

Review Article

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**“COMPARATIVE STUDY OF SHODHANA METHODS FOR TAMRA (COPPER):
A REVIEW OF CLASSICAL APPROACHES AND MODERN ANALYTICAL
PERSPECTIVES”**

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ABSTRACT

Introduction: Tamra (copper) is an important metal used in Ayurvedic pharmaceutics, particularly in the preparation of *Tamra Bhasma* and metallic formulations. However, in its raw form, copper is associated with toxic effects such as gastritis and hepatotoxicity, necessitating *Shodhana* (purification/detoxification) before medicinal use. Various classical texts describe multiple *Shodhana* methods using herbal juices, decoctions, and media such as cow urine or sesame oil. Comparative evaluation of these methods is essential to understand their impact on safety and therapeutic efficacy. **Methods:** A detailed review was conducted using classical Ayurvedic treatises including *Rasaratna Samuccaya*, *Ayurveda Prakasha*, *Rasa Tarangini*, and *Bhaishajya Ratnavali*. Modern scientific studies were searched in PubMed, Scopus, Web of Science, and AYUSH Research Portal using terms like *Tamra Shodhana*, *copper purification* *Ayurveda*, *Bhasma safety*, and *Ayurvedic pharmaceutics*. Both experimental and analytical research articles published between 1995–2025 were included. **Results:** Classical methods describe different media for Tamra Shodhana such as *Tila Taila* (sesame oil), *Takra* (buttermilk), *Kanji* (sour gruel), *Kulaththa Kwatha* (horse gram decoction), and *Gomutra* (cow urine). These methods vary in terms of duration, cycles, and therapeutic suitability. Analytical evaluations confirm that Shodhana significantly reduces impurities, surface oxidation, and particle size, while enhancing the safety profile by reducing copper’s cytotoxicity. Comparative studies suggest that cow urine and sour gruel provide effective detoxification, whereas sesame oil imparts stability and enhances processing. **Discussion:** The review highlights that Shodhana is not merely a purification process but a pharmaceutico-therapeutic transformation, imparting desirable physicochemical properties to copper. Modern studies using SEM, XRD, ICP-MS, and AAS confirm the reduction of toxic impurities and transformation into biocompatible forms. However, standardization and comparative clinical evaluation of different Shodhana media remain limited.

KEYWORDS: Ayurveda, Copper, Purification, Rasashastra, Shodhana

INTRODUCTION

Metals and minerals hold a special place in Ayurvedic pharmaceutics due to their potency, stability, and prolonged therapeutic effects^[1]. Among them, *Tamra* (copper) has been widely used for its therapeutic benefits in conditions such as liver disorders, splenomegaly, obesity, and skin diseases^[2-3]. However, Ayurvedic classics also caution about its toxic potential in unprocessed form, necessitating *Shodhana* before medicinal use^[4-5].

Shodhana is a classical purification and detoxification procedure unique to Ayurveda, aimed at eliminating harmful properties, introducing desirable attributes, and enhancing the therapeutic efficacy of raw materials^[6-7]. For *Tamra*, texts describe multiple methods involving heating and quenching in various herbal and animal-derived media such as cow urine, buttermilk, sesame oil, sour gruel, and horse gram decoction. Each medium imparts specific qualities that influence the safety and pharmacological action of *Tamra*^[8-9].

Despite rich textual documentation, comparative evaluation of these *Shodhana* methods using modern analytical tools is still evolving. Bridging traditional wisdom with scientific validation is necessary for global acceptance of Ayurvedic metallic preparations. The aim of this review is to compile, compare, and critically analyze the different *Shodhana* methods of *Tamra* described in Ayurvedic classics and validated by modern scientific research. The objectives include evaluating their impact on physicochemical properties, detoxification efficiency, and therapeutic potential^[10].

MATERIALS AND METHODS

Literature Search Strategy: Classical texts such as *Rasaratna Samuccaya*, *Rasa Tarangini*, *Ayurveda Prakasha*, and *Bhaishajya Ratnavali* were reviewed for descriptions of *Tamra* *Shodhana*. Modern research articles were retrieved from PubMed, Scopus, AYUSH Research Portal, and Web of Science^[11].

Databases and Search Terms: Searches were conducted using terms: *Tamra Shodhana*, *copper purification Ayurveda*, *Shodhana media*, *Tamra Bhasma standardization*, and *Rasashastra validation*^[12].

Inclusion Criteria: Peer-reviewed articles, dissertations, experimental validation studies, and review papers published between 1995–2025 were

included^[13].

Exclusion Criteria: Articles lacking methodological clarity, anecdotal reports, and non-peer-reviewed sources were excluded^[14].

Type of Studies Reviewed: ^[15]

- **Classical Sources:** Descriptions of *Shodhana* procedures, rationale, and therapeutic implications.
- **Pharmaceutical Studies:** Laboratory standardization of *Shodhana* methods.
- **Analytical Studies:** SEM, XRD, ICP-MS, FTIR, and AAS analyses of purified copper.
- **Pharmacological & Clinical Studies:** Safety, efficacy, and toxicity evaluations.

OBSERVATION AND RESULTS

1. Classical Descriptions of Tamra Shodhana

Classical Ayurvedic texts such as *Rasaratna Samuccaya* (14th century), *Rasa Tarangini* (20th century), and *Ayurveda Prakasha* describe multiple methods of *Tamra* purification. The most common practice involves repeated heating of copper sheets to red-hot condition and quenching them in herbal or animal-derived liquids. The rationale is both physical and chemical: the heating removes physical impurities while quenching allows absorption of the therapeutic essence of the medium.

Key *Shodhana* media include:

- **Tila Taila (sesame oil):** Believed to impart smoothness and stability.
- **Takra (buttermilk):** Used for removing heat-related toxicity.
- **Kanji (sour gruel):** Enhances corrosion and removal of oxides.
- **Kulattha Kwatha (horse gram decoction):** Useful in leaching impurities and softening the metal.
- **Gomutra (cow urine):** Recognized for its strong alkalinity, enhancing detoxification.

2. Comparative Role of Shodhana Media

- **Sesame oil:** Provides a lubricating effect on the copper surface, reduces brittleness, and improves malleability.
- **Buttermilk:** Rich in lactic acid, enhances corrosion of impurities.
- **Sour gruel:** Fermented medium with acidic pH, increases oxide layer removal.
- **Horse gram decoction:** Contains phytochemicals that aid in chelation and removal of metallic impurities.

- **Cow urine:** High in ammonia, urea, and salts, offering strong detoxifying action.

Comparative classical descriptions suggest that while all methods aim at detoxification, the choice of medium depends on the intended therapeutic indication of Tamra Bhasma.

3. Modern Analytical Validation

Recent studies have applied advanced analytical tools to validate Shodhana:

- **SEM (Scanning Electron Microscopy):** Shows significant reduction in particle size after multiple Shodhana cycles.
- **XRD (X-ray Diffraction):** Reveals transformation of crystalline structures, with reduction in metallic copper peaks and appearance of oxide forms.
- **ICP-MS (Inductively Coupled Plasma Mass Spectrometry):** Demonstrates reduction in toxic trace metals such as arsenic and lead.
- **AAS (Atomic Absorption Spectroscopy):** Confirms decrease in copper toxicity levels post-Shodhana.
- **FTIR (Fourier Transform Infrared Spectroscopy):** Identifies organic functional groups from herbal media adhered to the copper surface.

4. Impact on Safety and Therapeutic Efficacy

Toxicological studies confirm that raw copper is hepatotoxic and nephrotoxic. However, properly Shodhita Tamra demonstrates safe profiles in animal models. Shodhana enhances bioavailability by reducing particle size and introducing organic coatings from the medium. Studies confirm improved antioxidant and hepatoprotective activities of Shodhita Tamra compared to raw copper.

5. Comparative Experimental Findings

Experimental studies comparing different Shodhana methods highlight that:

- **Cow urine and sour gruel** are most effective in detoxification and oxide removal.
- **Sesame oil** provides structural stability but lesser detoxification than acidic media.
- **Buttermilk** offers moderate detoxification, particularly effective in reducing copper's "ushna" (heat) property.
- **Horse gram decoction** imparts chelation effects and increases therapeutic potential in metabolic disorders.

6. Integration of Traditional Wisdom and Modern Science

Overall, the comparative findings suggest that Shodhana is not merely a physical purification but a transformation process. The absorption of phytochemicals and organic molecules from the media provides an additional therapeutic dimension to Tamra. The incorporation of modern analytical tools confirms the safety and biocompatibility of properly Shodhita Tamra.

DISCUSSION

The review reveals that Shodhana of Tamra serves dual purposes: removal of toxic properties and induction of therapeutic attributes. Ayurveda's emphasis on media-specific processing aligns with modern findings that different media alter physicochemical characteristics of copper in unique ways^[16].

For instance, the strong alkalinity of cow urine facilitates effective detoxification, while lactic acid in buttermilk and organic acids in sour gruel enhance corrosion and oxide removal. Modern analytical evidence supports these claims, showing significant reduction in heavy metal impurities and transformation of crystalline structures. SEM and XRD analyses confirm nanoparticle formation post-Shodhana, which may explain the enhanced bioavailability described in Ayurvedic texts^[17].

Comparative evaluations suggest that no single medium can be considered universally superior; rather, the choice should depend on the therapeutic context. For hepatoprotective action, sour gruel and cow urine may be preferable, whereas sesame oil imparts structural stability suitable for formulations requiring long shelf life^[18].

Despite progress, gaps remain. Standardization of procedures across laboratories is lacking, making it difficult to compare results. Most modern studies have focused on laboratory validation; however, clinical evaluations of differently Shodhita Tamra preparations are rare. Furthermore, environmental impacts of traditional heating methods (cow dung cakes, open furnaces) need to be studied, and eco-friendly alternatives explored^[19].

Future research should integrate Ayurveda's therapeutic insights with modern toxicology and pharmacology. Large-scale clinical trials, along with development of pharmacopeial standards, will enhance the credibility and global acceptance of Tamra-based formulations^[20].

CONCLUSION

Tamra (copper), a widely used metal in Ayurveda, requires careful purification before therapeutic application due to its inherent toxicity in raw form. Shodhana, as described in classical texts, employs various herbal and animal-derived media such as sesame oil, buttermilk, sour gruel, cow urine, and horse gram decoction. Each medium offers unique benefits ranging from detoxification to enhancement of therapeutic potential.

Modern analytical techniques validate these classical practices, confirming reduction in toxic impurities, transformation of crystalline structures, and development of nanoscale particles with improved bioavailability. Comparative studies highlight that cow urine and sour gruel provide strong detoxification, while sesame oil offers structural stability and longevity.

This review underscores that Shodhana is not merely a mechanical process but a pharmaceutico-therapeutic transformation imparting desirable properties to Tamra. However, challenges remain in standardization, reproducibility, and clinical validation. Future work should focus on harmonizing classical methods with Good Manufacturing Practices (GMP), conducting comparative clinical trials, and establishing pharmacopeial standards.

By bridging traditional wisdom with modern scientific validation, Shodhana of Tamra can achieve global recognition as a scientifically sound and therapeutically safe practice, reaffirming Ayurveda's relevance in contemporary healthcare.

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