Physicochemical Characterization of the Siddha Metallo Mineral Drug - Veera Aya Chenduram (VAC)

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ABSTRACT

Veera ayachenduram (VAC) is a metallo-mineral drug cited in Siddha text literature KannusamiyamparambaraiVaithiyam. The study aimed to standardises the VAC by evaluating its physicochemical characters such as colour, ash value, pH value analyses the heavy metal composition in modern instrumental techniques. Inductively coupled plasma optical emission spectrometry and to find out the particle size through scanning electron microscopy (SEM) and. The total ash value was found to be 7.7% w/w, acid-insoluble ash value is 1.25% w/w, water-soluble ash value is 25.32% w/w, and The pH value is 6.5. The ICP-OES reveals that heavy metals such as mercury, lead, arsenic, and cadmium are within the limit. High-resolution SEM analysis of the drug indicated the existence of nanoparticles.

INTRODUCTION

Siddha, an exclusive part of the integrated system of medicine in India, has a solid history of centuries beyond. The unique features lie in the metallo mineral formulations and the purification process by Siddhars, who are the proponents of the Siddha System of Medicine (Thiyagarajan and Sunderrajan, 1992). In this present scenario, Standardisation of these compound formulations remains to be the global acceptance by which the drug is validated qualitatively and quantitatively (Mukherjee et al., 2017). This study deals with the standardisation of metallo mineral formulation Veera AyaChendhuram mentioned in the Siddha classical literature Kannusamiyam parambarai Vaithiyam (Kannusami Pillai, 2006). The physiochemical characters like colour, ash values, PH value and it was evaluated in modern instrumental techniques like inductively coupled plasma optical emission spectrometry ICP-OES and scanning electron microscopy SEM.

MATERIALS AND METHODS

Selection of Drug
The drug VAC was selected from the classical Siddha literature, Kannusamiyam parambarai Vaithiyam (Kannusami Pillai, 2006).

Collection and Authentication of the Drug
The raw materials included in the formulation are
1. Ayapodi (Iron)
2. Gandhagam (sulphur)
3. Lingam (Red sulphide of mercury)
4. Veeram (Hydragyrum perchloride)
5. Vediuppup (Potassium nitrate)
6. Pooneeru (Fullers earth)

Which were purchased from the standard drug stores in Chennai. Drugs were identified and authenticated from Dept. of Pharmacognosy in Siddha Central Research Institute, Chennai and botanist in National Institute of Siddha, Chennai.

**Figure 1: SEM**

**Purification of the Drug**

The purification process was done according to the procedures mentioned in the classical Siddha literature.

**Purification of Ayam (Iron)**

The iron is soaked in lime juice for three days, and then it is washed and dried (Kannusamy Pillai, 2012).

**Purification of Gandhagam (sulphur)**

The leaves of Lawsonia inermis was grounded in a stone mortar and mixed with cow's curd. The above mixture is then placed in a mud pot. A cotton cloth with the sulphur above it was placed in the mud pot. The same is closed with a similar lid and sealed with a seven-layered clay cloth. It is then kept underground with the cow dung cakes arranged over it. The pot is subjected to pudam (set on fire), and the process is repeated seven times. Each time fresh curd is mixed with the processed sulphur (Thiyagarajan and Sunderrajan, 1992).

**Purification of Lingam (Red sulphide of mercury)**

The red sulphide of mercury is grounded with lemon juice; thereby, it gets purified (Anaivariananthan, 2008).

**Purification of Veeram (Hydragyrum perchloride)**

Bitter gourd is opened, and a hole is made. hydragyrum perchloride is placed in the centre of the hole and closed, tied with a rope. Tender coconut water is poured in the mud pot. The above-tied material is suspended in the pot without touching the water and burnt for one hour (Thiyagarajan and Sunderrajan, 1992).

**Purification of Vediuppup (Potassium nitrate)**

Potassium nitrate is soaked in lemon juice, and then it is dried (Anaivariananthan, 2008).

**Purification of Pooneeru (Fullers earth)**

Dissolve the fullers earth in water which amounts four times the weight of fullers earth and leave it for 4 - 5 hours. Then collect the liquid above the sedimented part and dry it under the sunlight (Kannusamy Pillai, 2012).

**Preparation of the Drug**

From the above-purified drugs, the Ayam and Gandhagam are placed in kalvam and rubbed with lemon juice till it reaches waxy consistency (mezhu) for about four samam (12 hours) and made it into a single pellet and dried under the sunlight. Then it is placed in the mud plate and closed. The margins are covered with seven layers of clay cloth, and it is dried. Then it is subjected to pudam with 15 cow-dung cakes—the finished product which is dark brown.

It is kept in kalvam along with other drugs and rubbed with lemon juice for 2-3 samam (6-9 hours). Then it is made into a single pellet and pudam is done as mentioned. The whole process is repeated three times. Finally, dark brown colourchendhram is obtained, which is stored in an airtight container (Kannusami Pillai, 2006).

**Physicochemical Evaluation**

The drug VAC was subjected to determine physicochemical characters such as colour, ash values, pH value, percentage yield, and solubility which were analysed according to the Standard Operating Procedures (SOPs) mentioned in the texts (Quality assessment of Ayurveda and Siddha drug, 2005).

**Instrumental Analysis**

**SEM**

Scanning electron microscope (SEM) one of the most valuable instruments available for the examination...
Table 1: Physico-Chemical Parameters

<table>
<thead>
<tr>
<th>No</th>
<th>Physico-Chemical Parameters</th>
<th>% in W/W (mg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loss on drying at 105ºC</td>
<td>7.31</td>
</tr>
<tr>
<td>2</td>
<td>Total ash</td>
<td>7.7</td>
</tr>
<tr>
<td>3</td>
<td>Acid insoluble ash</td>
<td>1.25</td>
</tr>
<tr>
<td>4</td>
<td>Water soluble ash</td>
<td>25.32</td>
</tr>
<tr>
<td>5</td>
<td>PH</td>
<td>6.5</td>
</tr>
<tr>
<td>6</td>
<td>Particle size by SEM</td>
<td>1-3 Micron</td>
</tr>
</tbody>
</table>

Table 2: ICP-OES

<table>
<thead>
<tr>
<th>S.no</th>
<th>Elements</th>
<th>Wavelength in nm</th>
<th>Veera aya chenduram mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aluminium</td>
<td>Al 396.152</td>
<td>BDL</td>
</tr>
<tr>
<td>2</td>
<td>Arsenic</td>
<td>As 188.917</td>
<td>BDL</td>
</tr>
<tr>
<td>3</td>
<td>Calcium</td>
<td>Ca 315.805</td>
<td>14.210</td>
</tr>
<tr>
<td>4</td>
<td>Cadmium</td>
<td>Cd 228.802</td>
<td>BDL</td>
</tr>
<tr>
<td>5</td>
<td>Copper</td>
<td>Cu 327.393</td>
<td>BDL</td>
</tr>
<tr>
<td>6</td>
<td>Iron</td>
<td>Fe238.204</td>
<td>213.430</td>
</tr>
<tr>
<td>7</td>
<td>Sodium</td>
<td>Na 589.592</td>
<td>5.810</td>
</tr>
<tr>
<td>8</td>
<td>Phosphate</td>
<td>P 213.617</td>
<td>62.121</td>
</tr>
<tr>
<td>9</td>
<td>Lead</td>
<td>Pb 220.353</td>
<td>BDL</td>
</tr>
<tr>
<td>10</td>
<td>Magnesium</td>
<td>Mg 285.213</td>
<td>12.160</td>
</tr>
<tr>
<td>11</td>
<td>Mercury</td>
<td>Hg 253.652</td>
<td>3.081</td>
</tr>
<tr>
<td>12</td>
<td>Potassium</td>
<td>K766.491</td>
<td>20.961</td>
</tr>
<tr>
<td>13</td>
<td>Zinc</td>
<td>Zn 206.200</td>
<td>1.315</td>
</tr>
<tr>
<td>14</td>
<td>Phosphorus</td>
<td>P213.617</td>
<td>62.121</td>
</tr>
</tbody>
</table>

and analysis of the microstructure morphology and chemical composition characterisations (Zhou et al., 2006). The SEM is carried out by using FEI-Quanta FEI 200-High Resolution Instrument with a Resolution of 1.2 nm gold particle separation on a carbon substrate, and its Magnification is From a min of 12 X to greater than 1,00,000 X. Its application is to evaluate grain size, particle size distributions, material homogeneity and intermetallic distributions. Hence the drug is subjected to SEM analysis at Sophisticated Analytical Instrument Facility (SAIF), Institute of Information Technology Madras(IIT Madras), Chennai.

ICP-OES

Inductively coupled plasma optical emission spectrometry (ICP-OES), an analytical technique used for the detection of trace metals. A Perkin-Elmer Optima ICP spectrometer is used for routine ICP-OES analysis. Obtaining qualitative information, i.e., what elements are present in the sample, involves identifying the presence of emission at the wavelengths characteristic of the elements of interest. Obtaining quantitative information, i.e., how much of an element is in the sample, can be accomplished using plots of emission 92 intensity versus concentration called calibration curves. The Procedure is done at Sophisticated Analytical Instrument Facility (SAIF), Institute of Information Technology (IIT Madras), Chennai-36 (Charles and Fredeen, 1997).

RESULTS AND DISCUSSION

The drug appears as a dark brown powder. The pH of the drug was 6.5. It denotes it is slightly acidic. Hence, in the oral administration of the drug, it may be absorbed quickly in the stomach. Loss on drying of Veera ayachendhuram at 105ºC is 7.31%. This reveals that drug will not lose much of its volume on exposure to atmospheric air at room temperature. It shows that the drug has more stability (Table 1).

SEM

Figure 1 shows the particle size of the drug VAC as 1-3 micron in a Scanning Electron Microscope(SEM). The particles were homogeneously distributed in the chendhuram. Hence the drug will have increased bioavailability.

ICP-OES

In ICP-OES As, Pb, Cd was found belowdetection
level and the Hg around the permissible level in Veera AyaChendhuram (VAC). Hence, it may be safe for human consumption. It also shows the presence of calcium, iron, sodium, phosphate, magnesium, potassium, zinc and phosphorus in the Veera AyaChendhuram (VAC). Table 2

CONCLUSIONS

Various standardisation on studies have been carried out to evaluate the physicochemical characters, chemical compounds and particle size of the drug VAC through ICP-OES and SEM respectively. Hence it is concluded that the drug is more stable, and it also shows the presence of calcium, iron, sodium, phosphate, magnesium, potassium, zinc and phosphorus in the drug VAC. The particle size also concludes that it increases the bioavailability.

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Conflict of interest

The authors declare that they have no conflict of interest for this study.

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