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# REVIEW ARTICLE ON *RASASHASTRA* AND BIOMEDICAL NANOTECHNOLOGY

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## ABSTRACT

Ayurveda is one of the oldest systems of medicine. Various types of medicines are used in this system like herbal, mineral, metallic and non- metallic. The process by which metallic, non- metallic and minerals are converted into easily absorbable form is called *Bhasmikaran* and the prepared fine powdered form is called *Bhasma.* The steps involved in *Bhasma* preparation are *Shodhana* (purification), *Jarana* (subjecting purified substance to heat), *Bhasmikaran* (conversion of substance in fine powder). These *Bhasma* have been in clinical use since the 8th century A. D. *Rasashastra* is the Ayurvedic branch which deals with the preparation of these *Bhasmas.* Nanotechnology is the advanced science technology which tends to develop dosage in the range of 1-100 nm (increased upto1000 nm). Nanotechnology is a newly introduced field in medical science which gives employment to today's generation and they also took keen interest to learn about this. Nanotechnology includes a diverse collection of disciplines whereas *Bhasma Kalpana* is one of the oldest methods of converting metallic, non- metallic substances into non-toxic, biologically active organo- metallic and organo-mineral substances which can be used clinically. Test of these *Bhasma* is done by various methods, to avoid any toxic and adverse effects. The combination of both sciences will bring the best treatment for various life-threatening diseases by lowering side-effects, toxicity and by improving bioavailability of drugs. Biomedical nanotechnology here is dedicated to nanoscience and nanotechnology for health wellness, diagnostic and treatment of various diseases. The application of

nanotechnology is gaining positive response in almost all fields especially in the healthcare sector, tremendous developments have been achieved. For example cancer diagnosis, medical implants, tissue engineering, drug design and delivery. In this review, we attempt to revisit the *Ayurvedic Bhasma Kalpana* concept and modern nanotechnology concept and its application in medicine and drug delivery systems.

**KEYWORDS:** *Rasashastra, Bhasmikaran, Bhasma Kalpana,* nanotechnology.

## INTRODUCTION

The word *Rasashastra* has two different constituents viz. *Rasa* and *Shastra.* The word *Shastra* means detailed and scientific study. The word *Rasa* has many meanings in Sanskrit language, however as far as this science is considered it means Mercury. Thus the literal meaning of the word Ras*ashastra* is a detailed and scientific study of mercury.[1]

*Rasashastra* also deals with *Bhasma Kalpana. Bhasma Kalpana* is the type of medicine, which deals with metals and minerals to produce the drug with higher efficiency in lower doses and with good palatability.[2]

*Bhasmikaran* is a process by which a substance which is otherwise bio- incompatible is made bio- compatible by using certain *Samskaras* or process.[3]

*Bhasma* prepared by this method has been used for treatment of various diseases since the 8th century. It is the oldest form of nano particle medicine used in ayurveda. *Bhasma* is prepared by repeated processes of *Shodhan, Jarana* and *Marana.* By this process solid metal and minerals are converted in smaller sizes which are easy to digestible and absorbable at cellular level.

Nanotechnology is derived from a Greek word *'Nanos'* which means dwarf. Nanotechnology is manipulation of matter on an atomic, molecular and supramolecular scale.

## MATERIAL AND METHODS

### *Bhasma kalpana*

*Bhasma* in Ayurveda has been defined as a substance obtained by calcination. Use of both *Bhasma* (Residue after incineration - calcined preparation) as well as in *Pishti* (powdered gem or metal) form along with appropriate herbs for treatment of critical ailments is a preparation in Ayurveda and Unani. Both Indian branches of medical science use natural

curative methods. The procedures for preparing these medicines are time-consuming and complicated.

*Bhasma* is a calcined preparation in which the gem or metal is converted into ash. Gems or metals are purified to remove impurities and treated by triturating and macerating in herbal extracts.

*Bhasmikaran* is a process by which a substance which is otherwise bio incompatible is made biocompatible by certain *Samskaras* or processes.

**The objectives of *Samskara* are**

- Elimination of harmful matters from the drug.
- Modification of undesirable physical properties of the drug.
- Conversion of some of the characteristics of the drug.
- Enhancement of the therapeutic action.

**Various steps involved in the preparation of *Bhasma* (or *Bhasmikaran*) are**

- *Shodhan* –Purification
- *Maran* – Powdering
- *Chalan*- Stirring
- *Dhavan* – Washing
- *Galan*- Filtering
- *Putan*- Heating
- *Mardan*- Triturating
- *Bhavan*- Coating with herbal extract
- *Amrutikaran* - Detoxification
- *Sandharan*- Preservation.

**Method of preparation**

Mainly involve 3 steps:

- *Shodhana*
- *Bhavana*
- *Marana*

***Shodhana***

According to *Rasa Tarangini*, it is combination of processes which removes unwanted particle and toxins from metal and minerals and enhance its therapeutic properties.[4]

According to *Rasamrita*, the act of treating a substance with prescribed matter by *Peshana* (rubbing), *Swedana* (steaming) etc. so as to remove unwanted properties of drug called as *Shodhana*.[5]

According to *Acharya Yadavaji Trikamji*, *Shodhana* is a process of removal of adulterants and toxicity from drugs by using various processes and techniques like *Swedana, Marana, Dhalana, Nirvapana* with prescribed drugs.[6]

In case of metals, *Shodhana* procedure is done by dipping metal in a certain liquid several times after it becomes red hot and in case of minerals, *Shodhana* procedure is done by dipping it in a certain liquid medium for a certain period of time.

**Role of *Shodhana* procedure in *Bhasma Kalpana***

- It helps either in the disintegration of molecules or particles to divide into finest form.
- To remove physical and chemical impurities.
- To make metal and minerals free from toxicity.
- Transformation of attributes.
- To make metallic substances suitable for *Marana* (incineration).

***Bhavana***

*Bhavana* is a process in which the material is completely submerged with specified liquids like *Swarasa, Kwatha* etc. and triturated to complete absorption of liquid media into the powder.[7]

**Role of *Bhavana* procedure in *Bhasma Kalpana***

- To enhance therapeutic efficacy of drugs.
- Removal of ingredients usually having opposite characteristics.
- *Bhavana* makes drugs easily digestible and assumable.
- Helps in conversion of coarse powder to finer state.
- Facilitate further processing.
- Facilitate breakdown of drug to finer form.

***Marana***

The process which converts purified metals and minerals into *Bhasma* after subjecting them to levigation and incineration is called *Marana*. Nowadays a muffle furnace is used for easy handling of the procedure.

**Role of *Marana* procedure in *Bhasma Kalpana***

- As the number of *Putas* increases, there is a decrease in particle size.
- Conjugation of trace elements.
- Elimination of impurities.

***Jarana***

*Jarana* is a specific procedure used for metals having low melting point like tin, zinc, lead. This procedure is done in between *Shodhana* and *Bhavana* procedures. In this procedure, metals are melted and mixed with some plant drugs and are rubbed until metals become complete powder form.

***Amrutikarana***

It is a specific procedure for *Abhraka* and *Tamra Bhasmas.* According to *Rasa Tarangini*, it is a purification method, which is used to get rid of remaining *Doshas* (blemishes) from the *Bhasmas* of metals and minerals, this method is termed as "*Amrutikarana*".[8]

**Role of *Amrutikarana* in *Bhasma Kalpana***

- To remove the remaining impurities from the *Bhasmas*.
- To reduce the *Ruksata* produced by *Agni Samskara*.
- To increase the potency of *Bhasma*.

***Bhasma Pariksha*[9,10,11]**

Method of *Bhasma Pariksha* given by different *Acharyas* are as follow:

1. **Physical parameters**

- *Rekhapurnatva* (easily entered into ridges of finger).
- *Varitaratva* (lightweight so as to easily float on water).
- *Unam* (if we keep *dhanya* on *varitara bhasma* it float on it).
- *Anjanabhatva* (smoothness).

**2. Chemical parameters**

- *Visishta Varnotpatti* (specific colour of *bhasma).*
- *Gatarasatva* (tasteless).
- *Nischandratva* (lustreless).
- *Apunarbhavata* (permanence).
- *Niruthatva* (irreversibility).

**Nanotechnology**

It is a modern science which deals with material of size 0.1-100 nm. It is based on nano science technology of the 21st century. It is engineering of functional systems at molecular level. One nanometer is one billionth or $10^{-9}$ of a meter. By comparison, typical carbon – carbon bond length or spacing between these atoms in a molecule, are in range 0.12-0.15 nm and a DNA double helix has a diameter around 2 nm.

According to modern science "Research and technology development at the atomic, molecular or macromolecular levels, in the length scale of approximately 1-100 nanometre range, to provide a fundamental understanding of phenomena and materials at the nanoscale, and to create and use structures, devices and systems that have novel properties and functions because of their small and/or intermediate size."[12]

**Techniques used in nanotechnology[13]**

Various techniques of nanolithography such as optical lithography, X-ray lithography, dip pen nanolithography, electron beam lithography or Nano imprint lithography were also developed. Lithography is a top-down fabrication technique where a bulk material is reduced in size to a nanoscale pattern.

Another group of nanotechnological techniques include those used for fabrication of nanotubes and nanowires, those used in semiconductor fabrication such as deep ultraviolet lithography, electron beam lithography, focused ion beam machining, nanoimprint lithography, atomic layer deposition, and molecular vapor deposition, and further including molecular self-assembly techniques.

The top-down approach anticipates nanodevices that must be built piece by piece in stages, much as manufactured items are made. Scanning probe microscopy is an important technique both for characterization and synthesis of nanomaterials. Atomic force microscopes and

scanning tunneling microscopes can be used to look at surfaces and to move atoms around. By designing different tips for these microscopes, they can be used for carving out structures on surfaces and to help guide self-assembling structures. By using, for example, a feature-oriented scanning approach, atoms or molecules can be moved around on a surface with scanning probe microscopy techniques. At present, it is expensive and time-consuming for mass production but very suitable for laboratory experimentation.

In contrast, bottom-up techniques build or grow larger structures atom by atom or molecule by molecule. These techniques include chemical synthesis, self-assembly and positional assembly. Dual polarisation interferometry is one tool suitable for characterisation of self assembled thin films. Another variation of the bottom-up approach is molecular beam epitaxy or MBE.

**Therapeutic applications of nanotechnology**[14]

- Increase in surface area.
- Enhanced solubility.
- Increase rate of dissolution.
- Protection of drugs from degradation.
- More rapid onset of therapeutic action.
- Achievement of drug targeting.
- Increase the stability of any volatile pharmaceutical agent.
- Reduce the dose.

**Application of nanotechnology**

The different fields that find potential applications of nanotechnology are as follows:

- Health and medicine.
- Electronics.
- Transportation.
- Energy and environment.
- Space exploration.

**Nanotechnology in medicine**[16]

Various life threatening diseases like cancer, HIV, Parkinson's disease, Alzheimer's disease, cardiovascular disease and multiple sclerosis hit mankind. Biomedical nanotechnology is the branch which works in the field of health and medicine.

Nano – science uses nanomaterial and nano sensors for benefit for human races.

With help of nanomedicine early detection, diagnosis and treatment of these diseases is possible. The use of nanotechnology testing has become more sensitive and more flexible.

Gene sequencing has become more efficient with the invention of nanod like gold nano-particles, these gold particles when tagged with short segments of DNA can be used for detection of genetic sequence in samples.

Damaged tissue can also be reproduced or repaired with help of nanotechnology. These called as artificially stimulated cells are used in tissue engineering. This led to revolution in the field of transplantation of organs or artificial implants.

Advanced biosensors with novel features can be developed with the help of carbon nanotubes. This biosensor is used for study of origin of life as well as cancer diagnostic sensor development.

**Nanotechnology in drug delivery**[13]

Nanotechnology has provided the possibility of delivering drugs to special cells using the nanoparticles. The overall drug consumption and side effects may be lowered significantly by depositing the active pharmaceutical agent in the morbid region only and in no higher dose needed. Target drug delivery is intended to reduce side effects of drugs and focuses on maximising bioavailability both at specific places in the body and over a period of time. This can potentially be achieved by molecular targeting by nano engineered devices.

A benefit of using nanoscale for medical technologies is that smaller devices are less invasive and can possibly be implanted inside the body, plus biochemical reaction times are much shorter. These devices are faster and more sensitive than typical drug delivery.

**The efficacy of drug delivery through nanomedicine is largely based upon**

- Efficient encapsulation of the drugs.

- Successful delivery of drug to the targeted region of the body.
- Successful release of the drug.

## CONCLUSION

Ayurveda is one of the oldest systems of medicine. *Rasa shastra* is the branch of science which deals with metal, minerals to convert it into digestible and easily absorbable form at cellular level. *Bhasma* is the prepared end product of repeated procedures of *Shodhana, Jarana and Marana.* This *bhasma* is used in various life threatening diseases like HIV, Parkinson's disease, Alzheimer's disease, cancer etc. These *bhasma* work at cellular level by target drug delivery system. Because of this, it has low side effect, high efficiency. Nanotechnology is the modern branch of science dealing with nanoparticles used in diagnose, treatment etc. of various diseases.

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