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CHARACTERIZATION OF A SIDDHA DRUG (PŪRNA CANTIROTAYA CENTŪRAM): AN APPROACH TO STANDARDIZATION

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ABSTRACT

Siddha system of medicine is existing among the Indian society since time immemorial. However, in spite of their efficacy, they have been widely criticized due to lack of standardization and their complex preparation methods. The present study was designed as a step towards standardization of the herbo-metallic formulation, Pūrna Cantirotaya Centūram (PCC). To assure the quality of PCC, the drug was subjected to physico-chemical parameters as mentioned in PLIM guidelines, X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) and Energy Dispersive analysis of X-ray (EDAX). The SEM study revealed that the particles in the formulation are agglomerated. The particle size varied between 1 and 10 µm. EDAX study indicated that the drug contains mercury, sulphur, gold, sodium, potassium, calcium, carbon and oxygen in major percentage and magnesium, aluminium, silicon, iron and niobium in minor percentage. It is concluded that PCC is a complex compound, having very small particle size and essential elements that might be the reason for its wide ranging clinical efficacy.

KEYWORDS: Kaya karpa drug, tuberculosis, thathuporul karpam, rejuvenator, lingam, mercury and sulphur.

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INTRODUCTION

The renaissance of Herbal medicines, with possible treatment for many health problems have led to increase in the safety concerns regarding the drug usage. According to WHO, 80% of world population are opting for herbal drugs for major health care\(^1\). Siddha system was developed by the Siddhars, the ancient spiritual saints of India. It had been taught through oral tradition and being the lifestyle of the South Indian people from centuries ago. Siddha system laid emphasis on the healthier lifestyle through a holistic approach. In siddha medicine, metals like gold, silver, mercury, minerals such as sulphur, mica, arsenic, zinc and several other gems, shells, horns are treated with herbs and are given as white calx (Parpams) and red calx (Centũrams). Centũram is prepared by the process of sublimation\(^2\). Pũrna Cantirotaya Centũram (PCC) is a formulation prepared from Gold, Mercury and Sulphur in the ratio of 1:8:16. It is indicated for bronchitis, asthma, rat bite, tuberculosis, anaemia, dropsy, constipation, fever, dysentery, diarrhoea, lancinating pain, leucorrhea, impotency, infertility, skin diseases\(^3\). It improves the sperm count. It acts as a nervine tonic. It is one of the thathuporul karpam, i.e. mineral rejuvenator drug\(^4\). Siddha vaithiyars used mercury not only to cure innumerable diseases, but also to rejuvenate the body and promote longevity. Although longer used in medicine, it was used once as a purgative treatment in syphilis\(^5\). Mercury (II) complexes with 2-formylpyridinethiosemicarbazone showed good anti-amoebic activity\(^6\) and their complexes with isatin-3-thiosemicarbazone showed good antimicrobial activity\(^7\). Siddha system has five forms of mercury viz., mercury metal-rasam, red sulphide of mercury-lingam, mercuric chloride-veeram, mercury sub-chloride (mercurous chloride)-pooram and red oxide of mercury-rasa chenduram\(^8\). Pharmaceutical literatures in Siddha system never insisted to use raw liquid mercury for therapeutic purposes. Ancient Siddha practitioners were experts in converting inorganic substances into nano and ionic form, known as Alchemy (Rasavaatham) which is more reactive and readily absorbed by the human cells\(^9\). Alchemical process is said to be the most critical but significant method that transform the low quality metals like lead into noble metals such as gold etc., for the management of chronic diseases. By impregnating and triturating with organic material, like juices, decoctions of herbs etc., they are made homologous to the tissue cells, their toxicity is reduced and acceptability to the cell is increased. During this process, certain organic and inorganic materials are added to mercury, which helps to increase its medicinal efficacy and safety. Mercury if taken in crude form it is lethal, but when properly purified and processed it is converted into noble drug\(^10\). The method of processing mercury for therapeutic purposes is known as rasa suthi in Siddha system of medicine\(^8\). In Siddha tradition, it is used in combination with sulphur. An easy bond making with the metal ions i.e. the reactivity of sulphur makes it unique to act as a precursor in the preparation of Centũram\(^11\). The addition of sulphur is to control the fluidity of mercury and converts into mercuric sulphide, which is insoluble in mineral acids. Sulphur is a laxative, enhances bile juice secretion, alterative, antiseptic and diaphoretic. It is excreted through duct glands like sweat, urine, mammary glands. It enhances secretions of skin, bronchioles and rectum. Sulphur is mainly used therapeutically in eighteen types of leucoderma, flatulence, hepatomegaly, ascites, gastric ulcer, eye diseases, poisonous bites, chronic venereal diseases, rheumatic fever, diarrhoea and respiratory symptoms\(^8\). Gold plays an important role in diagnosis, microsurgery of the ear and therapeutic applications. After the nano gold synthesis, the research on therapeutic application has been increased. Gold is proposed for use in chronic rheumatoid arthritis and cancers. Studies have proved that combining gold nanoparticle with other anticancer drugs could possibly target cancer cells in breast cancer and AIDS related...
Kaposi’s sarcoma\textsuperscript{12}. Siddha literatures claim that gold formulations could be useful as rejuvenator, to delay the ageing process, to improve immunity especially in chronic disease conditions. The drug PCC needs expertise to prepare the drug appropriately. The preparation of PCC is given by Theraiyar and Thirumoolar siddhars. The special effects of the drug were dealt by Thirumoolar in his verse as if a person take this drug for his ailment, he not only get cured from the disease, but also he can live long without any disease, can avoid greying of hair and halt aging. The previous work in the same drug explored its content as mercuric sulphide and gold oxides. However, the exploration of its preparation method comprehensively dealt in the present study with the standardization of the final product through physicochemical and analytical studies.

**MATERIALS AND METHODS**

*Procurement and authentication of raw drugs*

The raw drugs of mercury and sulphur were purchased from an authentic raw drug store in Chennai. Gold was purchased from India Post as 24 carats. The above raw drugs were authenticated by the Chemist, Siddha central research institute, Chennai. The plant juices were collected from Herbal garden, National Institute of Siddha, Chennai. These plants were authenticated by Assistant professor (Botany), National Institute of Siddha, Chennai (Fig.1).

**Figure 1**

*Showing Raw drugs for the preparation of PCC, Plantain stem pith, b) Red cotton flower, c) 24 carat Gold Coins, d) Raw Mercury, e) Raw Sulphur.*

**Purification Process**

Purification and Stage wise preparation method with the photographs are given below: The raw materials were purified as mentioned in the Siddha literature as follows, Gold was made as a thin foil by heat striking with rod repeatedly on it. Then it was coated with red soil (chemman) paste and dried. Then the foil was heat flared and washed. This process was repeated for six more times (Fig. 2).
The mercury was ground with brick stone powder and turmeric powder, each for one hour. Then washed in pure water, boiled with *Acalypha indica* (*kuppai meni*) plant juice, until it vaporized (Fig. 3).

The sulphur was taken with cow’s butter in an iron spatula, heated to melt and poured into Cow’s milk. This process was repeated for 30 times (Fig. 4).

Then the dried pellets were put in a mud vessel (*kuppi*) closed with mud plate and the junction was sealed with mud smeared cloth (*Seelai mann*) and allowed for complete drying. Then.

**Method of preparation**

*Pũrna Cantirotaya Centũram* (PCC) was prepared as per the method indicated in *Siddha Vaidya Thirattu*. The quantity of gold, mercury and sulphur for the preparation of PCC is given in Table 1. The purified gold foils and mercury (*rasam*) were ground together, and then sulphur (*ganthagam*) was added. Then the coarse black powder was triturated with the juice of red cotton flower for two days (48 hours) consequently. The substance was allowed to dry. Then further triturated with the juice of plantain stem pith for another consecutive two days then made into pellets and dried (Fig. 5). Then the dried pellets were put in a mud vessel (*kuppi*) closed with mud plate and the junction was sealed with mud smeared cloth (*Seelai mann*) and allowed for complete drying. Then.
the mud vessel was subjected to incineration by *pudam* with casurina logs. The heat process (*Erippu thittam*) was applied as three types namely *Deepakkini* (slow simple flame), *Kamalakkini* (medium flame) and *Kaadaakkini* (High flame), each for 12 hours continuously. On the next day, after the mud *kuppi* cooled the seelai mann was carefully removed and the final product was collected and ground for one day to make homogeneously fine powder. The *Centũram* was stored in an airtight container (Fig. 6).

**Figure 5**

*a) Mixture of gold, mercury and sulphur, b) Grinding with redcotton flower juice, c) Grinding with plantain stem pith juice*

**Figure 6**

*a) Medicinal pellets containing mud vessel with seelaiman application before pudam, b) Mud vessel after pudam, c) Erippu thittam, d) Final Centũram*

**Table 1**

*Raw drugs with composition*

<table>
<thead>
<tr>
<th>S.No</th>
<th>Ingredients</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Thanga rekku</em> (Gold foils)</td>
<td>1 part</td>
</tr>
<tr>
<td>2</td>
<td><em>Rasam</em> (Mercury)</td>
<td>8 part</td>
</tr>
<tr>
<td>3</td>
<td><em>Ganthagam</em> (Sulphur)</td>
<td>16 part</td>
</tr>
</tbody>
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Siddha Properties
Siddha specifications of Centũram were carried out as per the procedure given in the standard siddha text\textsuperscript{13,14}.

Physico-chemical Analysis
The drug was subjected to physico-chemical analysis such as loss on drying at 105\degree C, total ash, water soluble ash and acid insoluble ash as per the methods described in standard books\textsuperscript{14,15,16}.

X-Ray Diffraction spectra
The XRD spectrum\textsuperscript{17} of PCC was recorded on a D8 ADVANCE model BRUKER make instrument. Cu K Alpha radiation was used for recording the spectra. The pattern was recorder from the angle 5 to 85 degree.

RESULTS AND DISCUSSION

Siddha Properties of PCC
The prepared PCC was initially tested on the parameters mentioned in standard Siddha texts. Bright red coloured PCC has no specific taste and odour. To check the fineness, on rubbing in between the thumb finger and index finger, it was fine enough to enter into creases of the finger. On sprinkling, it was floating on the surface of the static water taken in a bowl indicating its lightness. The Centũram was checked for any lusture in daylight and no lusture was observed. This is suggested by the test “absence of lusture” a quality to be looked for in the final product. The textual specification and inference are recorded in the Table 2.

Table 2
Siddha traditional standards as per PLIM Guidelines of Centũram

<table>
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<tr>
<th>S.No</th>
<th>Textual Specification</th>
<th>Inference</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Colour</td>
<td>Bright red colour</td>
</tr>
<tr>
<td>2.</td>
<td>Lusture</td>
<td>Not Lustrous</td>
</tr>
<tr>
<td>3.</td>
<td>In between the lines of the finger</td>
<td>Entering into the finger prints while rubbing in between the index and thumb finger</td>
</tr>
<tr>
<td>4.</td>
<td>Over the surface of water</td>
<td>Floats</td>
</tr>
<tr>
<td>5.</td>
<td>Odour</td>
<td>Odorless</td>
</tr>
<tr>
<td>6.</td>
<td>Taste</td>
<td>Tasteless</td>
</tr>
</tbody>
</table>

Physico-chemical Parameters
The loss on drying (LOD) indicates the moisture present in a drug under investigation. In this study, the LOD of PCC was calculated to be 0.699\%, which is very less, it eventually designates its extensive shelf life. This confirms that Centũram retain their potency for 75 years as given in Siddha literature\textsuperscript{5}. The total ash of PCC was determined as 38.60 \%, which means that PCC contains 61.4 \% of organic matter or decomposable inorganic matter. Water-soluble ash was found to be 15.67 \%. It may be due to the presence of soluble cations such as sodium, potassium and other anions. The acid insoluble ash value of 19.56 \% reveals the content of hydrochloric acid insoluble metals and minerals, which may be gold in this case. The low value of the acid insoluble ash suggests the greater physiological availability of the drug. All the physico-chemical results are presented in Table3.
Table 3
Physico-chemical results of Pūrna Cantrotaya Centūram

<table>
<thead>
<tr>
<th>S.No</th>
<th>Physico-chemical Parameter</th>
<th>Mean (n=2) ± SD</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Loss on Drying at 105°C, % w/w</td>
<td>0.699±0.099</td>
</tr>
<tr>
<td>2.</td>
<td>Total Ash, % w/w</td>
<td>38.60±0.22</td>
</tr>
<tr>
<td>3.</td>
<td>Water soluble Ash, % w/w</td>
<td>15.76±0.11</td>
</tr>
<tr>
<td>4.</td>
<td>Acid insoluble Ash, % w/w</td>
<td>19.56±0.10</td>
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**X-Ray Diffraction spectra**

X-ray diffraction study of the final product did not give sharp peaks, indicating the loss of crystalline nature. Lack of crystallinity, i.e., amorphization, increased wettability and dispersibility and particle size reduction are considered to be important factors for dissolution rate enhancement. The complete XRD pattern of PCC is shown in Fig. 7. The XRD pattern showing the peak of gold is shown in Fig. 8 and that of mercuric sulphide is shown in Fig. 9. Mercuric sulphide (marked as cinnabar) is the product, which has formed during the process. The study also revealed peaks of mercuric sulphide, gold in the final product. The formation of some different compounds in the final product may be due to oxidation and reduction reaction of Au, Hg with sulfur in the presence of oxygen. In the process of PCC preparation, mercury is converted to its sulfide form in a major since the sulfur is an adjunct to the metal in the processing. During the heat treatment, some sulfides may be transformed to oxide. Because metallic sulfides when heated in air get converted to oxide of the metal and sulfur dioxide. Therefore, some oxides of gold and mercury are also found in the PCC. Many metal oxides are toxic; in comparison, a sulfide of a metal is generally less toxic compared to its oxide or chloride, being relatively less soluble in body fluids.

![Complete XRD spectrum of PCC](image-url)
Use of advanced analytical techniques is the highest need of time for the development of quality control parameters of the drug sample. Among them, SEM is the technique, which reveals the information on external morphology (texture), chemical composition and crystalline structure and orientation of materials making up the sample\textsuperscript{22}. SEM analysis results (Fig.10) revealed that the particle size varies from 1 - 10 µm. As the preparation involves crunching of raw materials with herbal juices, heat processes and subsequent cooling of product, it tends to agglomerate the drug particles, which causes the particle size variation. Present study clearly depicted the role of every step of purification in removing the toxicity of minerals used and in reducing the particle size and in converting the drug PCC into more nano-crystalline form, thus making the mineral preparation more biocompatible and contributed significantly in relieving the sufferings of ailing human society. The EDAX spectra showed the presence of 23.08% of mercury, 10.16% of sulphur, 20.18% carbon, 31.88% of oxygen, 3.5% of potassium, 2.32% of sodium, 2.77% of gold, 2.11% of calcium and other elements include magnesium (0.31%), iron (0.62%) sulphur (0.81%). The minor nutrients are responsible for the therapeutic action of the drug. The presence of calcium and magnesiu was reported in the previous studies\textsuperscript{22}. The EDAX spectrum is shown in Fig. 11 and the graphical representation in Fig. 12.
Figure 10
SEM images showing at different scales

Figure 11
EDAX graph showing various elements
CONCLUSION

Pūrna Cantirotaya Centũram is a classical herbo-mineral formulation having great therapeutic benefit containing mercuric sulphide as the major component, gold in considerable amount and other micronutrients in minor quantities. It is evident that it contains gold; however, the percentage of gold varies from the earlier reports. This difference could be justified only when different batches are prepared and studied under the same testing conditions.

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CONFLICT OF INTEREST
Conflict of interest declared none.

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