Standard manufacturing procedure of Makshika Bhasma

Research article

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Abstract

Rasa Shastra is a pharmaceutical science of Ayurveda known as Ayurvedic pharmaceutics deals with the processing of metals and minerals having therapeutic importance. Swarna makshika is an important mineral of Maharasa varga frequently used in therapeutics since Samhita period. Ancient Rasa Scholars have developed number of processing methods for a single drug by which crude form of drug converted into highly potent therapeutic agent. It is necessary to find out the standard manufacturing procedure for metals/minerals bhasma which ensures the quality, safety, efficacy, and reproducibility of the products for their global acceptability. This paper aims to make available SMP of Swarna makshika bhasma by kupipaka followed by putapaka method. Longitudinal muffle furnace instead of conventional voluka yantra was found advantageous for kupipaka of Swarna makshika with kajjali. Makshika obtained after kupipaka was further subjected to 6 puta with 4 kg cow dung cakes fire for genuine bhasma preparation.

Key words: Process, Sodhana, Marana, Puta, Standard

Introduction:

Ayurvedic pharmaceutics is a science and art of drug manufacturing. History of Ayurveda is as old as the history of mankind. In the development stream of civilization it was simultaneously developed. Drug, disease and their management are available in Vedic literature but in a scattered manner. It is found systematized later during Samhita period. During this period the use of different Ayurvedic dosage form of herbal drugs were frequent. Up to Samhita period, the use of metals, minerals in therapeutics were very limited and their processing techniques were not developed. During that period, minerals and metals were converted in to fine powder form with the help of heating, quenching, grinding and filtering and used for therapeutic purposes. After development of Rasa Shastra in medieval period as an independent branch of learning, many other specialized processing techniques like Shodhana (Purification), Marana (Incineration), Amritikarana (Nectorization), Satvapatana (Extraction of metal), Samskara (specialized processing techniques specially used for mercury) etc. were developed to convert raw and crude material in to easily absorbable therapeutic forms. Sodhana and marana occupy a major place in making Ayurvedic mineral and metallic bhasmas free from toxicity and easily digestible, absorbable and assimilable into the body.
tissues. Due to growth of commercialization of Ayurvedic pharmaceutics, it is difficult to get genuine bhasma with desired medicinal properties mentioned in classical texts. Hence it is essential to standardize the prepared bhasma at pharmaceutical level. Ancient Rasa Scholars have evolved number of shodhana and marana procedures for each metal and mineral. Selection of excellent, trouble-free and economical method for the preparation of metallic bhasma with regards to its safety, efficacy and cost effectiveness is essential. In this study, bharjana (roasting) method for shodhana amongst various methods described for shodhana and kupipaka followed by putapaka for marana of Swarna Makshika have been selected for establish standard manufacturing procedure of Makshika bhasma.

Aim and objectives:
1. To study the effect of shodhana process on Makshika.
2. To find out the best, easy and cheap method and to set forth standard manufacturing procedure of Makshika bhasma.

Materials and Methods:
Raw Swarna makshika was procured from the Ayurvedic Pharmacy, Faculty of Ayurveda, I.M.S., B.H.U., Varanasi. Other allied material i.e. Gandhaka, Parada and Lemon is procured from the local market.

Shodhana of Swarna Makshika:
Reference : Rasa Tarangini 21/7-11
Principle : Bharjana (Roasting)
Ingredients : Raw Swarna Makshika: 1 kg & Lemon juice: q.s.
Equipments : Iron pan, Spatula, Kosthi, Khalva yantra

Procedure:
Raw Swarna Makshika was taken in a clean and dry khalva yantra and pounded well to prepare its fine powder. Fine powdered Raw Swarna Makshika was kept in a clean and dry iron pan and subjected to intense heat at about a temperature of 750°C- 900°C. The iron pan is then closed with an iron lid to avoid loss of material due to dusting. This process was continued for three days after complete cessation of sulphur fumes and till the mixture become red like fire.

Observations:
During the process, fume and odour of sulphur was emitted. During the addition of lemon juice in to heated iron pan dust of material comes out. Initially powdered Swarna Maks was greenish black in colour then gradually changed in to blackish brown and finally reddish brown colour. Total duration of 3 days was required for completion of sodhana process. After completion of process loss in weight of Swarna Makshika was observed.

Result:
Initial weight - 1 kg
Final weight - 920 g
Loss - 80 g

Reason for loss:
Sulphur gets burnt and evaporated in the form of oxides of Sulphur and some particles of Makshika escapes in the form of dust / fine powder during roasting.

Marana of Swarna Makshika:
Reference : Rasayan Sar Page 286-287/282-283
Principle : Kupipaka & Putapaka
Ingredients : Sudha Parada 100 gm, Sudha Gandhaka 100 gm, Sudha Makshika 100 gm & Lemon juice: q.s.
Equipments : Khalva yantra, Valuka Yantra, Iron rod, Cloth and Mud smeared glass bottle
Preparation of Mixture:

Sudha Parada 100 gm and Sudha Gandhaka 100 gm were taken into a stone mortar and triturated till black coloured, shining free powder (Kajjali) was formed. In this 100 gm Shodhita Swarna makshika was added and triturated with nimbu swarasa till whole the material became homogenous and dried. Kajjali of Shuddha Parada, Shuddha Gandhaka and Shuddha Swarna Makshika were prepared for preparation of Swarna Makshika Bhasma following Kupipakwa method as initial step and then puta paka.

Kupipaka:

Filling of kachkupi: 300 gm. of Kajjali was filled in the bottle with the help of funnel.

Heating of Kupi in Electric Muffle Furnace: Kajjali filled Kach-kupi was kept in a vertical furnace and heating was started. Temperature was maintained in increasing order of mrudu, madhya and teevragni dividing the time into 3 parts as shown in the given table.

### Table No. 1: Shows different stages of Kupipaka process.

| Type of Agni | Temperature        | Stages            | Time |
|--------------|--------------------|-------------------|------|
| Mraduagni    | Up to 250°C        | Stage of melting  | 3hrs |
| Madhyamagni  | 250°C-450°C        | Stage of fuming   | 3 hrs|
| Teevragni    | 450°C-650°C        | Stage of flaming  | 4hrs |

Procedure and observations:

- At the starting of the experiment temperature recorded was 20°C.
- Temperature was recorded after every 15 minutes.
- Just after one and half hour when temperature reached 180°C, slowly yellow fumes started emitting from the mouth of the bottle.
- On increasing temperature, emission of fumes becomes dense. Gradually the temperature was allowed to rise up to 250°C.
- Red hot iron rod was repeatedly inserted into the mouth of bottle to clean the blockage if occurs during the stage of fuming.
- After three hours, during madhyamagni dark yellow fumes started to emerge out of the bottle in profuse quantity. The temperature recorded was 310°C. Gradually the temperature was allowed to rise up to 450°C. At this temperature fumes were completely subsided.
- When temperature was 500°C, blue flame comes out at the time of inserting red hot iron rod in to the bottle.
- At the temperature 525°C yellow coloured flames started coming from the mouth of the kupi, which reached a maximum height of 3 inches with increasing temperature. At this stage the temperature was 580°C.
- Gradually the length of flame was shortened and after 45 minutes it was disappeared. At this stage the temperature was 600°C.
- When the flames disappeared, bottom of the bottle became red hot, a copper coin was put on the mouth of the bottle and white shining particles of mercury were observed then corking was done and sealed.
- After corking high temperature of 650°C was given for ½ an hour and after that E.M.F. was switched off and allowed for self cooling.
- Next day when furnace was cooled, bottle was taken out and breaking was done as given below.

Breaking of Kupi:

Next day when furnace was self cooled then the bottle was carefully taken out, cleaned by scraping the outer covering of the bottle, a kerosene soaked thread was wrapped in the middle, over it and burnt. When flame was declined small amount of
water was sprinkled over the heated part of the bottle. This makes the bottle to break with a sound symmetrically. Carefully separated the both parts and partially prepared Swarna Makshika Bhasma was procured from bottom of the bottle and Rasa sindura was collected from the neck of the bottle.

Colour of Partially prepared Swarna Makshika bhasma was Blackish Green. Obtained bhasma was very smooth, rekhapurna and varitara but did not pass amla pariksha.

Table No. 2: Showing the Results of Kupipakwa process.

| Weight of Kajjali | Weight of Makshika bhasma (After Kupipaka) | Weight of Rasa Sindura |
|-------------------|-------------------------------------------|------------------------|
| 300 gm            | 96.5 gm                                   | 112 gm                 |

Putapaka:
Ingredients:
Makshika Bhasma (After Kupipaka): 96.5 g & Lemon juice: q.s.

Equipments:
Sarava (Casserole), Khalva yantra (Stone mortar with pestle), kapada mitti (Cloth smear with mud), Upala (Cow dung cakes), pyrometer etc.

Procedure:
Partially prepared Swarna makshika bhasma was put into a stone mortar and triturated with lemon juice until it was became like smooth paste. Thin, round and small chakrika were made with paste and dried in sun shine. Properly dried, greenish black coloured and weighted chakrika were arranged in a sharava and closed by another sharava. Gap between sharava was sealed by cloth smeared with clay for seven times and allowed to dry. Properly sealed and dried samputa was subjected to puta system of heating with 4 kg cow dung cakes. Same process was repeated for 6 times to obtain desirable Swarna makshika bhasma. The prepared bhasma had passed all confirmatory tests of properly prepared bhasma specified in classics for makshika bhasma.

Observation:
Greenish black pellets were turned to brownish black after 1<sup>st</sup> puta, from 2<sup>nd</sup> puta onwards the colour of material was gradually converted in to Reddish brown. After 1<sup>st</sup> puta pellets were very hard in consistency but after 2<sup>nd</sup> puta gradually pellets become soft. Initially after puta weight of pellets was decrease but after 3<sup>rd</sup> puta weight of pellets gradually increases in small amount. Till 3<sup>rd</sup> puta, partially prepared bhasma was slightly passed varitara and other required testing parameters of bhasma. After 6<sup>th</sup> puta material was passed all required classical test parameters of bhasma.

Result: Initial weight - 94g
Final weight - 102g
Gain - 08 g
Reason for gain: Due to the formation of different compounds.

Discussion:
Shodhana and Marana are the two essential steps for the preparation of Ayurvedic bhasma. Shodhana detoxifies the crude raw material and make them suitable for marana. Swedana, Mardana, Bharjana, Nirvapana and Putapaka are the different pharmaceutical techniques (principles) adopted by our Acharyas for Makshika shodhana. Bharjana method of shodhana was adopted for this study with the idea to make material fine and to provide maximum time to expose all material for chemical reactions. For this, procured Makshika was crushed and grinded to 80 mesh size and then roasted with nimbu swarasa at temperature ranges between 750<sup>o</sup>C-900<sup>o</sup>C with continuous stirring with the help of iron pestle. During roasting sulphur fumes was liberated from the Makshika in the form of oxides of
sulphur. The roasting was continued till the fumes of sulphur stops and the material becomes reddish brown in colour.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{graph1}
\caption{(Graph 1: Showing the heating pattern of kupi paka)}
\end{figure}

Apart from the puta system of heating, kupipaka in valuka yantra for marana is preferred by some Rasa scholars. As Rasa Vagbhata stated that mercury is the best material for incineration of metals. Hasty trituration, specific pattern of temperature and pressure promote the amalgamation of material with mercury. Amalgamation helps disintegration of material into fine particles. Due to this, the surface area of the material is extensively enhanced, which facilitates the rapid compounding process. Thus mercury acts as a catalyst in the compounding reaction and minimizes the time and labour. Due to these reasons, mercury was selected as medium for marana of Makshika. In this study shodhita Makshika was subjected to kupipaka followed by putapaka. For kupipaka instead of the traditional voluka yantra a modified electric muffle furnace (vertical) was used. The product obtained after kupipaka was further subjected to 6 puta with 4 kg cow dung cakes. Kupipaka has its own importance as Rasa Sindura can be procured as byproduct. In kupipaka process, a particular quantity of gandhaka is utilized by mercury forms Mercuric sulphide and sublimated at the neck of the kanchakupi which is collected as Rasa Sindura and some amount of gandhaka is escaped from the kupi. After proper paka fine powder of greenish material is found at the bottom of the kupi. XRD study of this material reveals that the material was CuFeS₂. It may be due to some parts of the sulphur are still remaining un-reacted in the bottom of the bottle. On a specific temperature and condition, this un-reacted Sulphur may react with Copper and Iron and get converted into Copper pyrite. But it was so fine and after putapaka quickly converted in to desire quality of Makshika bhasma. Kupipaka treatment with kajjali before putapaka, allow the material undergo hasty oxidation and reduction reactions in the presence of heat, oxygen, sulphur and mercury.

**Conclusion:**

Mercury and sulphur together act as the best media in preparing metallic and mineral bhasma. Muffle furnace is found advantageous than the conventional valuka yantra with regards to controlled valuka yantra (regulated) system, economical (saves land, labour, and capital) and prevention of dirt and contamination. It was found suitable for achieving optimum yield of the product. Marana with kajjali and
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