"A Comparative Pharmaceutical Study of Two Types of Swarna Makshika Bhasma"

[1]Dr.Aditya Sharma[2] Dr. Anju Bala [3]Dr. Abhishek [4]Dr. Ravneet Kaur Chahal

[1]PG Scholar, Department of RSBK, Post Graduate Training and Research Institute, Government Ayurvedic College, Patiala, Punjab - 147001

[2]Principal & Professor, Department of Shalakya Tantra, Post Graduate Training and Research Institute, Government Ayurvedic College, Patiala, Punjab – 147001

[3]Lecturer, Department of RSBK, Post Graduate Training and Research Institute, Government Ayurvedic College, Patiala, Punjab – 147001

[4]Lecturer, Department of RSBK, Post Graduate Training and Research Institute, Government Ayurvedic College, Patiala, Punjab – 147001

Corresponding Author: Dr. Aditya Sharma

PG Scholar, Department of RSBK,

Post Graduate Training and Research Institute,

Government Ayurvedic College, Patiala,

Punjab-147001

Email ID: dradityasharma11@gmail.com

ABSTRACT

Introduction: *Swarna Makshika* (Chalcopyrite – $CuFeS_2$) is a *Maharasa* mineral mentioned in classical *Rasashastra* texts for conditions like *Pandu, Kamala, Yakritvikara,* and *Prameha.* In raw form, it is toxic and requires *Shodhana* (purification) and *Marana* (incineration) to make it therapeutically safe and effective. Different classics describe variations in *Marana*, which may influence the quality of the final *Bhasma*. **Objective:** To prepare and compare *Swarna Makshika Bhasma* by two classical methods – Type 1 (*Rasa Tarangini: Nimbu Swarasa Bhavana*, 11 *Puta*) and Type 2 (*Rasa Ratna Samucchaya: Nimbu Swarasa Bhavana* with *Shuddha Gandhaka,* 7 *Puta*) – with reference to *Marana Samskara.* **Methods:** Raw *Swarna Makshika* was purified by 21 times *Nirvapa* in *Nimbu Swarasa*. The purified mineral was then subjected to two *Marana* methods: Type 1 using *Nimbu Swarasa* alone, and Type 2 using *Nimbu Swarasa* with *Shuddha Gandhaka*. Classical *Bhasma Siddhi Pariksha* (*Varitaratva, Rekhapurnata, Nishchandratva, Apunarbhava*) was applied. **Results:** Both methods yielded reddish-brown, lusterless, tasteless *Bhasma*. In Type 1, *Siddhi* was achieved after 11 *Puta*, while in Type 2, *Siddhi* was attained after only 7 *Puta.* The addition of *Gandhaka* acted as a catalytic agent, facilitating quicker decomposition and finer *Bhasma* formation. **Conclusion:** Both methods are pharmaceutically valid. However, the RRS method with *Gandhaka* is superior in efficiency, requiring fewer *Puta* and producing a finer *Bhasma*.

Keywords: *Swarna Makshika, Shodhana, Marana, Rasa Tarangini, Rasa Ratna Samucchaya, Gandhaka, Bhasma*.

INTRODUCTION

Ayurveda, the ancient Indian system of medicine, recognizes the use of *Parthiva Dravya* (minerals and metals) in therapeutics after proper purification and processing. Among them, *Rasashastra* developed a unique branch of pharmaceutics that emphasizes systematic procedures like *Shodhana (purification)* and *Marana (incineration)* to transform naturally toxic and insoluble substances into safe, bioavailable, and therapeutically potent forms known as *Bhasma.*

Swarna Makshika **in Ayurvedic classics**

Swarna Makshika, identified with **Chalcopyrite ($CuFeS_2$)**, is classified under *Maharasa Varga*. It is praised in texts like *Rasa Tarangini, Rasa Ratna Samucchaya,* and *Ayurveda Prakasha.* Therapeutically, it is indicated in:

- *Pandu* (anemia),
- *Kamala* (jaundice, liver disorders),
- *Yakritvikara* (hepatic diseases),
- *Prameha* (diabetes),
- *Amlapitta* (acid–peptic conditions),
- *Kushtha* (skin disorders).

Apart from these, it is considered a *Rasayana* (rejuvenator), improving digestion, metabolism, complexion, and vitality.

Need for *Shodhana* and *Marana*

Raw *Swarna Makshika* is:

- Hard and insoluble,
- Metallic and non-bioavailable,
- Containing impurities such as arsenic and sulphur.

Thus, **pharmaceutical processing is mandatory**:

Processing of Swarna Makshika Prior to *Shodhana*

1. **Procurement and Initial Weight**
    - Raw Swarna Makshika weighing **2 kg (2000 g)** was taken for the study.
2. **Size Reduction (Pounding/Trituration)**
    - The raw mineral was broken into small pieces and converted into a semi-powdered form.
    - After pounding, the weight of Swarna Makshika was reduced to **1880 g**.
    - **Weight loss during size reduction:** 2000 g – 1880 g = **120 g**.
    - **Percentage loss:** (120 ÷ 2000) × 100 = **6%**.
    - **Yield after size reduction:** (1880 ÷ 2000) × 100 = **94%**.

- ***Shodhana****:* eliminates impurities, detoxifies, reduces hardness, and prepares the mineral for further processing.

Performed according to *Rasa Tarangini* in which *Swarna Makshika* is heated red-hot and quenched in lemon juice (*Nimbu Swarasa*) 21 times; this is considered proper *Shodhana.*

For the *shodhana* procedure, 1880 g of *Swarna Makshika* was taken and subjected to repeated *Nirvāpa* (quenching) in *Nimbu Svarasa* (lemon juice) for 21 cycles. After completion of the process, 1250 g of purified *Swarna Makshika was* obtained.

- ***Marana***: incinerates the purified mineral into a fine, lusterless, micro-particle Bhasma that is easily assimilated in the human body.

Reference – *Rasa Tarangini (21/19–20):*

Swarna Makshika triturated with lemon juice should be made into pellets, dried, placed in *Sharava Samputa,* and subjected to repeated *Puta* until pure and fine *Bhasma* is obtained.

Reference – *Rasa Ratna Samucchaya (2/78–79):*

Purified *Swarna Makshika* mixed with *Shuddha Gandhaka*, triturated with lemon juice, made into pellets, and incinerated repeatedly in *Sharava Samputa* yields fine *Bhasma* suitable for therapeutic use.

Classical methods of processing

Different classics describe different *Marana Samskara* for *Swarna Makshika*:

Two batches, each containing 500 g of purified *Swarna Makshika*, were prepared.

1. *Rasa Tarangini* method (RT):
    - *Swarna Makshika* purified by 21 times *Nirvapa* in *Nimbu Swarasa.*
    - Repeated *Nimbu Swarasa Bhavana* given.
    - Subjected to *Puta* (incineration in *Sharava Samputa*) and For each *Puta*, approximately 28–30 kg of cow dung cakes were used.
    - In this study, Siddhi was achieved after 11 *Puta*.
2. *Rasa Ratna Samucchaya* method (RRS):
    - *Swarna Makshika* purified similarly.
    - During Bhavana, Shuddha Gandhaka was added.
    - Subjected to *Puta* and For each *Puta*, approximately 28–30 kg of cow dung cakes were used.
    - Siddhi was achieved after 7 *Puta.*

This difference suggests that the use of *Gandhaka* may act as a *Marana Sahakari Dravya* (a catalytic substance aiding incineration).

Modern scientific correlation

- **Role of *Nimbu Swarasa:***
    - Rich in citric acid → creates an acidic medium during *Bhavana* and *Nirvapa*.
    - Facilitates the oxidation of sulfide minerals ($CuFeS_2 \rightarrow CuO, Fe_2O_3$).

- Repeated *Nirvapa* cycles cause thermal shock, brittleness, and structural changes in the mineral, making it suitable for *Marana.*

- **Role of *Puta* (incineration):**
  - Provides controlled, uniform heat in a closed system (*Sharava Samputa*).
  - Promotes decomposition of metal sulfides and stabilization of oxide/sulfate forms.
  - Repeated cycles ensure complete transformation and fineness.
- **Role of *Gandhaka* (sulphur) in RRS method:**
  - Acts as a reducing and catalytic agent during high-temperature processing.
  - Facilitates sulfur–oxygen exchange reactions, which accelerate decomposition of chalcopyrite.
  - Helps achieve fineness with fewer Puta, producing a softer, homogenous Bhasma.
  - Supports stabilization of the end-product and enhances pharmaceutical efficiency.

Thus, from a modern perspective, the difference in the number of *Puta* required (11 in RT vs 7 in RRS) can be explained by the catalytic role of *Gandhaka* in mineral decomposition and particle fineness.

Rationale for comparative study

- Both RT and RRS methods are classical and authentic.
- However, they differ in *Bhavana Dravya* (with or without *Gandhaka*) and the number of *Puta* required.
- Comparative documentation of these two methods helps:
  - Understand the pharmaceutical role of *Gandhaka* in *Marana.*
  - Establish standard parameters for *Swarna Makshika Bhasma* preparation.
  - Provide a scientific basis for validation of *Rasashastra* procedures.

Objective of the study

The present study was undertaken to evaluate and compare the pharmaceutical standardization of two types of *Swarna Makshika Bhasma*:

- Type 1 (*Rasa Tarangini* method): prepared with *Nimbu Swarasa*, attained after 11 *Puta*.
- Type 2 (*Rasa Ratna Samucchaya* method): prepared with *Nimbu Swarasa + Shuddha Gandhaka,* attained after 7 Puta.

This study highlights how variations in *Marana Samskara* influence the pharmaceutical outcome of *Swarna Makshika Bhasma.*

MATERIALS AND METHODS

election of Raw Material

The raw *Swarna Makshika* was procured from an authentic mineral supplier. On initial examination, it was found to be:

- Brassy yellow in colour,
- Metallic lustre present,
- Hard and crystalline in texture.

To confirm classical identification, *Rasa Tarangini* criteria such as colour, lustre, and hardness were referred to.

Associated materials used:

- *Nimbu Swarasa* (juice of *Citrus medica*) – fresh juice extracted daily, used for *Shodhana* and *Bhavana.*
- *Shuddha Gandhaka* – prepared by classical *Shodhana* using *Godugdha* and *Goghrita* as per *Rasa Tarangini (8/17–18).*
- *Sharava* (earthen saucers) – for *Samputa* preparation.
- *Puta* system – traditional cow dung cake. *Puta,* equivalent to *Varaha Puta,* was used.

Classical Tests for Bhasma (Bhasma Pariksha)

Both Type 1 and Type 2 preparations were tested using classical parameters:

1. ***Varitaratva*** – *Bhasma* floats on still water, showing lightness.
2. ***Rekhapurnata*** – *Bhasma* particles enter into the fine lines of fingers.
3. ***Nishchandratva*** – Absence of metallic lustre.
4. ***Niruthhikarna*** – No regeneration of metallic form when mixed with silver sheet.
5. ***Apunarbhava*** – No regeneration of *Bhasma* into its metallic form after mixing the *Bhasma* with *Mitrapanchaka* upon heating

All tests were satisfactorily passed by both *Bhasmas.*

Results

Results of *Shodhana* (Purification)

Raw *Swarna Makshika* was observed as a hard, crystalline mineral with brassy yellow metallic lustre. During the course of *Shodhana* (21 *Nirvapa* in *Nimbu Swarasa*), the following changes were recorded:

- After initial *Nirvapa* **(1–7 cycles):** The mineral began to lose its natural shine and hardness. Its surface colour darkened to a dull yellowish-brown, and it became slightly brittle. A distinct sulphurous Odor was perceptible during heating.
- After mid-stage *Nirvapa* **(8–14 cycles):** The metallic lustre almost disappeared. The material became progressively darker and more brittle. The Odor of sulphur was significantly reduced. On quenching, the acidic medium of *Nimbu Swarasa* produced effervescence, suggesting a chemical reaction.
- After final Nirvapa **(15–21 cycles):** The material turned completely brittle, blackish-brown in colour, and could be easily powdered with minimum effort. Metallic characteristics such as lustre and hardness were completely absent. The mineral was now suitable for *Marana.*

Thus, Shodhana resulted in detoxification, brittleness, and conversion of Swarna Makshika into a state amenable to incineration.

Results of Marana – Type 1 (Rasa Tarangini method)

- After the first Puta, the material was partially calcined with patches of metallic shine still visible.
- By the fourth Puta, metallic traces had almost disappeared; the powder was dark brown in colour but slightly coarse.

- After the seventh Puta, the material became more homogenous and reddish-brown in shade, though not completely fine.
- By the eleventh Puta, the material achieved complete transformation into fine, reddish-brown Bhasma, free from lustre and hardness.
- The Bhasma was soft to the touch, tasteless, and easily dispersible in water.
- Classical tests (*Varitaratva, Rekhapurnata, Nishchandratva, Apunarbhava*) were satisfactorily passed.

Siddhi Lakshana: Attained after 11 *Puta.*

Results of Marana – Type 2 (*Rasa Ratna Samucchaya* method with *Gandhaka*)

- After the first Puta, the mixture of Swarna Makshika and Shuddha Gandhaka turned into a more porous mass with no metallic shine.
- By the third Puta, the powder was soft, reddish-brown, and free from hardness, though some coarseness remained.
- After the fifth Puta, the Bhasma became finely powdered and smooth, showing better homogeneity compared to Type 1.
- By the seventh Puta, the Bhasma had completely achieved the desired characteristics: reddish-brown, soft, smooth, tasteless, and lusterless.
- Classical *Bhasma Pariksha* confirmed Varitaratva, Rekhapurnata, Nishchandratva, and Apunarbhava.

Siddhi Lakshana: Attained after 7 *Puta.*

Comparative Findings

- Both methods successfully produced therapeutically acceptable Swarna Makshika Bhasma.
- Type 1 (RT method) required 11 Puta for completion, whereas Type 2 (RRS method with Gandhaka) required only 7 Puta.
- The addition of Gandhaka in Type 2 facilitated quicker decomposition and enhanced homogeneity of the final Bhasma.
- In both methods, the final Bhasma was reddish-brown, soft, tasteless, lusterless, and satisfied all classical *Bhasma Pariksha.*

Table 1: *Shodhana* Observations (21 *Nirvapa*)

Stage	Observation
Raw mineral	Hard, brassy yellow, metallic lustre
After 7 *Nirvapa*	Brittle, darker
After 14 *Nirvapa*	Lustre reduced, odor diminished
After 21 *Nirvapa*	Completely brittle, blackish-brown

Table 2: Comparative Marana Observations

Parameter	Type 1 (RT method)	Type 2 (RRS Method)
Initial weight	500 gm	500 gm
Bhavana medium	*Nimbu Swarasa*	*Nimbu Swarasa +Shudha Gandhaka*
No. of Puta required	10	5
Final color	Reddish-brown	Deeper reddish-brown
Texture	Fine, smooth	Softer, finer, homogeneous
Taste	Tasteless	Tasteless
Siddhi Lakshana	After 11 *Puta*	After 7 *Puta*
Final weight	388 gm	397 gm

DISCUSSION

The process of *Marana* is pivotal in transforming *Swarna Makshika* ($CuFeS_2$) into a therapeutically potent Bhasma. Classical Ayurvedic texts such as *Rasa Ratna Samuccaya* and *Rasa Tarangini* emphasize that proper *Marana* ensures the Bhasma attains desired characteristics like *Varna* (color), *Nischandratva* (lustrelessness), *Rekhapurnata* (fineness), and *Varitaratwa* (floating on water), which indicate its quality and bioavailability.

In the present study, two types of *Swarna Makshika Bhasma* were prepared using different *Marana* techniques. Both types satisfied the classical organoleptic parameters, confirming appropriate processing. However, subtle differences in physical and chemical properties were observed, indicating that the method of *Marana* can influence the final pharmaceutical characteristics.

Physicochemical analysis showed variations in *ash values*, *pH*, and *loss on drying*, suggesting that heating cycles, levitation media, and thermal conditions impact the Bhasma's composition. For instance, a finer particle size and uniform texture observed in one Bhasma may enhance absorption and bioavailability, consistent with the classical notion of *Rekhapurnata* as an indicator of therapeutic efficacy.

Elemental analysis highlighted a reduction in potentially toxic components, such as free sulfur and excess iron, demonstrating that proper *Marana* detoxifies the raw mineral while preserving therapeutic elements. The observed differences in mineral composition between the two methods may affect pharmacological activity, which aligns with modern studies showing that particle size and elemental content influence bioavailability and safety of metallic Bhasmas.

This comparative standardization underscores the importance of methodical *Marana Samskara* to achieve consistent quality, safety, and efficacy in *Swarna Makshika Bhasma*. The study provides a scientific basis for standardizing Bhasma preparation, ensuring reproducibility across batches. Future pharmacological and clinical studies are warranted to establish correlations between these standardized parameters and therapeutic outcomes.

The present study was undertaken to evaluate and compare the pharmaceutical preparation of Swarna Makshika Bhasma by two classical methods: (Type 1) *Rasa Tarangini* (RT) method using *Nimbu Swarasa Bhavana* alone, and (Type 2) *Rasa Ratna Samucchaya* (RRS) method using *Nimbu Swarasa Bhavana* with the addition of *Shuddha Gandhaka.*

Classical Validation

- *Rasa Tarangini* emphasizes purification through 21 *Nirvapa* and gradual *Marana*, ensuring complete detoxification.
- *Rasa Ratna Samucchaya* allows the use of *Gandhaka* in *Marana*, which is justified pharmaceutically because Gandhaka acts as a companion in Rasashastra processes (*Rasa Bandhaka* and *Rasa Sahakari*).
- Both texts are validated in practice: the RT method ensures thoroughness, while the RRS method ensures efficiency.

Modern Scientific Correlation

- **Shodhana:** Repeated heating and quenching induces microcracks in the crystal lattice of $CuFeS_2$, allowing acid penetration and leaching of impurities.
- **Marana:**
  - Without Gandhaka: oxidation proceeds slowly, requiring more thermal cycles.
  - With Gandhaka: sulphur reacts to form sulphates, lowering the activation energy for decomposition.
- **End product:** Fine oxides and sulphates of copper and iron, in nano- to micro-size range, which are more bioavailable and therapeutically safe.

Significance of the Study

This comparative pharmaceutical evaluation highlights:

- The importance of choosing an appropriate *Marana* method.
- The role of *Gandhaka* as a catalyst in reducing the number of Puta.
- The balance between classical authenticity and pharmaceutical efficiency.
- Standardization of Bhasma preparation for reproducibility and clinical safety.

CONCLUSION

The present study on the comparative pharmaceutical standardization of two types of *Swarna Makshika Bhasma* with reference to *Marana Samskara* highlights significant differences in the physicochemical and organoleptic parameters resulting from the variations in processing methods. Both types of Bhasma met the classical Ayurvedic quality standards (*Varna, Nischandratva, Rekhapurnata,* etc.), confirming their proper *Marana*. However, subtle differences in parameters such as particle size, ash values, and elemental composition indicate that the method of *Marana* influences the final pharmaceutical characteristics and potentially the therapeutic efficacy of the Bhasma. These findings provide a scientific basis for standardizing *Swarna Makshika Bhasma*, ensuring reproducibility, safety, and quality in Ayurvedic formulations. Further

pharmacological and clinical studies are recommended to correlate these standardized parameters with therapeutic outcomes.

Both methods yield pharmaceutically valid Swarna Makshika Bhasma.

In the present study, Type 1 (RT method) required 11 *Putas* for the preparation of *Swarna Makshika Bhasma*, whereas Type 2 (RRS method with *shudha Gandhaka*) required only 7 *Puta*, thereby demonstrating superior efficiency. Furthermore, the final yield of Type 2 *Bhasma* was 397 g from 500 g of purified *Swarna Makshika*, which was higher compared to the yield obtained by the Type 1 method which is 388 gm. This indicates that the RRS method with *Shudha Gandhaka* is not only more efficient but also provides a better yield of *Swarna Makshika Bhasma* than the conventional RT method.The addition of *Gandhaka* improves fineness, homogeneity and reduces the number of incineration cycles. Comparative pharmaceutical standardization validates *Rasashastra* principles and supports the RRS method as pharmaceutically advantageous.

REFERENCES

1. Shri Vagbhattacharya Rasa Rattna Samucchya Suratnojjvala hindi commentary 9th edition published by Chaukhambha Amar Bharti Prakashan, Varanasi by Kaviraj Ambikadutt Shastri chapter 2/1 Pg.39
2. Shri Vagbhattacharya Rasa Rattna Samucchya Suratnojjvala hindi commentary 9th edition published by Chaukhambha Amar Bharti Prakashan, Varanasi by Kaviraj Ambikadutt Shastri chapter 2/77 Pg.49
3. D.R. Lohar Protocol for testing Ayurveda,Siddha, Unani Medicine, Government Of India, Department Of AYUSH, ministry of health & family welfare, Pharmacopoeial Laboratory for Indian Medicines, Ghaziabad Pg. 31
4. Shri Vagbhattacharya Rasa Rattna Samucchya Suratnojjvala hindi commentary 9th edition published by Chaukhambha Amar Bharti Prakashan, Varanasi by Kaviraj Ambikadutt Shastri chapter 5/13 Pg.96
5. Di Palma L, Mecozzi R. 2007. Heavy metals mobilization from harbour sediments using EDTA and citric acid as chelating agents. Journal of Hazardous Materials, 147(3):768–775. https://doi.org/10.1016/j.jhazmat.2007.01.072.
6. Feidt M. 2012. Thermodynamics of Energy Systems and Processes : A Review and Perspectives q F, heat flux at the cold side of the machine. Journal of Applied Fluid Mechanics 5(2): 85–98
7. Sharma S. 2012. Rasa Tarangini (11th ed.; K. Shastri., ed.), New Delhi: Motilal Banarasidas.
8. Rajput DS, Gokarn RA, Patgiri B, Shukla VJ. 2013. Standard operating procedure of Naga Shodhana and study of chemical changes in the media and Shodhita Naga Introduction : Annals of Ayurvedic Medicine, 2(4):123–132.