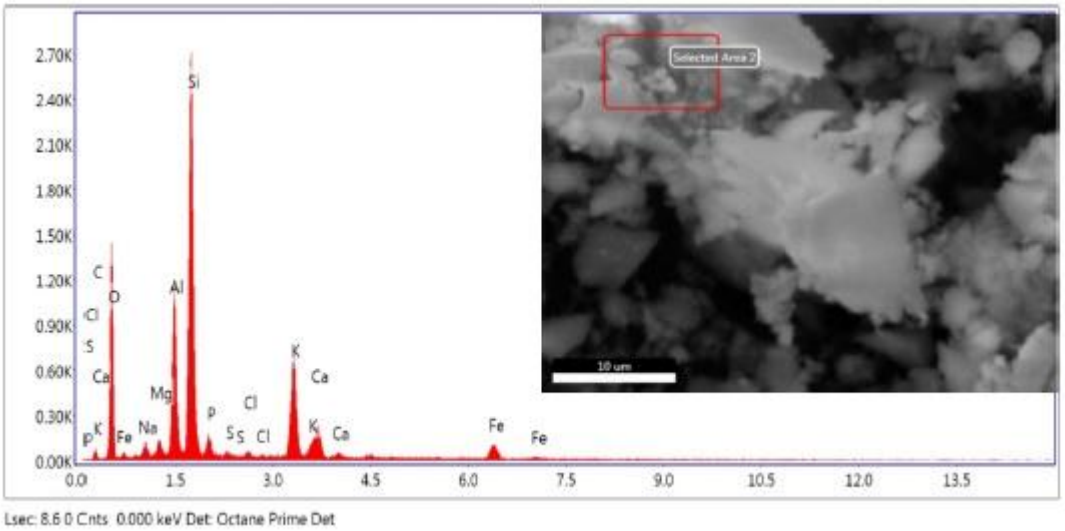

Figure 2: EDAX analysis of Gandhaga Sarkkarai.

Table 1: Edax analysis of Elements in Gandhaga Sarkkarai.

Element	Weight %	Atomic %	Net Int.	Error %
C K	5.95	9.9	31.28	20.29
O K	47.64	59.49	899.79	9.92
NaK	1.75	1.52	66.27	16.34
MgK	0.83	0.68	62.76	18.48
AIK	8.92	6.61	923.05	6.79
SiK	20.76	14.77	2348.82	5.62
P K	1.50	0.97	122.88	13.59
S K	0.14	0.09	14.21	64.59
ClK	0.11	0.06	12.16	64.02
K K	7.18	3.67	779.17	4.40
CaK	2.78	1.39	260.52	9.40
FeK	2.43	0.87	144.08	9.43

The X-ray diffraction pattern of the prepared sample *Gandhaga Sarkkarai* reveals the presence of major peak with 2- Theta value of 28.42 with the intensity of 11000.(Fig.3) Major peaks observed in test sample with 2-theta values of 28.42 and their corresponding intensities matching with the material sulphur.

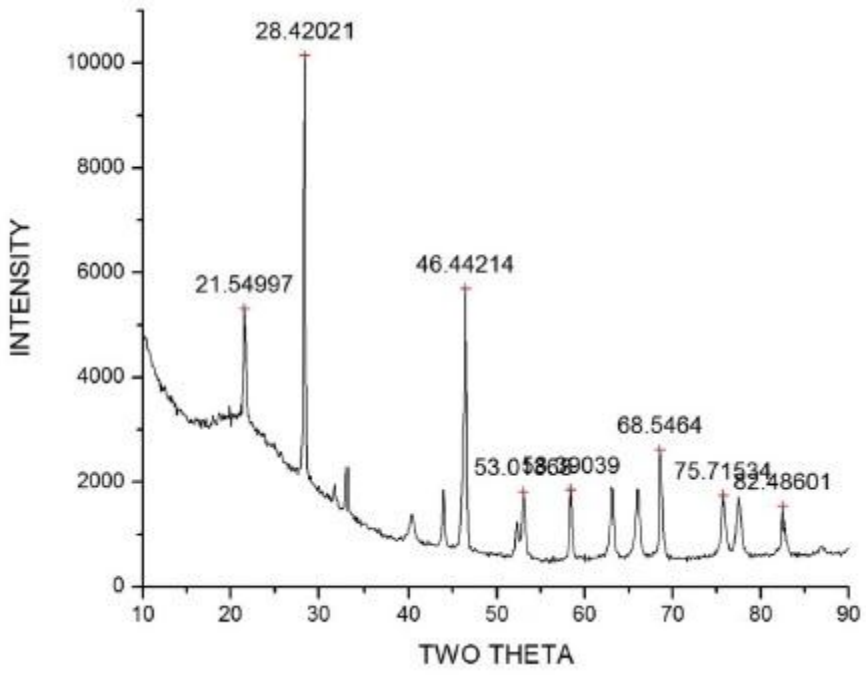

Figure 3. XRD pattern of Sample Gandhaga Sarkkarai.

CONCLUSION

Particle size of the *Gandhaga Sarkkarai* is measured as around 100 nm. The presence of silicon, sulphur, aluminium, iron, calcium, potassium, sodium and chlorine and their

concentrations are revealed through EDAX analysis. XRD showed that the Sulphur is the key ingredient in the sample *Gandhaga Sarkkarai*. Hence, *Gandhaga Sarkkarai* is standardized.

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