

BHASMA THERAPY: BRIDGING AYURVEDA'S RASA SHASTRA WITH MODERN NANOMEDICINE**Dr. Vandana N. Hirudkar^{*1} and Dr. Varsha P. Wanjari²**¹Professor, Rasashastra and Bhaishajya Kalpana, L. N. Ayurved College and Hospital, Bhopal (MP) India.²Professor, Rasashastra and Bhaishajya Kalpana, L. N. Ayurved College and Hospital, Bhopal (MP) India.***Corresponding Author: Dr. Vandana N. Hirudkar**

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ABSTRACT

Ayurveda, practiced in India and neighboring regions, is an ancient healing system that incorporates the use of metals for therapeutic purpose. Under the umbrella of Rasa-Shastra Ayurveda utilizes many herbo-metallic preparations for treating various health issues. Bhasma is one such preparation of Ayurveda made from metals, minerals and other natural substances. These preparations undergo unique purification and size reduction processes to yield fine particles that may enhance absorption and bioavailability of drug. Bhasma as nano-medicine offers unique therapeutic potency with minimal dosing. The preparation methods include metals like iron, copper and mercury, etc. which play vital roles in the property of final formulation. Standardizing Bhasma is essential to ensure their safety, quality and efficacy. Techniques such as X-ray diffraction and TEM have confirmed nano-scale size of Bhasma, thus can be classified as nano-medicine. This article explores qualities of Bhasma as traditional formulation as well as nano-medicine.

KEYWORDS: Ayurveda, Nanomedicine, Bhasma, Rasa-Shastra, Herbo-metallic.**INTRODUCTION**

Ayurveda made up of *Veda* and *Ayush* means knowledge of life. Ayurvedic system adopts many approaches towards the physical, mental and spiritual health of human being. *Rasa-Shastra* is one such approach of Ayurveda, deals with herbo-mineral preparations including *Bhasmas*. These formulations possess ability to target drugs at the site of action and having advantages of being nontoxic and gently absorbable. During the preparation process *Bhasma* being treated with herbal juices and exposed to control heat. These processes make *Bhasma* as nano-sized medicine which are claimed to be absorbed biologically as nano-particles.^[1-4]

Bhasma as herbo-mineral-metallic compounds ranging in nano-dimensions size from 5–50 nm. This is confirmed by many modern microscopic and spectroscopic techniques. These herbo-mineral-metallic compounds are used for treating diverse chronic ailments. These metal/mineral based drugs function best when converted from their original metallic state to oxide state. The manufacturing process called *Bhasmikiranana* converts metal to their higher oxidation state. This process eliminates toxicity of metal while rendering medicinal value of metals. *Bhasmikiranana* involve various processes of purification and incineration in which particle size reduced significantly making *Bhasma* nano medicines.

These all process converts *Bhasma* into bio-assimilable, absorbable and biocompatible form. Thus *Bhasmikiranana* not only reduces particle size of metal but also make *Bhasma* most suitable for human body. It can be stated that *Bhasma* as nano-particles are organo-metallic complexes with improved stability, absorption, bioavailability and effectiveness. Their classification based on main composition and properties are presented in **Figure 1** and **Table 1** respectively. *Bhasma* maintain alkalinity inside the body, provide easily absorbed and usable form of mineral and metals, cleanse kidneys and intestines, maintain strength of bones and imparts rejuvenating effect.^[4-8]

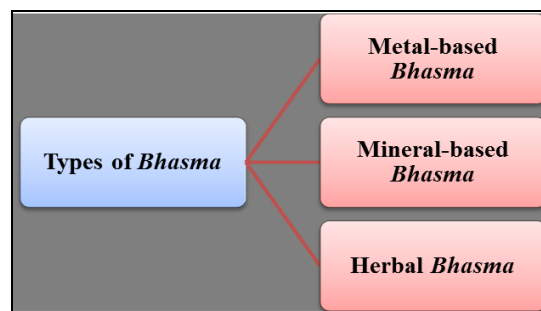
**Figure 1: Types of Bhasma.**

Table 1: Characterization of *Bhasma*, into physical and chemical characteristics.

| Characteristic | Description |
|---------------------------|--|
| <i>Varna</i> | Specific color to each <i>Bhasma</i> , depending on the parent material. |
| <i>Nishchandravam</i> | <i>Bhasma</i> must be lusterless; presence of luster indicates need of further incineration. |
| <i>Varitara</i> | <i>Bhasma</i> should float on stagnant water since properly incinerated <i>Bhasma</i> definitely demonstrates this property. |
| Particle Size | <i>Bhasma</i> should be in powder form. |
| <i>Apunarbhavata</i> | <i>Bhasma</i> should not regain its original metallic form. |
| <i>Niruttha</i> | Test of inability to regain metallic form of metallic <i>Bhasma</i> . |
| <i>Rasa-Bhaavashuddhi</i> | <i>Bhasma</i> remains non-reactive to basic taste. |

Quality Control of *Bhasma*

- There should be no metallic luster in *Bhasma*
- *Bhasma* is spread between the index finger and thumb and rubbed, it should be so fine as to get easily into the lines and crevices of the fingers
- *Bhasma* should be tasteless
- *Bhasma* should not produce nausea on administration.

***Bhasma* as Nano-particle**

Bhasma materials undergo process of *Shodhana* which involves incorporation of herbal extracts. Then final material incinerated in furnace to yield a nontoxic material. *Swarna Bhasma* consisted of gold ash with globular particles of gold ranging from 56-57 nm. Mercury compound contains crystalline size of mercury sulfide of 25-50 nm. During *Putapaka* method the size of particles reduces and effectiveness of *Bhasma* increases depending upon the number of *Putapaka*. Since size reduction affects pharmacokinetic of formulation therefore also affects effectiveness, in this way *Putapaka* become important to convert *Bhasma* into nano-medicines. Different number of *Putapaka* is needed for various purposes ranging from 10 *Put* to 1000 *Put* depending upon the therapeutic potency required from *Bhasma* formulation. *Mardana* and *Bhavana* are

preparative processes involve in *Bhasma* preparation and helps to reduces particle size of formulation and also improve therapeutic value while reducing toxicity.^[5-9]

Bhasmas are being prepared by *Shodhana*, *Bhavana* and *Marana*, etc. procedures. *Shodhita* materials finally mixed with drugs for further incineration and are subjected to *Bhavana*. These all procedures increase brittleness, reduces hardness and finally causes reduction in particle size. When the stress is applied in the form of attrition; smaller size particle are produced. Repetition of preparative procedures in final stage leads to reduction in particle size. The specific preparative procedure not only reduces particle size of *Bhasma* but also make them biologically compatible.

The nano-particle size of these *Bhasmas* is believed to play a critical role in their rapid therapeutic efficacy. Various studies have demonstrated that Ayurvedic *Bhasmas* are composed of nano-sized particles, offering new insights into their bioavailability and pharmacological effects. **Table 2** summarizes key findings of Ayurvedic *Bhasmas* as nano-particles, highlighting their particle size and therapeutic applications.^[6-10]

Table 2: *Bhasmas* as nano-particles and their specific applications.

| <i>Bhasma</i> | Major Element | Particle Size (nm) | Therapeutic Applications | Characterization Techniques |
|-----------------------|-----------------------|--------------------|---|--|
| <i>Swarna Bhasma</i> | Gold (Au) | 56-57 nm | Mycobacterial, collagen, and pristane-induced arthritis, antioxidant effects in stroke models. | TEM, SAED, AAS, IS, AFM |
| <i>Gold NPs</i> | Gold (Au) | 27 ± 3 nm | Amelioration of arthritis symptoms, increased apoptosis in Chronic Lymphocytic Leukemia (CLL). | TEM, Raman Spectroscopy |
| <i>Ras-Sindoor</i> | Mercury sulfide (HgS) | 25-50 nm | Bioavailable macromolecules contribute to medicinal value, rapid cellular action. | AAS, IS, elemental analysis |
| <i>Yashada Bhasma</i> | Zinc (Zn) | Nanometer range | Effective in treating lung adenocarcinoma cells, oxygen-deficient state imparts therapeutic properties. | XPS, ICP, EDAX, DLS, TEM, Raman Spectroscopy |

As mentioned above *Swarna Bhasma* has been found to consist of globular gold particles and its antioxidant property has been confirmed, making it comparable to modern gold NPs in medical applications like arthritis and stroke recovery. *Ras-Sindoor*, a mercury-based compound, exhibits nano-particle sizes, has been

associated with organic macromolecules, contributing to its bioavailability and efficacy in treatment. *Yashada Bhasma* composed of zinc, also demonstrates nanometer-sized particles and is involved in therapeutic applications, particularly against lung cancer cells, due to its oxygen-deficient state.

The nano-particle size of *Bhasmas* enhances their bioavailability, allowing faster and more targeted therapeutic actions, hypothesized to influence protein synthesis at the cellular level. The incineration process in Ayurvedic pharmaceuticals is critical, as increasing the number of incinerations reduces particle size, potentially increasing the efficacy of the *Bhasma*.^[7-10]

Multiple studies confirmed the nano scale nature of Ayurvedic *Bhasmas*, which also validate quality of these traditional preparations with following modern techniques.

- Transmission Electron Microscopy (TEM)
- Atomic Force Microscopy (AFM)
- Raman Spectroscopy
- Dynamic Light Scattering

Detection of nano-particles in *Bhasma* can be done with the help of techniques mentioned above. Scanning electron microscopy, laser scanning microscopy, fluorescence optical microscopy, energy dispersive x-ray analysis, etc. also can be utilized to study the nano medicine like behavior of *Bhasma*. These modern techniques establish presence of nano-particles in formulation, ascertain that composition is homogeneous or not, also analyze crystalline and amorphous behavior of nano-particles. The integration of modern approaches with ancient techniques provides wide arena for validating nano-medicine like behavior of *Bhasma*.^[8-11]

CONCLUSION

Bhasma contains minerals and metals mainly; manufacturing process plays crucial role in the achievement of desired quality in final product. Different processing techniques like *Shodhana*, *Marana* and *Bhavana*, etc. helps to convert *Bhasma* in desirable bio-compatible form. During these manufacturing processes particle size reduces significantly which improves absorption and assimilation of the drug inside the body. The particle size in the *Bhasma* is ranging in nanometer which makes them comparable with modern nano-medicines. Nanoparticle size of *Bhasmas* enhances their bioavailability, allowing for quicker and more targeted therapeutic effects, with potential influence at the cellular level. Studies confirm the nano-scale nature of *Bhasmas*, validated by techniques like TEM, AFM and Raman Spectroscopy, etc. Integration of modern techniques supports the validation of *Bhasmas* as nano-medicines.

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