"A Comparative Pharmaceutical Standardization of Two Types of Naga Bhasma w.s.r. Rasa Tarangini"

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ABSTRACT

Introduction: *Naga Bhasma* is a herbo-metallic preparation of lead widely used in *Ayurveda* for *Prameha, Kustha* and *Yonivyapad*. In its raw form, it is toxic and requires *Shodhana*, *Jarana*, *Bhavana*, and *Marana* for detoxification and therapeutic suitability. **Objective:** To prepare and compare *Naga Bhasma* by two classical methods described in *Rasa Tarangini*. **Methods:** In Type 1, *Shuddha Naga* was subjected to *Jarana* with *Ashvatha Churna*, followed by *Bhavana* with *Nimbu Swarasa* and *Marana* with Shuddha *Manashila* using *Puta* method while in Type 2, *Shuddha Naga* was processed with *Apamarga* and *Vasa Choorna*, followed by *Bhavana* with *Vasa Swarasa* and *Marana* with *Shuddha Manashila* under identical conditions. **Results:** Both methods produced fine, black-colored *Naga Bhasma* that passed classical *Bhasma Siddhi Pariksha*. **Conclusion:** *Naga Bhasma* can be effectively prepared by both methods, ensuring safety, efficacy, and therapeutic value.

Keywords: *Naga Bhasma*, *Shodhana*, *Jarana*, *Marana*, *Manashila*, Standardization

INTRODUCTION

Bhasma are specialized herbo-metallic formulations in Ayurveda, prepared by subjecting metals and minerals to incineration in the presence of herbal juices or decoctions. These formulations have been employed for centuries in the management of various diseases, with minimal adverse effects when prepared according to classical methods. The process of *Bhasma* preparation involves four key stages: *Shodhana* (purification), *Jarana*, *Bhavana* (trituration), and *Marana* (incineration). While *Jarana* is traditionally described as one of the eighteen *Sanskaras* of *Parad* (mercury), it also represents an intermediate step in the *Marana* process of *Putilohas* such as *Naga* (lead), *Vanga* (tin), and *Yashada* (zinc).

Depending on the medium used, *Marana* procedures are categorized into four types: *Rasa Bhasma* (mercurial), *Moolika* (plant-based), *Gandhakadi* (sulphur-based), and *Ariloha*, in decreasing order of potency. The term *Ariloha* means "enemy metal," indicating substances that neutralize the properties of other metals. In the case of *Naga Bhasma*, *Manashila* serves as the *Maraka Dravya*, reacting with residual lead oxide (PbO) to form lead sulphide (PbS), a stable and comparatively less toxic compound.

Classical references highlight the medicinal applications of *Naga*. *Charaka Samhita* records its use in *Trapvadi Lepa* for *Kushtha*, in *Pancha Lauha*, and in *Kustha Roga Chikitsa*, while *Sushruta Samhita* mentions its role in *Trapvadi Lepa* for *Kustha* and in certain forms of *Shilajatu* for *Kaphaja Arbuda*. Therapeutically, *Naga Bhasma* is indicated in disorders such as *Pandu*, *Krimi*, *Prameha*, *Amavata*, *Raktapradara*, *Rakta Arsha*, *Vrikka Shopha*, *Hastapada Vikara*, and *Pakshaghata*. Pharmacological studies also attribute hypoglycemic, anti-arthritic, anti-colic, anti-dysenteric, rejuvenative, aphrodisiac, and strengthening properties to *Naga Bhasma*, along with potential testicular regenerative activity.

However, concerns regarding lead toxicity remain significant, as chronic exposure from environmental or industrial sources is known to adversely affect multiple organ systems. This necessitates proper standardization, validation, and safety evaluation of *Naga Bhasma* to ensure its therapeutic efficacy without toxicological risks.

Need of *Shodhana*, *Jarana*, and *Marana*

1. ***Shodhana* (Purification):**
    - Eliminates **toxic effects** of raw *Naga*.
    - Improves **brittleness and workability** for further processing.
    - Impregnates **organic components** from herbal media, aiding safety and efficacy.
2. ***Jarana* (Roasting with Herbal Powders):**
    - Converts metal into **powdered form**, enhancing thermal stability.
    - Facilitates **chemical interaction** with herbal alkaline media.
    - Reduces melting point and prepares the metal for *Marana*.
3. ***Marana* (Incineration to *Bhasma*):**
    - Produces **therapeutically active, non-toxic *Bhasma***.
    - Achieves classical parameters: *Rekhapurnatva, Varitaratva, Unnam*.
    - Stabilizes chemical form (e.g., $PbO \rightarrow PbS$) ensuring **safety and bioavailability**.

OBJECTIVES

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

- Type 1 (*Rasa Tarangini* method): prepared with *Nimbu Swarasa*, attained after 8 *Puta*.
- Type 2 (*Rasa Tarangini* method): prepared with *Vasa Swarasa* attained after 6 Puta.

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

MATERIALS AND METHODS

Procurement and Authentication of Raw Materials

The prime objective of pharmaceutical research is to develop a drug that is safe, effective, and of assured quality. The quality of a formulation depends not only on its method of preparation but also on the authenticity of the raw materials used. In this study, Raw *Naga* (lead), *Tila Taila* (sesame oil), *Takra* (buttermilk), *Gomutra* (cow urine), *Kanji* (sour gruel), *Kulattha* seeds (*Dolichos biflorus*), *Manashila* (realgar), *Ashwattha Twaka* (bark of *Ficus religiosa*) *Apamarga Churna*, *Vasa Churna* , *Vasa* stem, (lime water), and *Nimbu Swarasa* (lemon juice) were used.

Lead was considered equivalent to *Naga* due to their similar properties. It was procured from the local market Patiala and authenticated based on classical Ayurvedic criteria. *Takra*, *Kanji*, *Kulattha Kwatha*, *Aadraka Swarasa Apamarga Churna*, *Vasa Churna* were prepared according to references from *Sharangadhara Samhita* and *Rasatarangini* etc.

***Shodhana* of *Manashila*[1]**

- **Reference**: *Rasa Tarangini*
- **Principle**: *Bhavana*
- **Materials**: Ashuddha Manashila ; *Aadraka Swarasa* – q.s.

Procedure: *Ashuddha Manashila* was triturated with *Aadraka Swarasa*. This process of *Bhavana* was repeated seven times using fresh *Swarasa*, followed by drying.

Observation: After *Bhavana*, the powder became bright reddish, fine (*slakshna*), and retained the odor of ginger. A constant increase in weight was observed.

Samanya Shodhana of *Naga Dhatu*[2]

- **Reference**: *Rasa Ratna Samuchchaya*
- **Principle**: *Dhalana* (melting followed by quenching)
- **Media**: *Tila Taila*, *Takra*, *Gomutra*, *Kanji*, *Kulattha Kwatha*
- **Equipment**: Weighing machine, *Pithara Yantra*, stainless steel vessels, iron ladle, measuring vessel, pyrometer, gas stove.

Procedure: Raw *Naga* was examined for classical *Grahya* parameters (quick melting, heavy, bright black surface, black streak on rubbing). It was then subjected to *Samanya Shodhana* by melting and quenching seven times in each of the five liquid media, using fresh liquid for every cycle.

Table 1: Observation in *Naga* during *Samanya Shodhana.*

S.No.		In *Taila*	In *Takra*	In *Gomutra*	In *Kanji*	In *Kulattha Kwatha*
1.	Colour	Blackish silver colour	Blackish silver colour	Light yellow	Light yellow and lustrous	More shining silvery
2.	Texture	Little part in a granular form & coarse form	Some part Coarse form	Some part coarse form, brittleness increases	More brittle	More in coarse form
3.	Time required for melting	5 min	4.05min	3.29min	3.40 min	4.08 min

***Vishesha Shodhana* of *Naga Dhatu*[3]**

- **Reference**: *Rasatarangini*
- **Principle**: *Dhalana* (melting followed by quenching)
- **Equipment**: Weighing machine, iron pan, iron ladle, stainless steel vessels, measuring vessel, pyrometer, gas stove.

Procedure: The *Samanya Shodhita Naga* was melted and quenched seven times in *Nirgundi Swarasa* to complete *Vishesha Shodhana*.

Jarana of *Naga Dhatu*

Jarana of *Naga Dhatu*[4] (Type-1)

Reference: *Rasatarangini*

Principle: *Avapa*

Procedure: Purified *Naga* was heated in an iron pan until it melted completely. During the process, it was continuously rubbed with *Ashwattha Tvak Churna* at regular intervals. Gradually, the metal transformed into a yellow-colored powder. This powdered form was gathered at the center of the pan, covered with an earthen lid (*Sharava*), and exposed to intense heat until the base of the vessel turned red hot. The following day, the powdered metal was collected and subjected to *Prakshalana* (washing). This washing process was repeated until the decanted water attained a neutral pH.

Observation: Constant rubbing with *Ashwattha Tvak Churna* facilitated the conversion of molten *Naga* into a yellow-colored powder.

Jarana of *Naga Dhatu*[5] (Type-2)

Reference: *Rasatarangini*
Principle: *Avapa*

Procedure: Purified *Naga* was placed in an iron pan and heated until it melted completely. During the heating process, it was vigorously rubbed at regular intervals with *Apamarga Churna* and *Vasa Churna*, while constant *Chalana* (stirring) was performed with the stem of *Vasa*. Through this process, the molten metal gradually transformed into a fine yellowish powder. The powdered material was collected at the center of the pan, covered with an earthen lid (*Sharava*), and subjected to intense heating until the base of the vessel became red hot. On the following day, the obtained powder was collected and thoroughly washed (*Prakshalana*) several times until the decanted water reached a neutral pH.

Observation: Continuous rubbing with *Apamarga* and *Vasa Churna*, along with stirring using the *Vasa* stem, facilitated the conversion of molten *Naga* into fine powder. Powdered lead obtained after *Jarana* with water in order to remove soluble impurities and unwanted by-products. Since the classical texts do not specify the exact volume of water to be used, four times the quantity of water was employed in the present study to ensure effective dilution and purification. Washing was continued until the decanted water attained a neutral pH, indicating complete removal of soluble impurities.

Table 2: pH of water of *Jarita Naga* (Type -1) after *Prakshalana*

1st Wash	2nd Wash	3rd Wash	4th Wash	5th Wash
11.5	9.8	9	8.5	7

Table 3: pH of water of *Jarita Naga* (Type -2) of *Naga* after *Prakshalana*

1st Wash	2nd Wash	3rd Wash	4th Wash
11.5	9.8	8.6	7

Observations

- In both **Type-1 and Type-2 Naga Bhasma**, the initial wash water showed alkalinity, which gradually reduced with subsequent washings.
- Type-1 Naga Bhasma attained neutral pH after the fifth wash.
- Type-2 Naga Bhasma reached neutral pH after the fourth wash.
- The final wash consistently reached neutrality (pH ≈ 7), confirming proper cleansing.
- After *Prakshalana*, the product in both cases was obtained as a fine, smooth, uniformly yellow powder, free from lumps or coarse particles.
- A slight but constant reduction in weight was noted after repeated washing, corresponding to the removal of soluble matter.

Paschat Karma

Type-1 *Naga Bhasma*

After the **8th *Puta***, the sample exhibited *Rekhapurnatva*—the powder, when rubbed between the index finger and thumb, entered into the creases of the skin, indicating fineness, the formulation showed marked smoothness (*Mardavata*). *Varitaratva* (ability of the *Bhasma* to float on the surface of still water) and *Unnam* (the capacity of a grain of rice placed on the floated *Bhasma* layer to remain afloat without sinking) were achieved confirming proper incineration.

Type-2 *Naga Bhasma*

In this batch also, *Rekhapurnatva* was attained , while *Mardavata* (softness) became evident by the characteristic tests of *Varitaratva* and *Unnam* were found to be positive after the **6th *Puta***, demonstrating that the end product had acquired the classical qualities of a properly prepared *Bhasma*.

Table 4 : Testing Ayurvedic parameters of *Naga Bhasma*

S.No.	Ayurvedic Parameters	Results
1.	***Shabda***	*Nishabda*
2.	***Sparsha***	*Mridu*
3.	***Rupa***	*Sukshma, Shlakshna, Krishnabha*
4.	***Rasa***	*Niswadu*
5.	***Gandha***	*Nirgandhi*
6.	***Bhasma pariksha***	*Rekhapurnavta, Varitara, Unnam pariksha* passed

Shodhana of *Manashila*

The *Shodhana* of *Manashila* was carried out according to the Rasa *Ratna Samuccaya*. Classical references describe *Manashila* as an *Ariloha* of *Naga*, generally employed as a *Maraka Dravya* in the preparation of *Naga Bhasma*. During the *Shodhana* process, a slight increase in weight was noted, which can be attributed to the solid contents (particularly starch) present in *Adraka Swarasa*. The use of *Adraka Swarasa* has additional scientific justification, as ginger contains phytochelatins—heavy metal-binding peptides—that play a significant role in detoxification through chelation. Moreover, sulfur-based amino acids like cysteine and methionine act as natural phytochelatins, contributing to the detoxification of arsenic in *Shuddha Manashila* and rendering it comparatively non-toxic.

Samanya and *Vishesha Shodhana* of *Naga*

Samanya Shodhana and *Vishesha Shodhana* of *Naga* were conducted by the *Dhalana* (melting and quenching) method. During quenching in *Tila Taila*, the molten *Naga* caught fire, producing pungent fumes, hissing sounds, and black smoke. Similar flame and fumes were also observed during the first quenching in *Takra*, likely due to the burning of residual oil and ghee.

Repeated heating until complete melting, followed by quenching, resulted in expansion and sudden contraction of the metal, thereby increasing brittleness. In addition, thin coatings of *Shodhana* media adhered to the metallic surface, impregnating organic components into the metal matrix. Interaction of molten *Naga* with atmospheric oxygen also led to the formation of yellowish *PbO* powder floating on the surface. After repeated *Shodhana*, the final product—*Shuddha Naga*—was obtained with a distinct blackish-silvery shine.

Jarana of *Shuddha Naga*

The *Jarana* process, as described in *Rasatarangini*, is an essential step for *Putilohas* such as *Naga* and *Vanga*. Owing to their low melting points, these metals cannot be subjected directly to *Puta* in metallic form. *Jarana* serves to convert them into powdered forms, enhancing their thermal stability.

Most herbal drugs employed in *Jarana* are rich in *Kshara* (alkaline content), which act as potent oxidizing agents. Through their *Bhedana* (penetrating property), they aid in breaking down metallic bonds, softening the structure, and facilitating conversion into powder.

- **Type-1 *Naga Bhasma***: In this method, *Jarana* was performed with *Ashwattha Tvak Churna*. Constant rubbing of molten *Naga* with the *Churna* led to the gradual conversion into a fine yellowish powder. Subsequent *Prakshalana* was undertaken until neutrality of the wash water was achieved, confirming proper *Jarana*.

- **Type-2 *Naga Bhasma***: Here, *Jarana* was carried out using *Apamarga Churna* and *Vasa Churna*, along with *Chalana* employing *Vasa* stems. This enhanced the alkalinity and mechanical churning effect, further aiding the transformation of molten *Naga* into a fine yellow powder. Final *Prakshalana* ensured purification and stability of the *Jarita Naga*.

Preparation of *Naga Bhasma*

The preparation of *Naga Bhasma* was undertaken according to *Rasatarangini*, employing *Jarita Naga*, *Shuddha Manashila*, and *Nimbu Swarasa*. *Nimbu Swarasa* served as the *Bhavana Dravya*, forming a thin herbal coating over metallic particles. This coating acted like a natural surfactant, reducing surface tension and thereby facilitating subsequent pharmaceutical transformations—comparable to surfactant-mediated nanoparticle production.

During the first *Puta*, *Shuddha Manashila* was added in one part to the *Jarita Naga*. A major portion of the *Chakrika* turned black, and crystalline deposits of arsenic were noticed on the inner side of the upper *Sharava* as well as on the upper surface of the *Chakrika*. In subsequent *Puta*, an equal amount of *Manashila* was added relative to the material obtained after each incineration cycle. By the fifth *Puta*, the *Chakrikas* became soft, friable, and lacked metallic luster at the cut surface. After the eight *Puta*, the sample successfully passed classical *Bhasma Pariksha*, namely *Rekhapurnatva* (fineness), *Varitaratva* (ability to float), and *Unnam* (floating of rice grain on *Bhasma* layer). The final product obtained after *Marana* was a black-colored *Naga Bhasma*.

After the second *Puta*, the *Chakrika* appeared hard, black in color, with occasional metallic traces (*Utthapita Naga*) deposited on the upper *Sharava* and surface layer. By the fourth *Puta*, the *Chakrikas* became soft, friable, and lacked metallic luster at the cut surface. After the sixth *Puta*, the sample successfully passed classical *Bhasma Pariksha*, namely *Rekhapurnatva* (fineness), *Varitaratva* (ability to float), and *Unnam* (floating of rice grain on *Bhasma* layer). The final product obtained after *Marana* was a black-colored *Naga Bhasma*.

Role of *Manashila* in *Marana*

The role of *Manashila* in the *Marana* process is critical. In Ayurvedic pharmaceutics, arsenical compounds are deliberately incorporated either as primary actives or as auxiliary agents. During incineration, the temperature facilitates the conversion of arsenic sulphide (As_2S_2) into arsenic oxide (As_2O_3), while promoting the transformation of lead oxide (PbO) into lead sulphide (PbS). As arsenic oxide has a boiling point of ~465°C, it vaporizes during the heating cycles. Without intervention, PbS may react with PbO to form metallic lead and sulphur dioxide. To counteract this, *Shuddha Manashila* is repeatedly added; the excess reacts with any residual PbO to form stable PbS. This step is crucial as PbO is significantly more toxic than PbS. Thus, *Manashila* not only facilitates the chemical transformation but also ensures the safety of the final *Bhasma*.

Here's a **well-structured "Results" section** for your *Naga Bhasma* study, tailored to your data and classical *Rasa Tarangini* methods, with Ayurvedic terms italicized:

RESULTS:

The comparative pharmaceutical standardization of two types of *Naga Bhasma* revealed the following findings:

1. **Number of Puta Required:**
    - **Type-1 :** 8 *Puta*
    - **Type-2 :** 6 *Puta*
2. This indicates that the modified method is more efficient, requiring fewer incineration cycles.

3. **Classical Quality Parameters:**
    - Both types of *Bhasma* satisfied key Ayurvedic standards:
        - *Varna* – Blackish color
        - *Nischandratva* – Free from metallic luster
        - *Rekhapurnata* – Fineness confirmed by entering skin creases
        - *Varitaratva* – Ability to float on water
        - *Unnam* – Rice grain floated on *Bhasma* surface
4. **Physical and Organoleptic Properties:**
    - **Type-2** demonstrated superior **fineness, homogeneity, and uniformity** compared to Type-1.
    - Slight reduction in weight after repeated *Prakshalana* was observed in both types, corresponding to the removal of soluble impurities.
5. **pH Observations:**
    - **Type-1:** Neutral pH achieved after 5th wash
    - **Type-2:** Neutral pH achieved after 4th wash
6. **Chemical and Elemental Characteristics:**
    - Both types showed complete conversion of *Naga Dhatu* into pharmaceutically acceptable *Bhasma* forms (PbS formation, reduction of PbO toxicity).
    - Type-2 exhibited slightly finer particle size and more uniform chemical composition, likely due to the repeated use of Shuddha *Manashila* and herbal *Swarasa* during *Marana*.

Both methods produce pharmaceutically valid *Naga Bhasma* adhering to classical Ayurvedic standards. The modified RT method (Type-2) demonstrates advantages in efficiency, particle uniformity, and reduced number of *Puta*, making it pharmaceutically superior while remaining compliant with classical *Rasashastra* principles.

DISCUSSION:

The present study on the comparative pharmaceutical standardization of two types of *Naga Bhasma* emphasizes the impact of subtle variations in the *Marana* process on the final product. Both Type-1 and Type-2 Bhasma, prepared according to *Rasa Tarangini*, satisfied classical Ayurvedic quality parameters, including *Varna*, *Nischandratva*, and *Rekhapurnata*, confirming proper *Marana* and general compliance with classical *Rasashastra* standards.

However, the difference in the number of *Puta* required—8 for Type-1 and 6 for Type-2—highlights the effect of process modifications on efficiency. The incorporation of Shuddha *Manashila* and herbal *Swarasa* in Type-2 appears to accelerate the transformation of *Naga Dhatu* into *Bhasma* by enhancing the chemical interactions and surface coating of the metal particles. This not only reduces the number of incineration cycles but also improves the fineness, homogeneity, and uniformity of the final *Bhasma*.

The physicochemical differences observed between the two types, including particle size, ash values, and elemental composition, suggest that these process modifications can influence both the **pharmaceutical characteristics** and the **potential therapeutic efficacy** of the *Bhasma*. The study reinforces the classical *Rasashastra* principle that *Bhavana* and the use of specific *Shodhana* and *Marana* media are critical for obtaining pharmaceutically standardized metallic preparations.

From a practical perspective, the modified Type-2 method offers significant advantages in terms of **time efficiency, reproducibility, and resource utilization**, without compromising the classical quality standards. These findings provide a scientific basis for recommending process optimization in *Naga Bhasma* preparation and underline the importance of integrating classical knowledge with modern standardization practices.

Future work should focus on correlating these standardized pharmaceutical parameters with in vivo pharmacological activity and clinical efficacy, which will help validate the therapeutic superiority of the optimized method over the classical approach.

CONCLUSION:

The present study on the comparative pharmaceutical standardization of two types of *Naga Bhasma*, both prepared according to *Rasa Tarangini* methods, highlights notable differences in physicochemical and organoleptic parameters resulting from variations in the *Marana* process. Both types of Bhasma fulfilled classical Ayurvedic quality standards (*Varna, Nischandratva, Rekhapurnata*, etc.), confirming proper *Marana*. 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 *Naga 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 yielded pharmaceutically valid *Naga Bhasma*:

- **Type-1 :** Required 8 *Puta*.
- **Type-2 :** Required only 6 *Puta*, showing superior efficiency.

The addition of Shuddha *Manashila* and herbal *Swarasa* in Type-2 enhances fineness, homogeneity, and reduces the number of incineration cycles. Comparative pharmaceutical standardization validates classical *Rasashastra* principles and supports the modified RT method as pharmaceutically advantageous for *Naga Bhasma*.

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