



Review Article

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A REVIEW ON TRANSFORMING METALS INTO MEDICINES: PHYSICAL AND CHEMICAL CHANGES DURING DHATU SHODHANA

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ABSTRACT

Dhatus have been used as medicine for a long time. But before being administered internally, these metals must undergo various processing steps to leach out toxins and impurities. Apart from the samanya shodhana process, every dhatu has a specific shodhana process known as vishesh shodhana, such as Nirvapana, Swedana which includes various processes and materials or media. These processes have specific therapeutic values, including micro-reduction of particles, leaching out impurities, evaporation of volatile toxins, and introduction of various organic elements. Vishesh shodhana has to be applied to derive certain special gunas, i.e., qualities. Each drug from dhatu varga may have different types of impurities, and has to be removed via different types of vishesh shodhana. Each process and media leads to some specific physical and chemical changes, which aid in the further process and internal intake by medicine preparation. Nirvapana, Puta, Swedana: every process has its own identity, methodology, and end product.

Keywords: Shodhana, Dhatu Varga, Physical changes, Chemical changes, Nirvapana, Puta, Swedana, Pithara Yantra

INTRODUCTION

In Ayurveda, healing is not just about treating symptoms—it's about understanding the inherent nature (svabhava), qualities (guna), and actions (karma) of every substance used in therapy. One such crucial group of substances is the Dhatu Varga, which includes metals and minerals like Svarṇa (gold), Rajata (silver), Loha (iron), Tamra (copper), and Naga (lead). ¹ These have been an integral part of Rasa Shastra, the branch of Ayurveda that deals with alchemy and the preparation of potent herbo-mineral formulations.

However, it is important to understand that these metals are not used in their raw or natural state. In their unprocessed form, they may contain impurities, toxins, and energetic imbalances that could be harmful if administered directly. This is where the Ayurvedic concept of Shodhana—a structured and deeply transformative purification process—becomes essential.

*Uddiṣṭaiḥ Auśadhaiḥ Sārdham Kriyate Peṣāṇādikam Mala-
vicchittaye Yattu Śodhanam Tat iha ucyate²*

Shodhana is not merely a method of physical cleaning; it is a holistic procedure that detoxifies the metals, making it suitable for further pharmaceutical processes such as Marana (calcination). Ayurveda uses thoughtful techniques such as Swedana (steaming), Nirvapana (quenching in liquids), Mardana (grinding), Bhavana (levigation), and Dṛuti (melting) - all performed with specific herbal liquids or natural substances such as Gomutra, Triphala kwatha, Takra, Tila taila, and nimbu swarasa. Each medium is chosen based on what the metal needs to be transformed and the purpose of its use.

Dhatu Shodhana refers to the special process of purifying individual metals according to their unique nature. This step is absolutely essential; it removes doṣhas (toxicity), enhances guṇas (positive qualities), and makes the substance yogya (suitable for digestion and absorption). The goal is to make the dhatu not just safe, but truly therapeutic.

Each metal has its own shodhana process:

- For instance, Loha (iron) is often purified by boiling and quenching it in Triphala decoction or Gomutra.
- Tamra (copper) is repeatedly heated and dipped in Tila oil, or Kanji.

These methods don't just cleanse the metal — they energise it, activate its healing potential, and reduce the risk of side effects. As explained in classical Ayurvedic texts such as Rasa Ratna Samucchaya, Rasa Tarangini, and Ayurveda Prakasha, Shodhana is the step that transforms ordinary metals into extraordinary medicines.

DEFINITION AND PURPOSE OF DHATU SHODHANA

In the classical science of Rasa Shastra, Dhatu Shodhana refers to the purification and detoxification of metallic and mineral substances (Dhatus) before they are processed further for medicinal use. These raw substances, although therapeutically potent, often contain toxic impurities and undesirable physical properties in their natural form, making them unsuitable or even harmful for human or animal administration without prior purification.

Shodhana is not merely a cleansing process but is seen as a biotransformative Samskara (pharmaceutical samskara) that enhances the bioavailability, potency, and safety of the substance.

Classical texts like Rasa Ratna Samuccaya, Rasatarangini, and Ayurveda Prakasha emphasise that Shuddha Dhatus are essential for the success of Rasaushadhis.

Objectives of Shodhana:

1. Elimination of toxic constituents
2. Removal of foreign matter and physical impurities
3. Conversion of metals into forms that are suitable for further processes (e.g., Marana)
4. Enhancing therapeutic potency (Veerya Vardhana)
5. Improving absorption and assimilation in the body (Yogya Rupa Nirmanam)

TYPES OF SHODHANA IN RASA SHASTRA

Samanya Shodhana

This refers to general or preliminary purification, applicable to most Dhatus to remove common impurities and make the metal more receptive to specific purification and processing.

Procedure: Typically involves repeated **Nirvapana** (quenching) of the heated metal into a series of liquids like:³

- Taila (Sesame oil)
- Takra (Buttermilk)
- Gomutra (Cow's urine)
- Kanji (Sour gruel)
- Kulattha Kwatha (Horse gram decoction)

Purpose: To soften the metal, to remove Mlechha Dravyas (external contaminants), to enable further processing like Bhasmikaarana (Calcination)

Vishesha Shodhana

This refers to specific purification procedures tailored to a particular metal or mineral based on its unique chemical composition and toxic profile.

Media Used: Often includes herbal pastes, juices, decoctions, or combinations with specific properties.

Purpose

- Detoxify specific toxic constituents
- Activate the metal/mineral for therapeutic action
- Increase affinity to combine with other substances (Samskara Siddhata)

DHATUS AND THEIR SHODHANA

Table 1: Dhatu and their Specific Shodhana

Dhatu	Type of method used	Dravya used
Swarna	Putra (Kapota putra 7)	Bijoranambu swarasa and Panchmrittika ⁴
	Putra (Kukkuta Putra 1)	Saindhava lavana, Vanyopala Raakh and Bijoranambu Swarasa ⁵
Rajata	Nirvapana	Agasyta patra Swarasa 3 times ⁶
	Nirvapana	Nimbu Swarasa ⁷ (Repeat until it turns soft)
Tamra	Nirvapana	Changeri Patra Swarasa 21 times ⁸
	Swedana	NeelPushpa Swarasa 1 day ⁹
Lauha	Nirvapana	Triphala Kashaya 7 times ¹⁰
	Nirvapana	Triphala Kashaya and Gomutra 7 times ¹¹
Naaga	Nirvapana by pithra yantra	Nirgundimool swarasa 7 times ¹² Churnodaka 7 times ¹³
Vanga	Nirvapana by Pithra Yantra	Churnodaka 7 times ¹⁴ Arka Ksheer 7 times ¹⁵
Yashada	Nirvapana by Pithra Yantra	Nirgundimool swarasa 7 times ¹⁶ Churnodaka 7 times ¹⁷ Godugdha 21 times ¹⁸ Snuhikskeer 7 times ¹⁹

THE SCIENCE BEHIND CLASSICAL PROCESSING

NIRVAAPA

Dhatvadeva Hni-taptasya Jaladau Yat Nishechanam Sah Nirvapah Smritam Cha Api Nishekah Apanach Tat²⁰

Nirvapana refers to the process of repeated heating of a metal or mineral until it turns red-hot and quenching it immediately in a liquid medium such as: Tila Taila (sesame oil), Takra (buttermilk), Gomutra (cow urine)

Table 2: Physical Changes during Nirvapana

Change	Observation
Colour change	Metal becomes red-hot while heating and loses lustre upon cooling. Surface becomes dull or oxidised.
Texture change	The surface becomes rough, porous, and brittle, making the metal easier to powder.
Breakability increases	Thermal cycling induces microcracks and brittleness due to expansion and contraction.
Surface morphology	SEM studies show increased surface area and porosity, which improve grinding.

Table 3: Chemical Changes during Nirvapana

Change	Explanation
Surface oxidation	Heating in air leads to the formation of oxides on the surface of the metal.
Detoxification via leaching	Quenching helps to dissolve toxic salts and foreign elements in the liquid media.
Ion exchange and adsorption	During interaction, ions may get exchanged or adsorbed, altering their nature.
Chelation	Active herbal components (such as tannins and phenolics) may form chelates with metals, thereby reducing toxicity.
pH-dependent reactions	Media such as Gomutra or Kanji have a specific pH that induces the hydrolysis or neutralisation of harmful ions.
Reduction of trace toxic metals	Toxic contaminants like Pb, As, or Hg can be reduced or transformed to inert forms.

PUTA

Rasoparasa lohadeh pakamana pramapakam utpaladyagni samyogat yat tad atra putam smritam ²¹

Putra refers to a specific heating process used during the preparation of Bhasma (calcined ash of metals/minerals). It is a key step in the Marana (incineration) process, in which a purified metal or mineral, after being triturated with herbal juices (Bhavana), is sealed in a container (Sharava Samputa) and heated under controlled conditions in a traditional furnace or a modern muffle furnace.

Table 4: Physical Changes During Puta

Change	Observation
Color transformation	Metal turns from shiny or metallic colour to black, red, brown, or grey ash.
Phase change	Solid metal or mineral is transformed into a fine, non-metallic ash.
Texture	Coarse particles become light, fluffy, and smooth, increasing their absorption.
Loss of lustre and shine	Metallic sheen disappears, indicating breakdown of metal structure.
Particle size reduction	Repeated heating and grinding produce nano- or microfine particles.

Table 5: Chemical Changes During Puta

Change	Explanation
Oxidation of metals	Metals convert to oxides, sulfides, or other stable forms (e.g., Fe → Fe ₂ O ₃ , Cu → CuO).
Complex formation	Organic material from Bhavana may form organometallic complexes, improving bioavailability.
Detoxification	Toxic elements (like arsenic, mercury) convert to less toxic forms (e.g., Hg → HgS).
Fusion with media elements	Trace minerals or salts from Bhavana interact with metal, changing the chemical structure.

SWEDANA

Swedana refers to the sudation or steaming process where a purified metal or mineral is subjected to mild, moist heat using herbal decoctions (Kwathas) or other liquids in a Dola Yantra setup (a traditional steaming apparatus).

Table 6: Physical Changes During Swedana

Change	Explanation
Softening of substance	The material becomes less rigid or brittle, easing further processing.
Opening of micropores	Heat and moisture expand pores, allowing impurities to leach out.
Colour change	Surface may darken, lighten, or change hue due to herbal interaction.
Mass change	Slight weight loss or gain, depending on liquid absorption or impurity removal.
Homogenization	Helps in achieving a more uniform texture

Table 7: Chemical Changes During Swedana

Change	Explanation
Leaching of water-soluble toxins	Harmful salts, soluble oxides, or alkaloids are dissolved and removed via decoction.
Herbo-mineral interaction	Herbal media's active principles (alkaloids, tannins, flavonoids) bind to minerals, reducing toxicity or enhancing potency to specific conditions.
pH-based reactions	Acidic or alkaline media induce ion exchange, chelation, or hydrolysis.
Partial oxidation/reduction	Moist heat may induce mild redox reactions at the surface of oxides.
Detoxification	Substances like Hartala (orpiment) and Gandhaka (sulphur) lose arsenic or selenium toxicity.
Volatilization of volatile impurities	Any light volatile toxins or gases may evaporate during steaming.

NIRVAPA WITH PITHARA YANTRA

Pithara Yantra is a metallic heating apparatus traditionally used in Rasa Shastra for the controlled heating and quenching (Nirvapana) of metals and minerals during Shodhana (purification).

While not explicitly mentioned in early texts such as Rasa Ratna Samuccaya or Rasatarangini, the use of iron or earthen crucibles for heating and quenching is well documented in Shodhana kriyas. In contemporary classical practice, Pithara Yantra has evolved as a standardised metal box-furnace apparatus for Nirvapana procedures for Puti Lauha.

The physical chemical changes behind the process with pithara yantra are the same, except that when pithara yantra is used, it avoids the spillage of dhatus like vanga yashada, etc. As it contains a covering (pidhanak) above it with a small opening in the centre, to pour the molten liquid.

Ideal for Standardisation

- Due to its reproducibility, it supports the standardisation of Ayurvedic pharmaceutical procedures.
- Useful for academic institutions, research labs, and GMP-approved Ayurveda pharmacies.

The result obtained from the nirvapan process with and without the use of the Pithara yantra is almost similar, apart from using the Pithara yantra for Puti Lauha to avoid spilling of the metal.

DISCUSSION

The purification of metals and minerals in Ayurveda, particularly through Visheshha Shodhana, is a refined process that goes beyond mere detoxification. It involves specific procedures tailored to the nature of each dhatu, using chosen herbal or natural media that bring about targeted physical and chemical changes. These changes are critical to transforming toxic raw materials into bioavailable and therapeutic substances.

Processes like Nirvaapa (quenching) lead to structural changes in the metal. Repeated heating and sudden cooling—especially in media such as gomutra, Triphala kashaya, or Takra—induce size reduction and refinement, the removal of surface oxides, and an increase in brittleness. These changes make metals easier to powder and more suitable for the subsequent Marana (calcination) stage.

In Swedana (sudation/steaming), metals are steamed in herbal decoctions, which soften the surface, loosen impurities, and initiate chemical interactions between the metal surface and the herbal media. This helps reduce toxicity and initiate herbal addition, a concept increasingly validated by modern phytochemical and surface analysis studies.

The Puta method, used especially in Marana but also used in Visheshha Shodhana of several shatu such as Swarna, involves controlled heating in closed containers (Sharava Samputita Puta). This technique results in oxidation, reduction, and conversion to fine ash (Bhasma) with nanoparticle-level dispersion.

Each of these methods, when applied with Visheshha Shodhana protocols, modifies the metal's properties in terms of:

- Particle size reduction
- Alteration of crystalline structure
- Improved solubility
- Increased surface area for biological interaction
- Enhanced therapeutic efficacy
- Minimised toxicity

Shodhana is not merely a traditional ritual but a scientifically relevant intervention. It aligns with modern pharmaceutical goals such as bioavailability enhancement, detoxification, and targeted drug delivery, especially when further processed into Bhasma.

This detailed integration of Ayurvedic wisdom with observable physical and chemical transformations highlights the brilliance of classical protocols and the need for their standardisation and validation in contemporary research. It also reaffirms that proper

Shodhana is not optional—but foundational to the safe and effective use of Dhatu Varga in Ayurvedic therapeutics.

CONCLUSION

Shodhana stands as a cornerstone in Ayurvedic Pharmaceutics, ensuring that potent yet potentially toxic metals and minerals are transformed into safe, effective, and biocompatible therapeutic agents. Far from being a mere ritual, this process involves precise physical and chemical alterations—such as detoxification, particle size reduction, improved solubility, and enhancement of medicinal properties.

These transformations not only align with the classical Ayurvedic understanding of doṣha removal and guṇa enhancement, but also reflect principles recognised in modern pharmaceutics and nanotechnology. By tailoring the purification method to the nature of each individual dhatu, Visheshha shodhana safeguards the therapeutic integrity of Rasaushadhis and highlights the deep foresight of Ayurveda in metal-based drug formulation.

Future efforts must also aim to scientifically validate and standardise these ancient processes, bridging traditional wisdom with modern research for global acceptance and clinical application.

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