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# Comprehensive Study of Tamra Bhasma Pareeksha W.S.R *Nambhuri* Phase Spot Test

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**KEYWORDS**

Tamra Bhasma, Bhasma pareeksha, NPST

**ABSTRACT:**

Introduction: Tamra is a significant metallic drug classified under Dhatu Varga in Ayurveda. Tamra Bhasma, a calcined preparation of copper, holds a prominent place in Ayurvedic therapeutics, particularly for its hepatoprotective and digestive properties. It is widely used in the management of liver disorders such as hepatitis, gallstones, cirrhosis, and hepatosplenomegaly.

Objective: This study focuses on the systematic preparation of Tamra Bhasma and its validation through Bhasma Pariksha (classical organoleptic and physicochemical tests) and NPST to confirm its authenticity and compliance with standard parameters.

Materials and Methods: The preparation of Tamra Bhasma involves a two-stage process: Shodhana (purification) and Marana (incineration).

Ensuring the quality and safety of bhasma preparations is crucial for their therapeutic efficacy. Hence, the final Bhasma sample was evaluated using classical Bhasma Pariksha tests (such as Rekhapurnatva, Varitaratva, Nischandratva, etc.), along with NPST for chemical fingerprinting. The results were compared against the standard values prescribed by the Central Council for Research in Ayurvedic Sciences (CCRAS) guidelines.

Observations and Results: The prepared Tamra Bhasma successfully passed all classical Bhasma Pariksha parameters. The NPST analysis further validated its quality, showing characteristic spot patterns in accordance with CCRAS standards, indicating proper incineration and the absence of toxic residues.

Conclusion: The study demonstrates that prepared Tamra Bhasma meets the classical and modern scientific quality standards. The successful validation through Bhasma Pariksha and NPST reinforces its safety, purity, and therapeutic potential. Standardized preparation methods combined with modern analytical techniques ensure the efficacy and reliability of Tamra Bhasma for clinical applications in hepatobiliary and digestive disorders.

## 1. INTRODUCTION:

*Rasashastra* is a specialized branch of *Ayurveda* that deals with the processing and therapeutic applications of metals and minerals. Ayurvedic medicines are broadly classified into three categories: *Kashta Aushadhis* (herbal formulations), Rasa *Aushadhis* (metallic and mineral-based preparations), and *Jangama Aushadhi*s (animal-derived medicines). *Bhasma* (calcined metal/mineral preparations) and *Sindura* (mercury-based preparations) fall under the *Rasa Aushadhi* category, known for their potent therapeutic efficacy when properly processed. [1]

*Tamra* (Copper), classified under the *Dhatu Varga* (metallic group) of *Rasadravya*, is chemically identified

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as Cu (Copper) [2]. *Tamra Bhasma* (incinerated copper) is described in classical texts as *Tikta* (bitter) and *Kashaya* (astringent) in taste, *Madhura Vipaka* (sweet post-digestive effect), and *Ushna Virya* (hot in potency). It primarily pacifies *Kapha Dosha* and exhibits potent cholagogue (bile-stimulating) activity. [3]

After preparation of Tamra bhasma, ensuring its purity and proper incineration is crucial, as improperly processed *Tamra Bhasma* can lead to toxic effects. *Ayurvedic* texts describes eight types of untoward effects (*Ashta Doshas*) that may arise due to incomplete incineration of *Tamra.* [4]

To ensure the safety and efficacy of *Bhasma* formulations, various classical and modern analytical techniques are employed. Among these, the Namburi Phased Spot Test (NPST) is a unique and rapid technique used to assess the quality and standardization of Bhasma and Sindura. This technique was developed and standardized by Dr. Namburi Hanumantha Rao in 1970, later gaining official acceptance by the Central Council for Research in Ayurvedic Sciences (CCRAS), New Delhi [5]. A distinctive feature of NPST is its ability to analyze spot characteristics at three different time intervals, providing a phased evaluation of chemical reactions [6].

Given the significance of quality assessment in Ayurvedic mineral formulations, this study aims to prepare Tamra Bhasma using modern equipments and analyse the prepared formulation through classical organoleptic tests and modern analytical techniques through NPST, to ensure its compliance with established safety and efficacy standards.

## 2. MATERIALS AND METHODS:

The work was done in two phases, the first phase involved pharmaceutical study of *Tamra Bhasma* and the second phase focused on its analytical evaluation through classical *Bhasma pareeksha* and NPST.

### 2.1 Preparation of *Tamra Bhasma:*

#### 2.1.1 Materials

Tamra Patra (copper sheets) were procured from a local market. Similarly, all the necessary ingredients required for the processes of Shodhana (purification) and Marana (incineration) were also sourced from the local market. The Tamra Patra was analyzed for their characteristic features (Grahyalakshanas) as described in classical Ayurvedic texts. These features included Ghanaghata-saha (The ability to withstand impact without breaking when struck with a hard object), Sachikkana (A smooth and glossy appearance), Vimala (Cleanliness), Japa-suma-prabha (A reddish hue reminiscent of hibiscus flowers), Mrudu (Softness). [7]

#### 2.1.2 Samanya Shodhana of Tamra

Equipment/Requirements: [8]

- Tamra patra - 250 gms
- Tila Taila - Q.S
- Takra - Q.S
- Gomutra - Q.S
- Aranala - Q.S
- Kulatha kwatha - Q.S
- Gas stove
- Iron laddle
- Iron vessel

Procedure of Samanya Shodhana:

This process was carried out through Nirvapa Samskara. The specified quantity of Tamra Patra was taken in an iron vessel and heated over fire until it turned red hot. Once it changed color, it was quenched in **Tila Taila** (sesame oil), **Takra** (buttermilk), **Gomutra** (cow urine), **Kanji** (fermented rice water), **Kulatha Kwatha** for seven times each.

#### 2.1.3 Vishesha shodhana of tamra

Equipment and materials used are Tamra patra (which has undergone samanya shodhana), Gomutra, Gas stove, Vessel and Iron ladle. [9]

Procedure of Vishesha shodhana:

Once the Samanya Shodhana of Tamra was completed, it was taken in a large vessel and a sufficient quantity of Gomutra (cow urine) was poured into it. The boiling process was then continued for 1 Yama (3 hours). Later, the Shodhita Tamra was collected.

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Fig. 1 Tamra Patra

Fig. 2 Tamra Patra Bharjana

Fig. 3 Taila Nirvapa


Fig. 4 Takra Nirvapa

Fig. 5 Gomutra Nirvapa


Fig. 6 Preparation of kanji

Fig. 7 Preparation of kanji

Fig. 8 Kanji Nirvapa


Fig. 9 Kulatha kwatha Nirvapa

Fig. 10 Vishesha shodhana of tamra

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**2.1.4 Marana of tamra:** [10]

Preparation of kajjali:

Equal quantities of Shuddha Parada and Shuddha Gandhaka were taken in a clean Khalva Yantra and triturated until the Kajjali Siddha Lakshanas were obtained. [11]

Procedure of Marana:

1. The required amount of Shodhita Tamra was taken in a wet grinder and mixed with an equal quantity of Kajjali and the required amount of Nimbu Swarasa. The mixture was then ground for 45 minutes (attained a semi-solid consistency).

2. The ground material was made into Chakrikas (pellets) and left to dry. Once the pellets were dry, they were placed in a silica crucible, which was then covered with lid.

3. The crucible was placed in an electrical muffle furnace, maintaining a temperature of 500°C for one hour. A pyrometer was inserted into the muffle furnace to determine the temperature inside, and the gradual decrease in temperature was noted once the process was completed.

4. After Swangashita (self-cooling) the crucible was removed from the muffle furnace, carefully de-sealed, and the Bhasma was weighed. The color, taste, texture, and other characteristics of the Bhasma were observed and noted.

5. Two additional Puta (incineration) processes were performed, following the same procedure as mentioned above, with the temperature maintained at 500°C.

6. After the process of Marana, the Tamra Bhasma is taken into khalva yantra and pounded to make it into a fine powder.

Fig. 11 & 12 Bhavana of Shoditha Tamra

Fig. 13 Chakrika preparation



Fig. 14 & 15 Crucibles placed in the muffle furnace

Fig. 16 Bhavana after Marana

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**2.1.5 Results:**

**Table 1: Showing Observations and Results after complete Shodhana of Tamra**

| Initial weight | Final weight | Loss | Changes during Process |
|---|---|---|---|
| 250 gms | 190 gms | 60 gms | Tamra patra turned into black color, some of it turned into coarse powder |

**Table 2: Showing Quantitative Observations during process of preparation of Tamra Bhasma**

| No. of puta | Weight of Tamra (gm) | | Weight of kajjali added(gm) | Amt of nimbu swarasa added(ml) | Duration of levigation (min) | Max temp of puta (°C) | Wt. loss/ gain of Tamra |
|---|---|---|---|---|---|---|---|
| | Before Puta | After Puta | | | | | |
| 1 | 190 | 260 | 190 | QS | 45 | 500°C | 70 |
| 2 | 260 | 280 | 190 | QS | 45 | 500°C | 20 |
| 3 | 280 | 300 | 190 | QS | 45 | 500°C | 20 |

**2.2 Analytical study by classical *Bhasma pareeksha* and NPST of Tamra Bhasma:**

**2.2.1 Classical Bhasma pareekshas:**

1. Nischandratva:

Nischandratva is a specific parameter for Tamra Bhashma. A portion of the prepared Tamra Bhasma was rubbed between fingers and thumb, and the rubbed portion was examined in sunlight. The prepared samples of Tamra Bhasma (Fig. 17) were found to be Nischandra (Absence of shining particle). [12]

2. Rekha Poornatha:

This test indicates the fineness of a Bhasma. The Bhasma was rubbed between the thumb and index finger. The particles of the Bhasma attained a state where they could settle in the ridges of the fingers. The prepared samples of Tamra Bhasma (Fig. 18) were found to be Rekha Poornatha. [13]

3. Nirdhoomatva:

This test was performed to check for moisture, organic content, or sulfur in the Bhasma. A small quantity of the Bhasma was taken in a silica crucible and ignited. The ignition of the Bhasma was observed carefully, and the observations were noted. The prepared samples of Tamra Bhasma (Fig. 19) did not produce any fumes and were found to be Nirdhooma. [14]

4. Varitaratva:

This test checks the lightness of the Bhasma. A small amount of the Bhasma was put over the jar containing water and observed. The prepared samples of Tamra Bhasma (Fig. 21) floated on the water and were found to be Varitara. [15]

5. Amla Dadhi Pareeksha:

This test checks for the maturity of the Bhasma. The Bhasma was put over Dadhi and observed for color. There was absence of color in the curd (Fig. 20) even after 12hrs suggesting Pakwa Bhasma. [16]

6. Avami Pareeksha:

This test is specific to Tamra Bhasma. The pinch Bhasma was consumed and observed for 1 hour. In The prepared sample of Tamra Bhasma there (Fig. 22) was absence of nausea and vomiting sensation. [17]

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Fig. 17 Nischandratva Pareeksha

Fig. 18 Rekha poornatha Pareeksha

Fig. 19 Nirdhooma Pareeksha

Fig. 20 Amla dadhi Pareeksha


Fig. 21 Varitara pareeksha

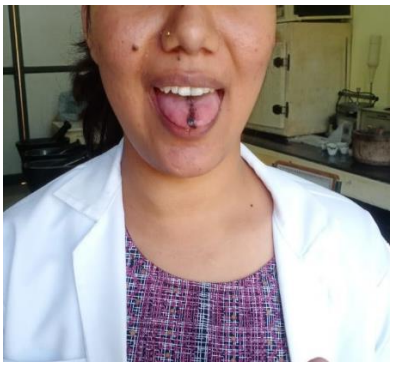

Fig. 22 Avami pareeksha

**3.2.2 Evaluation by NPST of Tamra Bhasma:**

NPST is the only Qualitative analytical test which identifies the product as per the name of Rasa Shastra such as Kajjali marita bhasma, Gandhaka marita bhasma etc. It was developed by Dr. Namburi Hanumantha Rao in 1970 and recognized by CCRAS, New Delhi. The Namburi Phased Spot Test (NPST) is a new technique for assessing the quality of a Herbo-mineral compound and is based on the principles of Chromatography that is identification based on the colour and pattern produced as a result of chemical reaction between trial drug, reagent and reacting paper. The classical tests like Bhasma Pariksha are based on physical qualities and do not specify Bhasma chemically, but in NPST, as the test is chemical reaction-based, specific bhasmas are denoted even chemically

**PRINCIPLE:** The technique is based on the principle of liquid chromatography. When a drop of a substance under investigation (Bhasma or Sindhura) is placed on specially prepared chemical reacting papers, a spot appears with a series of colour and pattern changes.

**AIM:** Identification of bhasma and sindoor by their specific names known in Ayurveda by virtue of their quality difference not by their chemical names alone and to determine the stability and comparison of quality of Bhasma.

**METHOD:**

The process of NPST is under three sub headings:

1. Preparation of Reacting Papers:

In this method, Whatman paper No. I is invariably impregnated in a suitable reagent and dried. A suitable impregnated paper (chemical reacting paper) is treated with a drop of the solution of the substance (bhasma or sindura) under examination.

2. Preparation of Solution

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The chemicals used for preparation of solution of trail drug is selected based on the solubility of component.eg- 20% HCL for Tamra, 5N HNO3 for Lauha, Naga because of its solubility.

3. Observations

When the drop encounters the paper a characteristics spot begins to develop and changes with times. The change of colour and pattern of the spot taken at 3 different phases at 3 different time intervals.

1. 1st Phase: The first phase of reaction extends from the very moment of formulation of the spot till the end of 5th minutes. The reaction is also called as Immediate Reaction.

2. 2nd Phase: The second phase of reaction extends thereafter up to 20th minute. This method of reaction may be termed as Delayed Reaction.

3. 3rd Phase: The Third phase of reaction, also known as Late Reaction extends from the end of 20th minute to some hours or days

**PROCEDURE for NPST of Tamra Bhasma:**

The procedure for NPST of Tamra Bhasma involved the use of Whatman Paper No. 1, test tubes, glass rods, glass trays, glass droppers, test tube holders, beakers, a Bunsen burner, prepared Tamra Bhasma, and aqua distilled water. The chemicals used in this study included 5% potassium ferrocyanide and 20% hydrochloric acid. For the preparation of reagents, 5 grams of potassium ferrocyanide were mixed with 100 ml of distilled water to obtain a 5% potassium ferrocyanide solution. In the preparation of impregnated papers, square pieces of Whatman paper measuring 12 cm × 12 cm were thoroughly dipped into the 5% potassium ferrocyanide solution and dried on a glass sheet, maintaining uniformity of impregnation. Once dried, the papers were collected and stored separately. To prepare the sample solution, 0.25 grams of Tamra Bhasma were dissolved in 20% hydrochloric acid.

**Procedure:**

In the NPST procedure for Tamra Bhasma, Whatman paper No. 1 was impregnated with a 5% potassium ferrocyanide reagent and thoroughly dried on a clean sheet of glass. Then, 0.25 grams of Tamra Bhasma was taken in a micro test tube, and 20% concentrated hydrochloric acid was added. This solution was slightly heated and then allowed to settle for 24 hours, with vigorous shaking at intervals. After this duration, using a dropper, a drop of the supernatant layer from the sample was placed over the potassium ferrocyanide paper. Color changes and patterns were observed at three-time intervals: 0 to 5 minutes (first phase), 5 to 20 minutes (second phase), and 4 hours after the first phase (third phase). The color pattern changes at these intervals were recorded and compared with the standards provided in the NPST manual.

**OBSERVATIONS AND RESULTS:**

Samples were analysed for classical bhasma pareeksha and NPST test method and the obtained parameters were compared to standard values as per CCRAS guideline.

**Table 3: Analysis of sample of prepared *Tamra Bhasma* by classical method:**

| Parameters/ Test | Tamra Bhasma |
|---|---|
| Colour | Black |
| Odour | Not specific |
| Touch | Soft and fine |
| Taste | Tasteless |
| Rekhapurnatva | Present |
| Varitara | Present |
| Nishchandra | Absent |
| Avami | Absent |
| Nirdhooma | Absent |
| Amla Dadhi Pareeksha | Absent |

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**Table 4: NPST observations of sample of prepared Tamra Bhasma**

| Criteria | | Sample | Standard findings in phase 3 |
|---|---|---|---|
| Changes on heating | Liberation of fumes | Nil | |
| | Charring | Nil | |
| | Odour | Acidic | |
| Spot, colour and fading time at different phases | At 1st phase (0-5 minutes) | Chocolate brown central spot with white periphery | |
| | At 2nd phase (0-20 minutes) | Chocolate brown spot with light blue margin and white periphery<br><br>Chocolate coloured spot enhanced blue margin and white periphery | |
| | At 3rd phase (4 hours after 1st phase) | | Chocolate coloured central spot with blue margin and white colourless periphery |

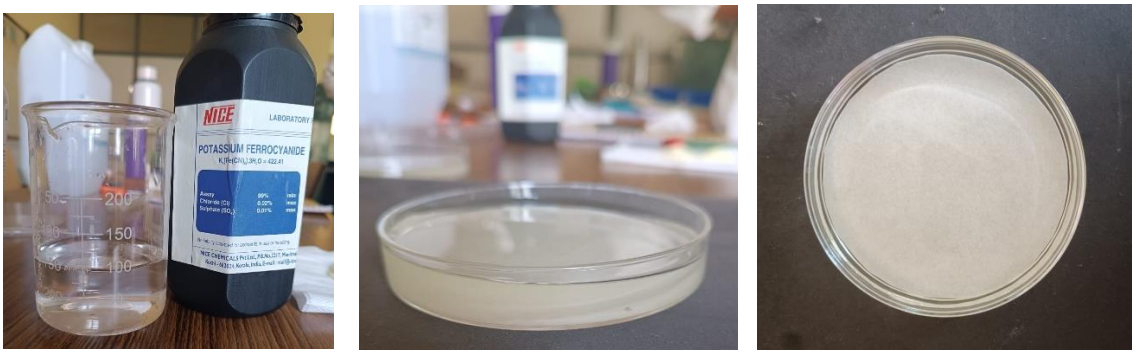


Fig 25. Preparation of Impregnated Paper of 5% Potassium ferrocyanide

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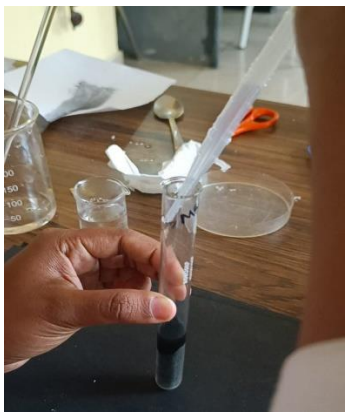


Fig. 26: Preparation of solution of sample with 20% Hcl



Fig 27: Heating the sample Fig 28: Supernatant part

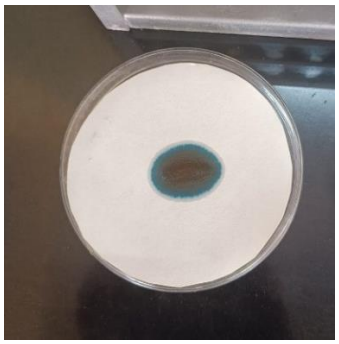
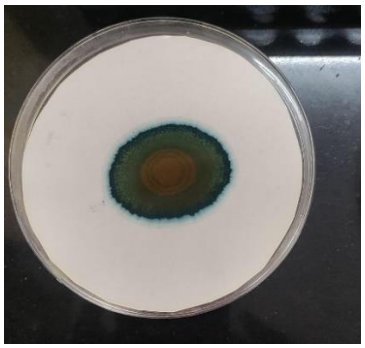
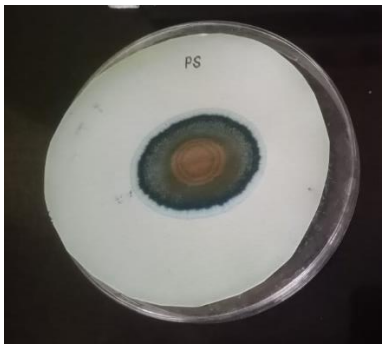


Fig 29: 1st phase Fig 30: 2nd phase Fig 31: 3rd Phase

**4. Discussion:**

**Discussion on Pharmaceutical Procedure and NPST Methods Adopted**

The pharmaceutical procedure of Tamra Bhasma preparation involved a systematic sequence of *Samanya shodhana, Vishesha shodhana, and Maraṇa*, each fulfilling a specific pharmaceutico-therapeutic purpose. The rationale behind performing shodhana was not

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limited to the removal of physical and chemical impurities but also to enhance the physicochemical properties of Tamra for better absorbability and digestibility. Notably, 35 Nirvapa Samskaras were carried out in the Samanya Shodhana process using sequential quenching in Tila Taila, Takra, Gomūtra, Āranala and Kulattha Kwātha., transforming the Tamra into a brittle form which significantly improved its grindability and facilitated further processing.

*Vishesha Shodhana* was done through Pachana in Gomutra for one Yama (3 hours), which provided both a biochemical medium and an alkaline pH necessary for the detoxification and transformation of Tamra. Gomutra also assists in chelation and oxidation processes essential for detoxifying tamra, hence its preference in this step.

During Marana, the finely powdered Shuddha Tamra was triturated with Kajjali and Nimbu Swarasa in a wet grinder, which expedited the formation of a smooth, semi-solid mass. The use of a wet grinder instead of a traditional Khalva Yantra ensured better homogeneity and effective particle size reduction, essential for Bhasmikarana. Though classical texts suggest Gajaputa for Tamra Marana, controlled heating at 500°C in a muffle furnace was adopted to prevent Adhika Paka. After three Puta, classical Bhasma Pariksha were performed to assess the Siddhi Lakshanas. For chemical validation, the NPST method was adopted to overcome the limitations of classical organoleptic tests.

**Discussion on the Results Obtained in Pharmaceutical Procedure and NPST**

The pharmaceutical observations indicated significant structural and physical transformation of Tamra.After Shodhana, Tamra turned black and brittle, confirming successful removal of impurities and initial transformation. After Marana, a progressive weight gain was observed (from 190 g to 300 g), suggesting effective interaction and integration with Kajjali and organic media. The color and texture also transformed to the classical attributes of Bhasma. The processed Tamra successfully passed all classical Bhasma Pariksha such as Varitara, Rekha Poorṇatva, Niṣchandra, and Nirdhuma demonstrating the complete transformation of metallic copper into a pharmaceutically acceptable Bhasma. These Siddhi Lakshaṇas confirmed the proper shodhana and maraṇa.

The NPST method further validated the authenticity of the Bhasma. The complete solubility of Tamra Bhasma in concentrated hydrochloric acid after 24 hours was a result of the transformation of metallic copper into $Cu^{2+}$ ions, due to the action of oxidizing agents such as dissolved oxygen or $Fe^{3+}$. When tested with potassium ferrocyanide, a characteristic chocolate-brown precipitate of copper(II) ferrocyanide [$Cu_2Fe(CN)_6$] was observed, confirming the presence of $Cu^{2+}$ ions. The brown coloration was due to charge transfer interactions within the complex.

These NPST outcomes aligned with classical observations and provided scientific evidence for the completion of Bhasmīkaraṇa, thus proving that the Bhasma was not only devoid of unprocessed metal but also chemically transformed into a bio-assimilable form. The use of both traditional and modern validation techniques reinforced the credibility and efficacy of the pharmaceutical preparation process.

**5. Conclusion:**

The pharmaceutical preparation of Tamra Bhasma involves a meticulous process of Shodhana (purification) and Marana (incineration) to ensure the transformation of raw copper into a bioavailable, therapeutically potent form. The classical Bhasma Pariksha tests confirmed its compliance with traditional Ayurvedic standards, indicating proper incineration and the absence of metallic impurities. Additionally, the Namburi Phased Spot Test (NPST) served as a modern analytical tool, reinforcing the authenticity and standardization of the prepared Bhasma.

This study highlights the importance of integrating traditional wisdom with modern quality assessment techniques to ensure the safety, efficacy, and reproducibility of Ayurvedic metallic formulations. The results reaffirm that when prepared through standardized protocols, Tamra Bhasma remains a potent and reliable formulation for the management of hepatic, gastrointestinal, and systemic disorders. Further research involving advanced analytical techniques and pharmacological validation can contribute to a deeper understanding of its therapeutic mechanisms, fostering wider acceptance of Ayurvedic mineral formulations in global healthcare.

**6. Conflict of interest:** None

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**7. Source of Support:** None

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