

Dhatu Bhasmas: An Ayurvedic Nanomedicine Perspective

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Date of Submission: 06-05-2026

Date of Acceptance: 17-05-2026

Abstract

This article reviews the clinical pharmacology of *Dhatu Bhasmas*, a class of Ayurvedic metallic-mineral preparations characterized as ancient nanomedicines. *Bhasmas* are microfine powders produced through elaborate processes of purification (*Shodhana*) and incineration (*Marana*), resulting in significantly reduced particle size that enhances absorption and therapeutic efficacy. The article highlights the manufacturing steps, quality control parameters, the nanoparticle properties influencing biodistribution and action, and the specific therapeutic implications and pharmacological actions of prominent *Dhatu Bhasmas* like *Swarna* (Gold), *Rajatha* (Silver), *Tamra* (Copper), *Vanga* (Tin), *Naga* (Lead), and *Lauha* (Iron). Research indicates *Bhasmas* potential in managing chronic and complex disorders due to their high efficacy, immunomodulatory (*Rasayana*), and drug-targeting (*Yogavahi*) properties.

Keywords

Dhatu Bhasmas, Nanoparticles, Ayurveda, Rasashashtra

I. Introduction

Bhasmas are defined as ash obtained through incineration, involving an elaborate process of purification followed by a reaction phase incorporating other minerals and/or herbal extracts.¹ *Bhasma* which contain Fe, Cu, S or others, manufacturing process plays a specific role in the final product(s). Particle size reduced significantly, which may facilitate absorption and assimilation of the drug into the body system. Key characteristics of a *Bhasma* include *Rasayana* (immunomodulation and anti-aging quality) and *Yogavahi* (the ability to target drugs to the site of action)². *Dhatu Bhasmas* are prepared from metals such as *Swarna*, *Rajatha*, *Tamra*, *Lauha*, *Naga*, *Vanga*, *Yashada* etc. The efficacy and therapeutic application of *Bhasmas* depend heavily on the proper preparation, quality

control, and administration with appropriate *Anupana* (vehicle).

II. Material and Methods:

The manufacturing of *Dhatu Bhasmas* involves three main processes:

- 1. Shodhana (Purification):** This process reduces the drug's toxicity to a sustainable limit. It involves the elimination of harmful matter, modification of undesirable physical and chemical properties, and enhancement of therapeutic action. Apart from specific purification methods (*Vishesh Shodhana*), the general method (*Samanya Shodhana*) of purification for metals like *Swarna*, *Rajatha*, *Tamra*, *Lauha* is that the metal is heated to red hot and quenched for seven times into various liquids like *Taila*, *Takra*, *Gomutra*, *Aranala*, and *Kulattha Kwatha*. In case of *Puti Lohas*, which are having low melting points are first melted and poured into specific liquids through *Pitara Yantra*.
- 2. Jarana (Intermediary process):** These are intermediary process between *Shodhana* and *Marana* to convert low melting point metals suitable for *Marana*. Here metals are added with *Apamarga Panchanga Choorna* or *Aswatha Twak Choorna* rich in alkali content and burnt till metal converts into black powder form.
- 3. Marana (Incineration):** Also called *Bhasmikiranana*, this is the process of converting materials into a microfine, tasteless, non-hazardous, acceptable, and absorbable form for medicinal use. It includes steps like *Mardana* (trituration), *Chakrikakarana* (disk formation), and *Sharava Samputikarana* (sealing and heating).³

Quality Control Of Bhasma

Traditional Criteria: evaluated based on

i. Physical characteristics-

- *Varna* (Specific Colour): Each *Bhasma* has a characteristic colour,

<i>Bhasma</i>	<i>Varna</i>
<i>Swarna</i>	<i>Champaka</i>
<i>Rajatha</i>	<i>Krishna</i>
<i>Tamra</i>	<i>Krishna</i>
<i>Lauha</i>	<i>Jambu</i>
<i>Naga</i>	<i>Paravata</i>
<i>Vanga</i>	<i>Swetha</i>
<i>Yashada</i>	<i>Swetha</i>

- Lustreless(*Nishchandratvam*): *Bhasma* must be lusterless before therapeutic application. For this test, *Bhasma* is observed under bright sunlight and checked whether luster is present or absent. If luster is still present, it indicates further incineration is needed.
- Lightness and Fineness(*Varitara*): *Bhasma* floats on stagnant water surface. This test is based on law of surface tension. Properly incinerated *Bhasma* need to float on water surface.⁴
- Particle size (*Rekhapurnatvam*) : Here the *Bhasma* are rubbed in between thumb and index finger. If the *Bhasma* enters and embeds into the fingerprints, it indicates it is fine and accepted as standard.

ii. Chemical characteristics⁵

- *Apunarbhavatva*: It means incapability to regain original metallic form. For this test *Bhasma* is mixed with equal quantity of seeds of *Gunja* (*Abrus precatorius*), honey, ghee, borax, jaggery (*Mitrapanchaka*) then sealed in earthen pots and heated with similar grade of heat used in *Marana*. No changes should be present in the quality & quantity of *Bhasma*.
- *Niruttha*: *Niruttha* is to test inability to regain metallic form of metallic *Bhasma*. In this test *Bhasma* is mixed with a fixed weight of silver leaf and kept in sealed earthen pots, then similar grade of heat used in *Marana* is applied and after self-cooling, the weight of silver is taken. Increase in weight of silver leaf indicates improperly prepared *Bhasma*.

Modern Standardization: may include

- Analytical tests
- Botanical Authentication and Foreign Matter analysis.
- Organoleptic, Macroscopic, and Microscopic Evaluation.
- Heavy Metal Contaminants and Microbial Count.
- Volatile Matter, Ash Value, Extractive Value, Pesticide Residue, Marker Component, and Chromatographic Profile.

Properties

Pharmacological and Therapeutical Properties

<i>Dhatu Bhasma</i>	Therapeutic action/ Indication (with <i>Anupana</i>) ⁶
<i>Swarna</i> (Gold)	<i>Kaanti, Medhya, Rasayana (Ghrita); Vrshya (Bhringaraja Swarasa).</i>
<i>Rajatha</i> (Silver)	<i>Avasada(honey); Prameha (Trijathaka); Rajayakshma(Bharangi & Shunti choorna).</i>
<i>Tamra</i> (Copper)	<i>Vrana (Processed with Gandhaka Yoga and specific Kashaya); Amlapitta (Amalaki Choorna); Chardi (Half Ratti with Aswattha Twak Choorna).</i>
<i>Lauha</i> (Iron)	<i>Valipalitha nashana (Triphala choornam); Pandu (Ghrita/ Madhu/ Haridra swarasa); Amlapitta (Amalaki choorna, Pippali choorna, sugar).</i>
<i>Naga</i> (Lead)	<i>Prameha (Haridra choorna & Amalaki choorna with Madhu), Raktha pradara (Asoka twak kwatha), Antrasotha(Balamoola & jatamansi kwatha)</i>
<i>Vanga</i> (Tin)	<i>Prameha (Guduchi satwa+Madhu), Nadishoola (Swarnamakshika bhasma & rajatha bhasma), Gulma (Tankana choorna), Ajeerna(Puga choorna)</i>

Yashada (Zinc)	Svasa (Tankana, Abhraka Bhasma, Vamshalochana Choorna); Drushtimandhya (Puratana Goghrita).
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Dhatu Bhasma	Pharmacological action
Swarna Bhasma	<ul style="list-style-type: none"> ➤ Immunomodulatory property⁷ ➤ Anti-microbial property⁸ ➤ Anti-cancer property⁹
Rajatha Bhasma	<ul style="list-style-type: none"> ➤ Antibacterial property¹⁰ ➤ Antidiabetic activity¹¹ ➤ Memory enhancing activity. ➤ Anti-depressive property¹² ➤ Hepatoprotective activity¹³
Tamra Bhasma	<ul style="list-style-type: none"> ➤ Antioxidant activity¹⁴ ➤ Anti- bacterial activity¹⁵ ➤ Anti- hyperlipidemic activity¹⁶ ➤ Cardio- protective activity¹⁷
Lauha Bhasma	<ul style="list-style-type: none"> ➤ Antioxidant property¹⁸ ➤ Haematinic property¹⁹ ➤ Anti-inflammatory property²⁰
Naga Bhasma	<ul style="list-style-type: none"> ➤ Antidiabetic property²¹
Vanga Bhasma	<ul style="list-style-type: none"> ➤ Antihyperglycemic property²² ➤ Anti-microbial property²³
Yashada Bhasma	<ul style="list-style-type: none"> ➤ Antimicrobial property²⁴ ➤ Anti-cancer activity²⁵

Mode of action

Dhatu Bhasma	Mode of Action (Nanoparticles)
Swarna (Gold)	AuNP interaction with bacterial cells. ²⁶ AuNPs interact with the bacterial cell wall, change its structure and eventually destroy it. Thus, the first interaction of AuNPs with bacteria is at the molecular level with the cell wall.
Rajatha (Silver)	AgNPs bind to the virus DNA or RNA, suppressing replication or virus proliferation. AgNPs can induce apoptosis-dependent programmed cell death. ²⁷
Tamra (Copper)	Copper oxide NPs cause DNA fragmentation, chromosomal aberration, and apoptosis in cancer cells. ²⁸
Lauha (Iron)	Iron nanoparticles kill microbes via production of ROS, obstructing membrane structure and changing macromolecules chemistry which leads to death of microbial pathogens. ²⁹
Naga (Lead)	(i) Electrostatic interactions with bacterial membranes, generating reactive oxygen species (ROS) that induce cell death (ii) Pb ²⁺ ion released from PbO NPs plays in antibacterial mechanisms of bacterial hindering through inhibiting active transport, bacterial metabolism, disruption of membranes, and intracellular accumulation leading to bacterial cell death and (iii) another mechanism could be the direct contact with bacterial cell walls, causing lysis, damaging bacterial cell integrity, resulting in the leakage of intracellular content ³⁰ .
Vanga (Tin)	Many factors influence the antibacterial activity of SnO ₂ NPs, including particle size, the capping agent used during synthesis, and nanoparticle morphology ³¹ .
Yashada (Zinc)	ZnO inactivates bacteria is the direct interaction with the cell surface. This interaction significantly alters the permeability of the membranes and provides a

	path for the ZnO-NPs to enter the bacterial cell and cause oxidative stress leading to cell death. ³²
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Pharmacodynamics:

- Absorption and Distribution: Nanoparticles smaller than 500 nm have a high capacity for circulation. The distribution is affected by size, hydrophobicity, permeability and the tendency of blood proteins (Oponins) to recognize and remove large nanoparticles³³.
- Metabolism: Most orally administered nanoparticles enter systemic circulation via direct absorption into the portal blood. Metabolism varies with pH, enzymic activity etc. In the case of lipophilic medicines, the nanoparticles escape the lymphatic route avoiding hepatic first-pass metabolism³⁴.
- Elimination: Nanoparticle clearance is through urine excretion hepatobiliary and fecal excretion³⁵.

III. Discussion

The clinical efficacy of *Dhatu Bhasmas* is largely attributed to their particle characteristics

- Optimal Size: Nanoparticles smaller than 600 nm can be utilized. The size range of 10–100 nm offers good systemic absorption and longer circulation.
- Elimination: Particles smaller than 6 nm are typically eliminated by the kidneys.
- Absorption: Particles <10nm show a high surface area, rapid absorption through the GI tract, and faster action (e.g., *Swarna Bhasma*)³⁶.

Shape and Biodistribution

The shape of the nanoparticles dictates their accumulation site and uptake kinetics.

Shape of NP	Preferred Site of Accumulation ³⁶	Therapeutical Implications
Spherical	General body tissues	Systemic disorders (e.g., <i>Lauha Bhasma</i> for Anemia, <i>Swarna Bhasma</i> for immunity).
Rod	Lungs	Respiratory disorders and pulmonary disorders (e.g., <i>Rajatha Bhasma</i>).
Cylindrical	Liver	Hepatic disorders (e.g., <i>Tamra Bhasma</i>).
Irregular	Spleen	Chronic immune-related disorders (e.g., <i>Naga & Vanga Bhasma</i>)

IV. Conclusion

Bhasmas are the Ayurvedic nanoparticles that is been used since ages. As these are smaller molecules and with less molecular weight have the potency to reach the targeted site. Its small dosage itself points out the high efficacy of the therapeutics. These have wide properties and activities so as it can be used in simple to complex disorders. Most of the *Kricchra Sadhya Vyadhis* nowadays is focused to be managed using nanomedicines. The application of *Bhasmas* with the proper dose, *Anupana*, and time of administration have a high influence in curing the chronic ailments.

Reference

[1]. Pal D, Sahu CK, Haldar A. Bhasma : The ancient Indian nanomedicine Journal of Advanced Pharmaceutical Technology &

Research. 2014 Jan;5(1):4-12. doi: 10.4103/2231-4040.126980. PMID: 24696811; PMCID: PMC3960793.
 [2]. Kumar A, Nair AG, Reddy AV, Garg AN. Bhasmas: unique ayurvedic metallic-herbal preparations, chemical characterization. Biological trace element research. 2006 Mar;109(3):231-54. doi: 10.1385/bter:109:3:231. PMID: 16632893.
 [3]. Damodar Joshi, Rasasastra, Chaukhamba Orientalia, Varanasi, Edition 2010
 [4]. Vinay Kumar Kodibagil / Bargale Sushant Sukumar, Textbook of Rasa Shastra Evam Bhaishajya Kalpana, prescribed by NCISM New Delhi, Vol. 1.
 [5]. Vabhatacharya. Rasaratnasamuccaya. By Dr. V.A. Dole. Forwarded by Dr.Siddhinandan Mishra. Chapter 8.

- [6]. Ravidra Angadi, Rasa Tarangini of Sri Sadananda Sharma, Chaukhamba Subharati Prakashan, Varanasi, First Edition.
- [7]. Bhaskaran JK, Patel KS, Srikrishna R. Immunomodulatory activity of *Swarna Prashana* (oral administration of gold as electuary) in infants - A randomized controlled clinical trial. *Ayu*. 2019 Oct-Dec;40(4):230-236. doi: 10.4103/ayu.AYU_33_19. Epub 2021 Jan 14. PMID: 33935440; PMCID: PMC8078605.
- [8]. Singh K, Gupta PK, Kumar A, Singh BM. Characterization of Swarna Bhasma and Swarnaprash and Determination of Antimicrobial Properties Against Gut-Pathobiont and Symbiont. *Biological trace element research*. 2025 May;203(5):2924-2932. doi: 10.1007/s12011-024-04353-8. Epub 2024 Sep 6. PMID: 39240307.
- [9]. Das S, Das MC, Paul R. Swarna Bhasma in cancer: A prospective clinical study. *Ayu*. 2012 Jul;33(3):365-7. doi: 10.4103/0974-8520.108823. PMID: 23723642; PMCID: PMC3665104.
- [10]. Revati Sharma, Asan Bhatt, Mansee Thakur. Physicochemical characterization and antibacterial activity of Rajata Bhasma and silver nanoparticle. *Ayu*. January 2016.37(1):71DOI:10.4103/ayu.AYU_167_15. <https://www.researchgate.net/publication/318482990>
- [11]. Anand Prakash Rai. Evaluation of antidiabetic activity of Rajata bhasma. *International Journal of Green Pharmacy (IJGP)*. Vol. 13 No. 04 (2019). <https://doi.org/10.22377/ijgp.v13i04.2708>
- [12]. Agey KN, Mahabdi PP, Prajapati D, BJ Patgiri. Review of research works done on Rajata Bhasma [Incinerated Silver] at Institute of Teaching and Research in Ayurveda, Jamnagar. *Journal of Ayurveda and Integrated Sciences*. August 2024. Vol 9 Number 8. DOI:10.21760/jaims.9.8.14.
- [13]. Rai A. P, Tripathi S, Tiwari O. P. Assessment of Hepatoprotective Activity of Rajata Bhasma in CCl₄ Induced Hepatotoxicity Rats. *Biomed Pharmacol J* 2019;12(4).
- [14]. Rugmini R.K, Sridurga C.H, Venkata Subbaiah K. Antioxidant Activity of Tamra Bhasma and Tamra Yoga: An *In Vitro* Evaluation. *International Journal of Research in Ayurveda & Pharmacy* 9 (1), 2018.
- [15]. Prasanna Kumar T, Vijay Kumar GS, Shwetha Singh. *In Vitro* Antibacterial Activity of Tamra Bhasma. *International Journal of Ayurvedic Medicine*, 2010,1(1), 23-30.
- [16]. Chandrashekhar Yuvaraj Jagtap, Ashok Bk, Patgiri BJ, Pradeep Kumar Prajapati, Basavaiah Ravishankar. Comparative anti-hyperlipidemic activity of Tamra Bhasma (incinerated copper) prepared from Shodhita (purified) and Ashodhita Tamra (raw copper) *Indian Journal of Natural Products and Resources* October 2012.4(2):205211.
- [17]. Chandrashekhar Yuvaraj Jagtap, Suhas V Nayak, Basavaiah Ravishankar, Pradeep Kumar Prajapati. Cardioprotective Activity Of Tamra Bhasma And Somnathi Tamra Bhasma. *Rashtriya Ayurved Vidyapeeth*, March 2010.
- [18]. Deepak Khobragade. *In Vitro* Evaluation of Antioxidant Potential of Ayurvedic Preparations Lauha Bhasma and Mandura Bhasma. *Tropical Journal of Pharmaceutical Research* July 2017.7(2):63.
- [19]. Prasanta Kumar Sarkar, Pradeep Kumar Prajapati, Anand Chaudhary, Vinay J Shukla. Haematinic Evaluation of Lauha Bhasma and Mandura Bhasma on HgCl₂ -induced Anemia in Rats. *Indian Journal of Pharmaceutical Sciences*. February 2007. DOI:10.4103/0250-474X.39435.
- [20]. Sivaram K, Lakshmi Anusha V, Sunitha N, Thangabalan B. Evaluation of anti-inflammatory and analgesic activity of Bhasmas in experimental animal models. *World Journal of Advanced Research and Reviews*. May 2024. DOI:10.30574/wjarr.2024.22.2.1438.
- [21]. Rajput D, Patgiri BJ, Galib R, Prajapati PK. Anti-diabetic formulations of Nāga bhasma (lead calx): A brief review. *Ancient Science of Life*. 2013 Jul;33(1):52-9. Doi: 10.4103/0257-7941.134609. PMID: 25161332; PMCID: PMC4140024.
- [22]. Soni Chandan, Kumar Parveen, Mehta H.C., Gaidhani Sudesh, Wanjari Manish. Screening of Antidiabetic Effect of Vanga Bhasma (Tin Ash) in Alloxan-Induced Hyperglycemic Rats. *International Journal Of Research In Ayurveda And Pharmacy*. 2011, 2 (4) 1225-1230.
- [23]. Raman Belge, Rameshwar Pandey, Prakash Itankar. Analytical and antimicrobial study of *Vanga Bhasma* with special reference to *Ayurved Prakash*. *Journal of Ayurveda and*

- Integrated Medical Sciences. March - April 2021.
- [24]. Janani J., S. A. Doddamani and Surekha S. Medikeri. Invitro evaluation of antimicrobial activity of Yashada Bhasma prepared as per Rasa Chandamshu. World Journal Of Pharmacy In Pharmaceutical Sciences. July 2022. Vol. 11, Issue 8.
- [25]. Chandran S, Patgiri B, Bedarkar P, Mathat D. Anticancer activity of *Yashada Bhasma*(bioactive nanoparticles of zinc): A human pancreatic cancer cell line study. Ayu. 2019 Jan-Mar;40(1):58-63. doi: 10.4103/ayu.AYU_239_17. PMID: 31831971; PMCID: PMC6891994.
- [26]. Timoszyk A, Grochowalska R. Mechanism and Antibacterial Activity of Gold Nanoparticles (AuNPs) Functionalized with Natural Compounds from Plants. Pharmaceutics. 2022 Nov 25;14(12):2599. doi: 10.3390/pharmaceutics14122599. PMID: 36559093; PMCID: PMC9784296.
- [27]. Mikhailova EO. Silver Nanoparticles: Mechanism of Action and Probable Bio-Application. Journal of Functional Biomaterials.2020 Nov 26;11(4):84. doi: 10.3390/jfb11040084. PMID: 33255874; PMCID: PMC7711612.
- [28]. Chaudhari SY, Jagtap CY, Galib R, Bedarkar PB, Patgiri B, Prajapati PK. Review of research works done on Tamra Bhasma [Incinerated Copper] at Institute for Post-Graduate Teaching and Research in Ayurveda, Jamnagar. Ayu. 2013 Jan;34(1):21-5. doi: 10.4103/0974-8520.115440. PMID: 24049401; PMCID: PMC3764875.
- [29]. Hussain A, Yasar M, Ahmad G, Ijaz M, Aziz A, Nawaz MG, Khan FA, Iqbal H, Shakeel W, Momand H, Ali R, Ahmad S, Shah H, Nadeem M, Ahmad D, Anjum F, Faisal S. Synthesis, characterization, and applications of iron oxide nanoparticles. International journal of Health Sciences (Qassim). 2023 Jul-Aug;17(4):3-10. PMID: 37416845; PMCID: PMC10321464.
- [30]. Bidir Kassaw, Tadesse Bizuayehu, Mihret Ke ndie. Eco-friendly synthesis and biological activity investigations of lead oxide nanoparticles using *Rumex Nervosus Vahl* leaf extract. Results in Chemistry. Volume 16, July 2025, 102437. <https://doi.org/10.1016/j.rechem.2025.102437>
- [31]. Suresh Sagadevan, J Anita Lett, Is Fatimah, Yogeswaran Lokanathan, Estelle Léonard, Won Chun Oh, M A Motalib Hossain and Mohd Rafie Johan. Current trends in the green syntheses of tin oxide nanoparticles and their biomedical applications. Material Research Express. Volume 8, Number 8. DOI 10.1088/2053-1591/ac187e
- [32]. Hari Babu Boppudi ,Y. Subba Rao, Charan Kuchi , A. Ramesh Babu , Varadhi Govinda , M. Jagadeesh , Ma himaluru Lavanya .Zinc oxide nanoparticles as an efficient antioxidant, photocatalyst, and heterogeneous catalyst in C–P bond synthesis. Science Direct. Volume 6, December 2023, 101227. <https://doi.org/10.1016/j.rechem.2023.101227>
- [33]. Alexis F, Pridgen E, Molnar LK, Farokhzad OC (2008) Factors affecting the clearance and biodistribution of polymeric nanoparticles. Mol Pharm 5(4):505–515. <https://doi.org/10.1021/mp800051m>
- [34]. Du XJ, Wang J, Iqbal S, Li HJ, Cao ZT, Wang Y, Du J, Wang J (2018) The effect of surface charge on oral absorption of polymeric nanoparticles. Biomater Sci. <https://doi.org/10.1039/c7bm01096f>
- [35]. Larese Filon F, Mauro M, Adami G, Bovenzi M, Crosera M (2015) Nanoparticles skin absorption: new aspects for a safety profile evaluation. Regul Toxicol Pharmacol 72(2):310–322. <https://doi.org/10.1016/j.yrtph.2015.05.005>
- [36]. Haripriya, M., Suthindhiran, K. Pharmacokinetics of nanoparticles: current knowledge, future directions and its implications in drug delivery. Future Journal of Pharmaceutical Science. Vol 9, 113 (2023). <https://doi.org/10.1186/s43094-023-00569-y>.