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RASASHASTRA AND BIOMEDICAL NANOTECHNOLOGY

***[1]Dr. Rajiv Mehta, [2]Dr. Sapanjeet Kaur and [3]Dr. Prabhpreet Singh**

[1]B.A.M.S., MPH, M.D.(RS&BK), Ayurvedic Medical Officer, Punjab.

[2]B.A.M.S., M.D. (*Rasa Shastra* and *Bhaishajya Kalpana).*

[3]B.A.M.S.

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***Corresponding Author**
Dr. Rajiv Mehta
B.A.M.S., MPH,
M.D.(RS&BK), Ayurvedic
Medical Officer, Punjab.

ABSTRACT

Nanotechnology is an emerging science of 21st century which can develop extremely small structures of dimensions approximately between 1 to 100 nm which can be increased upto 1000nm. Nanomedicine is the relevance of nanotechnology in the area of healthcare, diagnosis, cure and prevention of disease. In *Ayurveda* metals and minerals are used as medicines since *Samhita* period but after 7th Cent AD with the evolution of *Rasashastra* the metal and minerals started converted from macro form into very fine form of medicines usually 5-50nm in dimensions known as *Bhasma* (Ash) by the various pharmaceutical processes called *Bhavna* (levigation), *Shodhana* (Purification), *Jarana* (purified substance subjected to heat) and *Marana* (incineration). *Bhasmas* are biologically active nanoparticles which are therapeutically most effective due to its increased bioavailability and are least toxic form of medicines. *Bhasma* can be used for targeted or controlled drug delivery system which reduces the repeated dose administration and lowers the adverse effects. *Ayurvedic Bhasma* form is considered safe and inexpensive in comparison to current metal based nano medicines. Integration of *Ayurveda* with recent developments in nanotechnology can help in designing safe and best future medicines to treat various life threatening diseases.

KEYWORDS: Nanotechnology, *Rasa Shastra*, *Bhasma*.

INTRODUCTION

The term nanotechnology is derived from a Greek word "nano" which means dwarf. It is a new technology in drug delivery system. The main purpose of nanotechnology is to develop

structures in the range of 1 to 100 nm which can be increased up to 1000 nm. Nanoparticles are used as a main part of nanotechnology that have a high surface area and can reach the target site because of its extremely small size.[1]

To overcome the limitations of using herbal medicines, nanotechnology and herbal science is combined. The development of novel drug delivery system for herbal drugs includes nano dose which helps in enhancing the bio-solubility and improved bioavailability profile, less toxicity and adverse reaction, enhanced pharmacological activity, sustained drug delivery etc. Such novel drug delivery system have site specific action and predetermined rate. One of the discipline or branch of *Ayurveda* called *Rasa Shastra* which deals with herbo-mineral preparations called *Bhasma* (Ash).

Bhasma Kalpana

Bhasma Kalpana is a procedure of preparing Ayurvedic medicine from metals and minerals. It involves four basic steps such as selection of acceptable form of metal (*Grahya Rasa Dravya*), its purification (*Shodhana*), levigation (*Bhavana*) and calcification (*Marana* or *Puta*).[2]

The reference regarding *Bhasma Kalpana* found in *Charaka Samhita*, *Sushruta Samhita*, *Ashtanga Hridaya* during *Arsha Sampradaya*. This concept of reduction in particle size of metal is prevailing since *Charaka Samhita* (1500BC).

Method of preparation

There are two method of preparation of *Bhasma.*

1. *Putpaka* Method

Bhasma is being prepared by subjecting minerals or metals to procedures like *Shodhana*, *Bhavana* and *Marana*. First of all by hammering metals or minerals are made in to coarse powder, then subjected to *Shodhana* procedure, in which most of the metals or minerals are heated to red hot and dipped in a specific liquid media for several times. *Shodhita* materials are then mixed with specific drugs for *Marana* in which firstly, *Bhavana* is given with particular drug for specific period of time. After completion of *Bhavana*, *Chakrikas* are prepared and then taken in to earthen crucibles. After that junction is sealed by mud smeared clothes. Then this *Sharava Samputa* is subjected for heating by giving *Putas* for specific time limit. In this way *Bhasma* can be prepared by classical method. Now a day electric muffle

furnaces are being used which are easy to handle. When cooled down, *Sarava Samputa* is taken out. Then *Samputa* opened to collect the product. These procedures are repeated for several of times or as per reference to get the desired final form as *Bhasma*.

2. *Kupipakwa* Method

In this method, *Bhasmas* are prepared by subjecting metals to procedures like *Shodhana, Kajjali Nirmana, Bhavana* and *Kupipakwa*. After *Shodhana,* they are subjected to form amalgam with purified mercury and purified sulphur is mixed and triturated till it become black, lusterless, fine and smooth powder. The prepared product is called as *kajjali*. Prepared *Kajjali* is triturated with specific liquid media for certain time. When the mixture becomes completely dry, it is filled in *Kachkupi* and this *kachkupi* is covered with 7 layers of mud smeared cloth. This bottle is then subjected to *Vaaluka Yantra.* Bottle is broken after self-cooling and the *Bhasma* is collected from bottom or neck or from both sites from bottle. Then it is grounded to powder form.

Bhasma Pariksha

The classical tests for assessment of good quality of *Bhasma* are as follows.

Physical tests

- ***Varitara-*** *Bhasma* floats on water shows lightness and fineness of *Bhasma.*
- ***Unnama***- After *Varitara* test, grain floats when placed on floating *Bhasma,* considered it properly prepared.
- ***Shlakshnata* and *Mruduta***- *Bhasma* when touched with finger tips should be smooth.
- ***Rekhapurna***- *Bhasma* when rubbed between index finger and thumb, it should be completely absorbed in furrows shows fineness of it.
- ***Anjanasadrushasukshmatva-*** *Bhasma* should be smooth like *Anjana*

Chemical Tests

- ***Nischandra***- *Bhasma* when seen in sunlight must be lusterless.
- ***Nirdhoomatva-*** *Bhasma* when sprinkle over burning coal should burn without smoke.
- ***Niruttha-*** *Bhasma* when mixed with silver leaf and given *Putta*, it should not show any free metal which indicates its reversibility to its original state means not properly incinerated.
- ***Apunarbhava***- *Bhasma* when mixed with *Mitrapanchaka* and given *Putta*, it should not show any free metal which indicates its reversibility to its original state hence improper

Marana.

- ***Dantagre kachakachabhava***- *Bhasma* when pressed in between teeth it should not produce *kachakach* sound.
- ***Varna***- Specific colour of each *bhasma* is mentioned in classics so colour should match with them.
- ***Gatarasatva***- Specific metallic taste of each *bhasma* transformed into tasteless compounds. Modern methodology of testing nano particles in *Bhasma*.[3]
- **Scanning Electron Microscopy (SEM) -** Analyse 3D imaging of sample.
- **Transmission Electron Microscopy (TEM) -** Magnification is more than 10,000 than Electron microscope. It can analyse particle size, size distribution, micro structure, crystal structure, elemental analysis.
- **Energy Dispersive X-ray analysis (EDAX) -** Analyse chemical nature, size and morphology of particles.
- **Induced coupled plasma atomic emission spectrometer**- Most common technique of elemental analysis with high specificity and multi element capability.
- **Flourecscence Optical microscopy**- Identify both major and trace elements.

Properties of Bhasmas[4]

- *Yogavahi* - Targeted drug delivery
- *Rasibhava* - Readily absorbable, Adoptable, Assimilable
- *Shegravyapi* - Spreads quickly & fast acting
- *Agnideepana* - Bhasma increases metabolism at cellular level
- *Rasayana* - Immunomodulation & Anti aging.

Nanotechnology

Nanotechnology is manipulation of matter on an atomic, molecular, and supramolecular scale. It is therefore common to see the plural form “nanotechnologies” as well as “nano scale technologies” to refer to the broad range of Research and application whose common trait is size.

Nanotechnology in medicine

Nano-medicine is an application of Nanotechnology which works in the field of health and medicine. Nanotechnology is becoming a great innovation in medicine and healthcare sector with a wide range of advances including nano scale therapeutics, Biosensors, implantable

devices, drug delivery systems and imaging technologies.

In medicine, revolution take place in targeted drug delivery, gene therapy, diagnostics and many areas of research, development and clinical application. Various diseases like diabetes, Cancer, Alzheimer‘s disease, Parkinson‘s Disease, cardiovascular diseases and Multiple sclerosis as well as infectious Diseases (e.g. HIV) affect mankind which can be cured by this advance nono- medicine technology.

Nano-medicine makes use of nano materials and nano electronic biosensors. This may helps in early detection and prevention, improved diagnosis and proper treatment of diseases and improves quality of life.

Classification of nanoparticles

- Labile nanoparticles: Liposomes, micelles, polymers, nano-emulsions etc.
- Insoluble nanoparticles: TiO_2, SiO_2, fullerens, quantum dots, carbon lattices etc.
- One dimensional nanomaterial: Nanowire and nanotube.
- Two dimensional nanomaterial: Self assembled monolayer film.

Target drug delivery system

Nanotechnology proves quite beneficial in treating various diseases by site-specific and target- oriented delivery of precise medicine.[5] The Treatment of chronic diseases such as cancer is the newest achievement in the Pharmaceutical drug delivery field. In target drug delivery system, Nano materials are used as drug carriers. Due of large surface area and small size of materials they can be easily transported into cells and nuclei and desired specificity to the target can be achieved. This is achieved by 3 ways i.e. 1)Nanospheres 2)Nanocapsules 3)Nano pores.[6] Drugs can be encapsulated in Nanocapsules and targeted towards desired parts of a body. Drug can be fast or slowly delivered as per requirement by opening the capsule using some external stimulus like magnetic field, infrared light etc. Commonly used nano carriers include liposomes, dendrimers, polymeric nanoparticles, silicon or carbon materials, magnetic nanoparticles and nano emulsion.[7] Some common advantages of the drug delivery system using nanoparticles are to increase bioavailability, improve solubility, reduce the toxicity, reduced repeated dose administration and enhance the Pharmacological activity.[8]

CONCLUSION

The collaboration of nanotechnology with *Ayurvedic* medicine can be a very powerful tool in designing future herbal and herbo mineral medicines with enhanced bioavailability profile and reduced toxicity and adverse effects. By utilising the concepts of nanotechnology, numerous dose- related adverse effects can be prevented as it reduces the quantity of drug intake. Nanotechnology also help to increase the potency and safety issues related to *Ayurvedic* medicines. To conclude, we can say that further invention of *Ayurvedic* drugs like *Bhasmas* in the nano carriers will enhance its potential to cure various chronic diseases. This will effectively increase the bioavailability and stability and will also lessen the dose intake of various *Ayurvedic* medicines.

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