

## PHARMACEUTICAL AND ANALYTICAL STUDIES ON SWARNA MAKSHIKA BHASMA – AN AYURVEDIC FORMULATION

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### ABSTRACT

*Swarna Makshika* (Chalcopyrite) is one of the main ores of Copper. It is also known as Copper pyrite. *Swarna Makshika Bhasma* is one such a drug, which is being used since ancient days. The classical texts of *Ayurveda* mentioned *Swarna Makshika* in the cure of various disorders. The present study aims at evaluation of *Swarna Makshika Bhasma* which was prepared by selected *Sodhana* (Purification) and *Marana* (Incineration) process. The *Bhasma* thus prepared was analyzed with standard parameters. It was also characterized by using Particle size analyzer, X-ray diffraction spectroscopy etc. The results are discussed in this paper.

**Keywords:** *Swarna Makshika, Bhasma, Ayurveda, X-ray diffraction spectroscopy*

### INTRODUCTION

*Swarna Makshika* is included under *Maharasa, Uparasa, Upadhatu* by various authors. Since *Samhita Kala* till today it has occupied an important place in *Ayurvedic* system of healing. It has a great importance in alchemical and therapeutic point of view. This is well explained in *Rasa Ratna Samuchaya*<sup>1</sup>.

*Swarna Makshika* has a typical chemical composition of Copper, Sulphur and Iron. These three elements are essential and play a vital role in the formation of Haemoglobin. Due to this it can cure various diseases alone and as a compound drug. *Swarna Makshika Bhasma* is considered therapeutically superior to other *bhasmas* of the iron group. It is also considered therapeutically superior because it has a *yogavahi guna* meaning that this drug has synergetic action.

*Swarna Makshika Bhasma* is indicated in the effective management of *Mandagni* (Poor digestion), *Anidra* (Insomnia), *Apasmara* (Convulsions), *Pandu* (Anemia) etc. It is one of the ingredients in popular preparations like *Chandraprabha Vati, Trilokya Chinthamani Rasa, Jayamangala Rasa* etc.

### MATERIALS AND METHODS

#### *Swarna makshika sodhana* (Purification)

The required raw drug *Swarna Makshika* and *Saindhava Lavana* (Rock Salt) was purchased from the market. Thus the obtained *Swarna Makshika* was blackish in colour with golden tints. The Raw *Swarna Makshika* is shown in Fig.1 and *Saindhava Lavana* is shown in Fig. 2. The required quantity of lemon for sufficient quantity of *Nimbu swarasa* (Lemon juice) was procured from the market.



Fig 1: Raw *Swarna Makshika*



Fig 2: *Saindhava Lavana*

#### Materials

1. *Asuddha Swarna Makshika* (impure) – 5 Kg
2. *Saindhava Lavana* – 1.25 Kg
3. *Nimbu Swarasa* (Lemon juice) – 2.5 litres

#### Method

*Asuddha Swarna Makshika* was taken and powdered with the help of *ulukhala yantra* (pounding instrument). This powder was sieved through No. 80 mesh. *Saindhava Lavana* was also powdered and sieved. These two powders were mixed thoroughly and subjected to *teekshnagni* (intense heat) in an iron pan. The mouth of the iron pan should be closed with a lid. The heat was given for 3 hrs. Then the iron pan was removed from the fire and *nimbu swarasa* was poured in to it. This was mixed with an iron spatula till a homogenous mixture is obtained. Again it was kept over fire till the juice get dries up. Then it is allowed to cool by itself. Fresh water was added to the obtained *Swarna Makshika* powder, macerated with the hands for several times and the water is decanted. This procedure was repeated till the salty taste completely removed. Again it was heated till the water content gets evaporated.

Smell of sulphur was emitted when *Swarna Makshika* was heated. Smoke of sulphur produces irritation in the nose and throat. Color of *Asuddha Swarna Makshika* powder was blackish with shining particles in it. After heating, slowly it attains reddish brown color with shining particles. Freshly collected *Nimburasa* (Lemon juice) was used in the process. Face was covered with a mask to avoid sulphur fumes at the time of boiling. After purification the weight of

Swarna Makshika was 4.5 Kg. The weight loss observed was 500 gm<sup>2</sup>.

### Swarna makshika marana (Incineration Process)

#### Materials

1. Suddha Swarna Makshika (purified) – 4.5 Kg
2. Kumari Swarasa (Aloe vera juice) – 2 Kg

#### Method

Suddha Swarna Makshika powder is ground with kumari swarasa in an end runner, till it attains semisolid paste like consistency. Then chakrikas (small round pellets) were made and dried. After drying these chakrikas were kept in sharava samputa (earthen plate) and sealed with the help of cloth smeared with multani matti. This was subjected to Varahaputa. The same process was repeated for 29 times. For each puta fresh kumari swarasa was added.

During each trituration the quantity of kumari swarasa was reduced gradually. The range of trituration time was 6 – 8 hours for each puta. The average drying time of chakrikas under sunlight was 12 hours.

Trituration was done properly to get fine swarna makshika particles. Chakrikas were dried well before subjecting to puta. Sandhibandana (sealing) of sharava samputa was done properly and dried properly before each puta. Bhasma was collected carefully after opening the

sharava samputa when it attains swangasheeta (self cooling) <sup>3</sup>. Fixed quantity of upalas (Cow dung cakes) were used for each puta. The final product is shown in Fig.3.

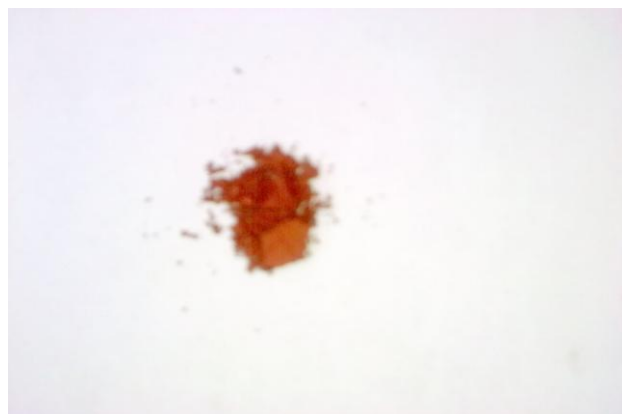


Fig. 3 Swarna Makshika Bhasma

#### Observations

The observations made during the incineration process are shown in Table No – 1. Graph No – 1 shows the temperature during puta. The temperature observed is shown in Table No – 2.

Table 1: Observations of Swarna Makshika Bhasma in different Putas

| No of Puta     | Wt of the Bhasma (Kg) | Wt of Cow dung cakes | Color          | Odor     | Taste      |
|----------------|-----------------------|----------------------|----------------|----------|------------|
| First          | 4.30                  | 35 Kg                | Reddish brown  | Odorless | Astringent |
| Fifth          | 3.42                  | 35 Kg                | Reddish brown  | Odorless | Astringent |
| Tenth          | 2.82                  | 35 Kg                | Slightly brown | Odorless | Astringent |
| Fifteenth      | 2.52                  | 35 Kg                | Slightly brown | Odorless | Astringent |
| Twentieth      | 2.37                  | 35 Kg                | Slightly brown | Odorless | Astringent |
| Twenty-fifth   | 2.05                  | 35 Kg                | Brown          | Odorless | Tasteless  |
| Twenty – ninth | 1.94                  | 35 Kg                | Brown          | Odorless | Tasteless  |

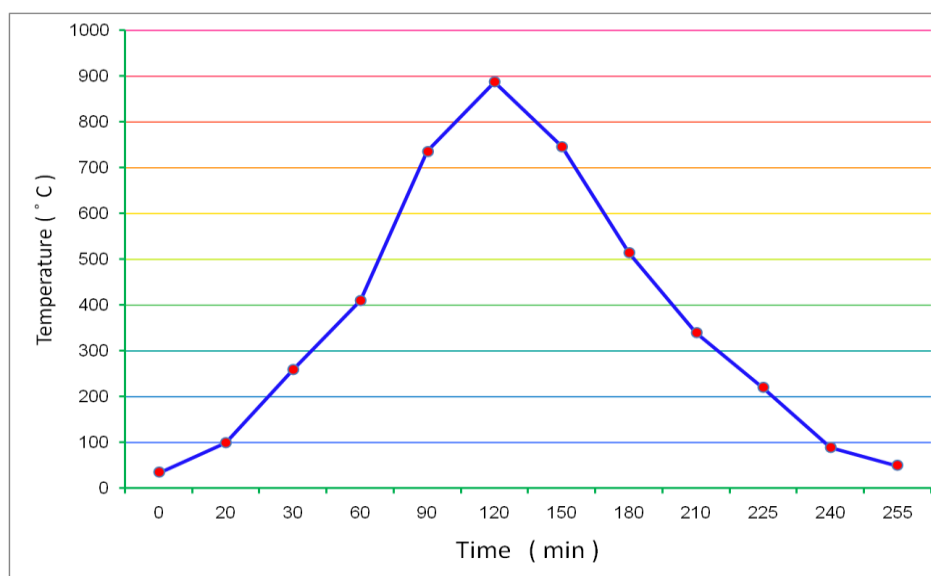
### Amriteekarana

#### Materials

1. Swarna Makshika Bhasma – 1.94 Kg
2. Triphala Kwatha – 3 litres
3. Surana Kanda (*Amorphophallus dusius*) – 1
4. Multani matti – QS

Swarna Makshika Bhasma thus prepared, was subjected to amriteekarana. Amriteekarana<sup>4</sup> is the process by which the

remaining doshas (impurities) after puta are removed. It was given bhavana with Triphala Kwatha (decoction of *Terminalia chebula*, *Terminalia bellirica* and *Phyllanthus emblica* fruits) for 3 hours and allowed to dry. It was then made in to bolus and kept inside the surana kanda and covered with ground surana pieces. The whole surana kanda was wrapped with multani matti applied cloth. It was dried and subjected to Gajaputa. The next day after swangasheeta, it was collected, weighed and made in to fine powder. The weight of Swarna Makshika Bhasma after Amriteekarana was 1.5 Kg.



Graph No1 :Temperature Graph of Varahaputa

Table 2 :Temperature chart of *Varahaputa*

| Time     | Temperature in ° C |
|----------|--------------------|
| 11.30 am | 35 ° C             |
| 11.50 am | 100 ° C            |
| 12.00 pm | 260 ° C            |
| 12.30 pm | 410 ° C            |
| 1.00 pm  | 736° C             |
| 1.30 pm  | 887 ° C            |
| 2.00 pm  | 746° C             |
| 2.30 pm  | 514 ° C            |
| 3.00 pm  | 340° C             |
| 3.15 pm  | 220 ° C            |
| 3.30 pm  | 90 ° C             |
| 3.45 pm  | 50 ° C             |

**BHASMA PAREEKSHA (Ayurvedic Parameters of testing *Bhasma*)****Varitara**

A little amount of prepared *Swarnamakshika Bhasma* was put on the surface of water and observed. It was found that the *bhasma* particles float on surface of the water. Surface tension is the principle of *Varitara Pareeksha*<sup>5</sup>.

**Rekhapurnata**

A pinch of *bhasma* was rubbed in between the thumb and the index finger. It was observed that the *bhasma* particles enter in to the furrows of the fingers<sup>6</sup>.

**Nischandratva**

The *bhasma* was taken in a Petri dish and observed for luster in daylight through magnifying glass. No luster was observed.

**Nisvadu**

The prepared *Swarnamakshika bhasma* was found to be tasteless when a small quantity was kept on the tongue.

**Avami**

Ingestion of 5 – 10 mg of *bhasma* did not produce any nausea or vomiting.

**Amla Pariksha**

A small quantity of *bhasma* was mixed with little amount of curd in a Petri dish and observed for any colour change. No colour change was observed. Hence the *bhasma* prepared is of good quality according to *Ayurvedic* parameters.

**RESULTS**

The analyses were carried out at Centre for Advanced Research in Indian System of Medicine (CARISM), SASTRA University, Thanjavur, Tamilnadu.

**Physico chemical analysis**

The prepared *Swarna Makshika Bhasma* was subjected to Physico chemical analysis following the standard procedure. The results are given in Table 3.

Table 3: Physico chemical Analysis

| Sample                        | Description                | Loss on drying at 105°C | Total Ash (%) | Water soluble ash (%) | Acid insoluble ash (%) |
|-------------------------------|----------------------------|-------------------------|---------------|-----------------------|------------------------|
| <i>Swarna Makshika Bhasma</i> | Brown coloured fine powder | 2.7571                  | 90.0758       | 40.1555               | 76.9230                |

**Sieve Analysis**

The final product was subjected to sieve analysis with different number sieves to know the fineness of the *bhasma*. The results of sieve analysis are shown in Table No4.

Table 4: Sieve Analysis

| Seive No. | Retained  | % Retained | % Passed |
|-----------|-----------|------------|----------|
| 240 BSS   | 32.810 gm | 63.620%    | 36.380%  |
| 300 BSS   | 5.823 gm  | 11.646%    | 24.734%  |
| 350 BSS   | 1.353 gm  | 2.7060%    | 22.028%  |
| 400 BSS   | 2.053 gm  | 4.106%     | 17.922%  |
| Pan       | 8.203 gm  | 16.406%    |          |

**Particle size analysis**

The Particle Size Analysis (Bluewave Microtrac, Nikkiso, Japan) .The Particle size analysis of the final product revealed that the average particle size after *puta* process is 30.00 +/- 20.60. It is shown in Fig.4.

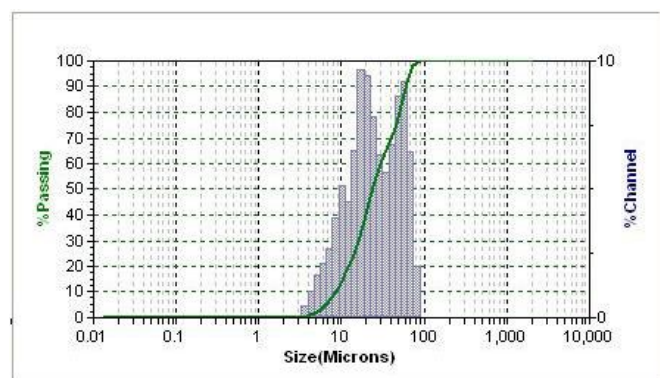
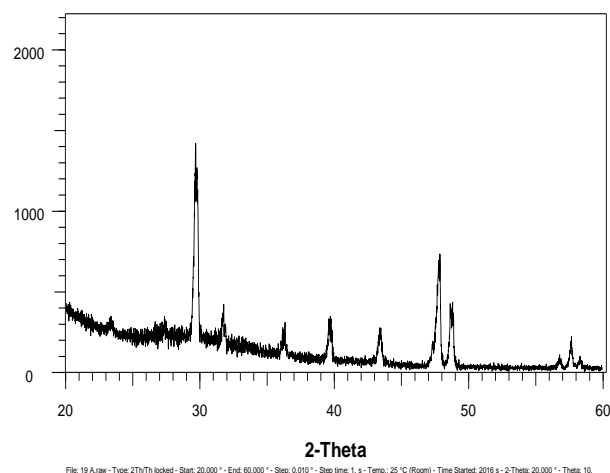


Fig 4: Particle Size Analysis

**X – Ray diffraction spectroscopy (XRD)**

X – Ray diffraction spectroscopy (Bruker D8 FOCUS). The XRD pattern of *Swarna Makshika Bhasma* is shown in Fig.5.

Fig 5: X- Ray Diffraction Studies on *Swarna Makshika Bhasma***DISCUSSION**

In this study, *saidhava lavana* and *nimbu swarasa* were used for *sodhana* of *swarna makshika*. In this procedure blackish powder of *swarna makshika* turns to reddish brown. During the process sulphur burns out which are evident from the fact that the sulphur smell is felt. The logic behind adding *saidhava lavana* is crucial to expedite the process of internal reaction at lower temperature. It acts like flux, which helps in removing gangue materials. The weight loss observed was 500 gm.

In the *marana* process, *kumara swarasa bhavana* and *varaha puta* was given. The colour of *chakrikas* were initially reddish brown and changes to slight brown by 11<sup>th</sup> *puta* and to brown colour by 25<sup>th</sup> *puta*. *Kashaya rasa* (astringent taste) was not seen after 23<sup>rd</sup> *puta*. *Chandrika* (luster) was lost by 29 *putas*. It attained *rekhapurnata* in 20<sup>th</sup> *puta* and *varitara* in 21<sup>st</sup> *puta*. By the end of 29<sup>th</sup> *puta* all the *bhasma lakshanas* like *nisvadu*, *varitara*, *rekhapurnata* etc. The total weight loss after *amriteekarana* was 3.5 Kg.

The total ash of the final product was 90.0758% which shows the presence of more inorganic matter. Sieve Analysis and Particle Size Analysis confirms the presence of micron sized particles. X-ray diffraction study shows the crystalline nature of the particles.

## CONCLUSION

The process of *sodhana* and *marana* play a vital role in the conversion of raw *swarna makshika* in to absorbable *Swarna Makshika Bhasma*. Among the different methods of *sodhana* and *marana* of *swarna makshika*, specific methods were selected and adopted in this study. According to the classics, 5 - 8 *putas* are sufficient to attain *bhasmata*. But in contrast to the classics, the desired *bhasma lakshanas* were obtained after 29<sup>th</sup> *puta* only. The increase in number of *putas* decreases the *doshas*. Subsequently the *gunas* of *Swarna Makshika Bhasma* increases therapeutically. There is a notable difference found in the particle size of the final product. It facilitates the easy absorption and assimilation of the drug in to the body system. Thus, the prepared *Swarna Makshika Bhasma* satisfies both ayurvedic and modern parameters of analysis.

## Glossary of technical terms used in this article

### Bhasma

*Bhasma* is a herbomineral preparation of *Ayurveda*, which is manufactured from metal/mineral by following typical *ayurvedic* pharmaceutical processes like *sodhana*, *marana* as documented in the ancient texts.

### Sodhana

It involves various pharmaceutical processes like heating and quenching in herbal juices, boiling in animal products like cow's urine, roasting in pan etc., in order to convert a metal/mineral in to a drug.

### Marana

The process usually followed by *sodhana* with an intention to convert metal/mineral in to a therapeutically potent drug using ancient *puta* system of heating.

### Putra

It is the measure of amount of heat required to convert or transform any metal or mineral in to *bhasma*. The amount of heat is substance specific and measured in terms of fuel used, number of cow dung cakes or its weight.

### Sarava

An earthen plate with specific measurements.

### Sarava Samputa

Keeping a *sarava* one over the other and sealing their edges with the help of *multani matti* (Rajasthan clay) smeared cloth.

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