PHYSICOCHEMICAL AND INSTRUMENTAL STANDARDIZATION OF SIDDHA HERBO MINERAL DRUG KANDHAGA PARPAM

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ABSTRACT
Kandhaga parpam is one of the traditional Siddha herbo mineral medicine is used in the treatment of diabetes. The aim of this present study was carried out to standardize the drug Kandhaga parpam by evaluating its Organoleptic characters, Physico chemical properties and modern scientific instruments like, Fourier Transform - Infra Red (FTIR) Spectroscopy, SEM (Scanning Electron Microscope). Organoleptic characters such as colour, odour, particle size and Physico-Chemical Characters like ash Values, pH value were analyzed. The total ash value was found to be 26.96%w/w, acid insoluble ash value is 9.05%w/w and moisture content is 3.59% w/w. The pH value is 9.4. FT-IR spectroscopy showed the presence of functional groups like amines, aliphatic amines, primary amines, amides and alkyl halides. These functional groups are key factors for anti diabetic activity. SEM analysis of the drug indicated the existence of nano particles. Nano particle sizes are 12.4 nm, 27.7 nm, 35.1 nm and 39.2 nm.

KEYWORDS: Physico-chemical properties, ash values, FT-IR spectroscopy, SEM.
INTRODUCTION

Siddha system is one of the ancient medical systems in India which reflects the life style and culture of the people. Siddhars, the founders of Siddha medicine had designed the health practices including seasonal discipline and food regulation. The characteristic unique features of Siddha Pharmacology (Siddha Materia Medica) are exploitation of metal, mineral and animal product based preparations\(^1\) to a greater extent in comparison with other traditional systems of medicine.

Herbo-mineral drugs (metals or minerals triturated with herbal juices or decoctions lead to reduction in the size of the particulate size even up to nano levels (less than 100 nm). These drugs are known to be effective even in low concentration with longer shelf life. It has been noted that metallic or mineral medicines can help tremendously in patients with chronic or degenerative diseases.

Parpams are powder substances obtained by calcification of purified metals, minerals and animal products by specific process. They are calcined in closed crucibles in pits and with cow dung cakes. Generally these methods of preparation of Siddha medicines involves conversion of minerals or metals into oxide or sulphide form by various herbal treatment followed by repeated high temperature calcinations and grinding cycles.\(^2\)

The drug Kandhaga parpam mainly has a therapeutic effect in treating Diabetes mellitus and also its complications. There are many anti diabetic medicines in Siddha system of medicine, yet there is no appropriate scientific standardization of such medicines. Standardization is necessary to make sure of availability of a uniform product in all parts of the world.\(^3\) Scientific evaluation is needed to validate its preciousness. This is a preliminary attempt to establish Kandhaga parpam is an excellent anti diabetic drug in Siddha system of medicine.

The present study investigated to standardize its Organoleptic, Physico-chemical properties and Instrumental analysis like Fourier Transform - Infra Red (FTIR) Spectroscopy, SEM (Scanning Electron Microscope).

MATERIALS AND METHODS

Selection of drug

Herbo mineral drug Kandhaga parpam was selected from Siddha literature.\(^4\)
Collection and authentication of the drug

The raw drugs included in Kandhaga parpam, Sulphur was purchased from raw drug country shop at Thirunelveli. Amaranthus tristis, Oryza sativa, Amaranthus tricolor and Amaranthus spinosus were procured from market at Thirunelveli. They were identified and authenticated by the Botanist and PG Gunapadam experts, Govt. Siddha Medical College, Palayamkottai, Thirunelveli. The model of each ingredient was labeled individually and kept in the lab for further reference.

Purification of the drug

The purification process was done according to the procedures stated in the classical Siddha literature.\textsuperscript{[5]} For the purification of Sulphur, it was placed in an iron pan. Sufficient quantity of cow’s butter was added and the pan was heated till the butter melts. This mixture was immersed in inclined position in cow’s milk to get purified sulphur. Fresh milk was used every time and the process was repeated for 29 times. For the purification of Greens, such as Amaranthus tristis, Amaranthus tricolor and Amaranthus spinosus and Oryza sativa they were washed many times in tap running water for the removal of sand and dust\textsuperscript{[6]}.

Preparation of the drug

Purified 70gms of Sulphur is powdered and put in a mud pot. One litre of Amaranthus tristis juice is poured in the pot, boiled gently until the juice is almost dried or reduced considerably. The pot is removed from the fire, poured cold water plenty, washed well repeatedly with cold water and dried. Likewise the same process is repeated with raw rice, Amaranthus tristis juice, Amaranthus spinosus and Amaranthus tricolor juice in the same manner. Then the parpam is grind and kept in air tight container.

Specific analytical parameters for parpam

Specific parameters for Parpam were carried out as per Siddha classical texts\textsuperscript{[7]}. A pinch of Parpam when kept on the tongue must be tasteless. Parpam must be float on the water. Moreover Parpam when placed between the thumb and index should enter the furrows of the finger. The Parpam should not contain any lustre on seeing naked eye.

Organooleptic and physicochemical standardization

The drug Kandhaga parpam was subjected for the determination of Organooleptic characters like colour, odour, state of matter, consistency and particle size and physicochemical
parameters such as total ash, acid insoluble ash, loss on drying@ 105°C and they were evaluated by standard procedure described in the texts.

**Preparation of extract for basic and acidic radical studies**
The drug Kandhaga parpam was subjected for qualitative analysis of cations and anions based on the texts mentioned.[8,9]

**Instrumental Analysis**

**FTIR (Fourier Transform - Infra red Spectroscopy)**
IR data acquired with Spectrum one FT-IR Spectrometer by means of KBr Pellet method was carried out at Anna University, Chennai [10]. 50 mg of the drug was stuck by the agate mortar and pestle to provide a very fine powder and 0.25 to 0.50 added spoons of KBr salt was added thoroughly ground in an agate mortar with the pestle until it became very fine. Infrared was passed from a source through a sample. This infrared was absorbed by the sample according to the chemical properties and some were transmitted. The spectrum that appears denotes the molecular absorption and transmission.

**SEM (Scanning Electron Microscope)**
To evaluate the size of the particle, surface topography SEM analysis was carried out using S-3400n SEM-Hitachi at a magnification range of 12 X to 1,00,000X at Anna University, Chennai.[11] The sample was mounted on a specimen stub. This mounted sample was placed inside the microscope’s vacuum column evaporator through a tight door. A focused beam of high energy electrons is allowed to pass to generate the signals at the surface of sample of drug. This result in the emission of electrons or photons was collected by an appropriate detector. The electrons were counted by the detector and the signals were sent to the amplifier. The resultant image was the number of electrons dispersed from each spot of the sample. The micrographs obtained from this analysis gave enough data about the topography (morphology, chemical composition) of the sample drug.

**RESULTS**
The results of Siddha analytical specific parameters of Parpam are shown in table no.1
Organoleptic & Physicochemical Standardization

The drug Kandhaga parpam appears whitish yellow in colour, having characteristic Odour, fine powder in nature. The drug is alkaline in nature having a pH of about 9.4. The values were noted in the Table no.2 and Table no.3. Total ash value is 26.96% w/w, acid insoluble ash value is 9.02% w/w, and loss of weight at 105° C is 3.59% w/w.

Results of basic and acidic radical studies

From the basic and acidic radical studies, the drug Kandhaga parpam had Calcium, Chloride, Carbonate and Sulphate which were shown below in the Table no.4.

Fourier Transform – Infra Red (FTIR) Spectroscopy

The results of Table no.5 and Figure no.1 demonstrated that the drug Kandhaga parpam contains amines, primary amines, amides, alkyl halides as functional groups.
Table. No. 5. Results of FTIR analysis of Kandhaga parpam

<table>
<thead>
<tr>
<th>Absorption peak cm⁻¹</th>
<th>Stretch</th>
<th>Functional Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>3853</td>
<td>N-H stretch</td>
<td>Amides</td>
</tr>
<tr>
<td>3400.5</td>
<td>N-H (stretch)</td>
<td>Amines and Amides</td>
</tr>
<tr>
<td>2345.6</td>
<td>-</td>
<td>Amines</td>
</tr>
<tr>
<td>1560.9</td>
<td>N-H bend</td>
<td>Amines primary</td>
</tr>
<tr>
<td>1110.1</td>
<td>C-N stretch</td>
<td>Aliphatic amines</td>
</tr>
<tr>
<td>759.2</td>
<td>C-Cl stretch</td>
<td>Alkyl halides</td>
</tr>
<tr>
<td>612.6</td>
<td>C-Br stretch</td>
<td>Alkyl halides</td>
</tr>
</tbody>
</table>

Fig. No. 1. showing the graph of FTIR spectroscopy

Scanning Electron Microscopy (SEM)

SEM analysis of the drug Kandhaga parpam exposed the presence of nano particles of size 12.4 nm, 27.7 nm, 35.1 nm and 39.2 nm. The Figure no.2 showed the particles had irregular morphology.

Fig. no. 2. SEM picture showing nano particles
DISCUSSION

Kandhaga parpam is indicated for anti diabetic activity in Siddha literature. The preparation stages of Kandhaga parpam were followed exactingly for maintaining the safety, quality and efficacy as well as purification and detoxification of ingredients such as Sulphur.

The total ash was found to be 26.96% indicated a less amount of organic matter and a significant amount of minerals. The acid insoluble ash value was 9.02% w/w indicating these parpam did not posses any siliceous matter. The loss on drying at 105°C indicates that only 3.59% of water and volatile components have been lost when 1g of Kandhaga parpam kept at 105°C. This moisture content helped to prevent deprivation of efficacy and disintegration of Kandhaga parpam. The pH value at 25°C was found to be 9.4 indicating alkalinity nature of the drug. Particle size denote the fineness, so that the drug Kandhaga parpam easily assimiable in GIT.

FTIR analysis of Kandhaga parpam showed 8 peaks. The results proved the existence of functional groups like amines, primary amines, aliphatic amines, amides, alkyl halides. These functional groups are key factors for anti diabetic activity.

SEM analysis of the drug Kandhaga parpam exposed the presence of nano particles of size 12.4 nm, 27.7 nm, 35.1 nm and 39.2 nm. Nano sized particles can attach with the cell surface and diffuse readily inside the cells. Thus, the size of particle is able to influence the efficacy at the targeted sites escape from the hepatic and renal pathways. It increases the therapeutic effect. Nano medicine has its benefit in the treatment for the diseases of cardio vascular system, cancer and nervous system etc. The advantage of the nano particle is its smaller size which enhances the solubility, bioavailability of the drug and avoids macrophage clearance. It reduces possibly of side effects.

CONCLUSION

In the present study it is concluded that the Organoleptic characters and Physico-chemical parameters such as the total ash value (26.96%w/w), acid insoluble ash value (9.02%w/w), Moisture content (3.59%w/w), pH value (9.4) can be capably used for standardization of herbo mineral formulation. The sophisticated analysis of instruments like FT-IR spectroscopy exposed the existence of functional groups like amines, primary amines, aliphatic amines, amides and alkyl halides are primarily responsible for anti diabetic activity. SEM analysis of the drug revealed the presence of nano particles. These nano particle sizes of Kandhaga
parpam may allow rapid absorption. The results of FTIR, SEM analysis can be used as outstanding finger prints for Physico chemical validation of the medicine. This study is earnest attempt to making appropriate scientific validation of Siddha herbo mineral medicine.

ACKNOWLEDGEMENT

The authors wish to thank the Principal, Govt. Siddha Medical College, Palayamkottai., respective H.O.D s’ of the department of Mechanical Engineering and Department of Chemistry of Anna University, Chennai, Centre for Advanced Research in Indian System of Medicine (CARISM) SASTRA University, Thanjavur for the standard support being given in finishing the work, in standardization of the drug and in finishing instrumental, Organoleptic and Physico-chemical analysis respectively.

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