

Nanomedicine and Nanotechnology in Ayurvedic Pharmaceuticals - An Overview

Dr. Pritibala Thakur Rajput¹, Dr. Abdul Kareem H²

¹MD(Ayu) Professor & HOD, Department of Rasashastra Evam Bhaishajya Kalpana,

²MD, PhD(Ayu). Professor, Department of Rasashastra Evam Bhaishajya Kalpana,

^{1,2}Shree Satya Ayurvedic Medical College & Hospital, Moradabad, Uttarpradesh, India

ABSTRACT

It is a truism that what you really value is what you miss, not what you have. Ayurvedic medicine has become an extremely valuable commodity for the world today, precisely because it provides what the world misses most. The formulations like Bhasma. etc, are the oldest form of nano particles and the prime aim of such formulations is to converting minerals and metals into suitable form for their effective absorption is due to the fact that pre – requisite for eliciting any pharmacodynamic response by any substance on the human system, is its absorption in the system. After marana process metals or minerals elements get transformed into organometallic compounds which are easily assumable in the biological system. Because of reduction in the particle size of material.

Nano particles are 1 crore smaller times than a hair and due to its small basic characteristic also get changed. Due change in electrical, thermal, chemical and biological characteristics. These particles can in be used various technology including medical technology. Nano materials are at the leading edge of the rapidly developing field of nano technology. Their unique size dependent properties make these materials superior and indispensable in many areas of human activity. Understanding of biological processes on the nano scale level is a strong driving force behind development of nanotechnology.

Therefore modern ayurveda practitioners and research personae are need to know about the concept of nano medicine for better understanding of formulations like Bhasma. etc, to keep pace with the modern system of medicine. This paper attempts to portray the use of nano technology as a tool for novel approach to evaluate the Ayurvedic pharmaceuticals.

INTRODUCTION

The drug is said to be optimum at its strength only when it passes through right Drug Delivery system & undergoes appropriate Pharmacokinetics. It can happen when the size of the particles are sufficiently tiny. Nano medicine/Nano technology may be the new concept for the present scientific society but this medicine/technology is in use since ancient period in Ayurvedic pharmaceuticals. In chronological development of Ayurvedic drug manufacturing subsequently many dosage forms were developed. In them many procedures and techniques were utilised. Ultimate idea was to make them suitable for the body system, safe and quick effecting.

Ayurvedic drug manufacturing started with the use of herbal material. Later therapeutic importance of minerals and metals were also recognised. For the medicinal use of minerals and metals many new processing techniques based on heating and quenching into specific plant extractives and animal products, roasting, grinding / milling etc. were developed. With this many new mineral and metal based dosage forms were derived. Production of bhasma and sinduras are the examples of nanotechnology employed for the processing of minerals and metals.

How to cite this paper: Dr. Pritibala Thakur Rajput | Dr. Abdul Kareem H "Nanomedicine and Nanotechnology in Ayurvedic Pharmaceuticals - An Overview"

Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-7 | Issue-2, April 2023, pp.417-420, URL: www.ijtsrd.com/papers/ijtsrd54022.pdf



IJTSRD54022

Copyright © 2023 by author (s) and International Journal of Trend in Scientific Research and Development Journal. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0) (<http://creativecommons.org/licenses/by/4.0>)



KEYWORDS: Nanotechnology, Nano Medicine, Nano particle, Bhasma, Marana

Nanomedicine is the medical application of Nanotechnology¹. The prefix "Nano" is a Greek word for "dwarf". One nanometer (NM) is equal to 1 billionth of a meter. About a width of 6 carbon atoms or 10 water molecules. A human hair is approximately 80000 nm wide. A red blood cell is 7000nm wide. Atoms are smaller than 1 nanometer. Molecules and some properties are between 1nm and above. One nanometer = SI unit 1×10^{-9} m, 1×10^{-3} μ m, 3.281×10^{-9} ft 39.37×10^{-9} in US customary Imperial units.

Nano Medicine: Drug delivery

Nanomaterial approaches to Drug Delivery center on developing nanoscale particles or molecules to improve the drug bioavailability. Bioavailability refers to the presence of drug molecules where they are needed in the body and where they will do the most good. Drug delivery focuses on maximizing bioavailability both at specific places in the body and over period of time. The strength of drug delivery systems is their ability to alter the pharmacokinetics and biodistribution of the drug. Nanoparticles have unusual properties that can be used to improve drug delivery. Where larger particles would have been cleared from the body, cells take up these nanoparticles because of their size. Complex drug delivery mechanism are being developed, including the ability to get drugs through cell membrane and into cell cytoplasm. Efficiency is important because many diseases depend upon processes within the cell and can be only impeded by drugs that make their way into the cell. Triggered response is one way for drug molecules to be used more efficiently. Drugs are placed in the body and only activate on encountering a particular signal. For example, a drug with poor solubility will be replaced by a drug delivery system where both hydrophilic and hydrophobic environments exist, improving the solubility. Also, a drug may cause tissue damage, but with drug delivery, regulated drug release can eliminate the problem. If a drug is cleared too quickly from the body, this could force a patient to use high doses, but with drug delivery systems clearance can be reduced by altering the pharmacokinetics of the drug. Poor bio distribution is a problem that can affect normal tissues through widespread distribution, but the particulates from delivery systems lower the volume of distribution and reduce the effect on non-target tissue. Potential nanodrugs will work by very specific and well-understood mechanisms; one of the major impacts of nanotechnology and nano science will be leading development of completely new drugs with more useful behaviour and less side effects.

Nano medicine and Nano technology in Ayurvedic pharmaceuticals:

Ayurveda is the oldest medical science of Indian sub-continent. Started with plant material for diet and drug, animal, mineral and metals were also further identified, used for therapeutic purposes. In the developmental stream of Ayurvedic pharmaceuticals which started with Panchavidakashayakalpna and developed many derivative techniques and unique Herbo-mineral-metallic preparations which can compare with Nanomedicine and Nanotechnology

Churna²: A herbal fine powder is an example of size reduction technology. With the synonyms of "Rajah, kshoda, Vansi and dhwansi" are indicative of fine particles (atom is $1/30^{\text{th}}$ of Vansi, atoms are smaller than 1 Nano) which visualize in the sun ray's, is able to suspend in the atmosphere.

Ayaskriti³: Internal use of minerals and metals started earlier from Samhita period in therapeutics. They were used in the fine powder form. Heating and quenching in various plant extractive and then grinding / milling and filtering through a fine cloth to get fine powder was the technique in practice.

Asavarista: Similar liquid form of iron produced through the process of sandhana also during the period of charka in Lohasava⁴. Where iron was made like thin flake (thickness up to sesamum seed) added into the fermenting liquid and kept for longer (for 6 month) till it dissolved (Yavat aloha samkshayat).

Kshara⁵: Dried plant materials burnt completely to ash, dissolved it in 4 times water and filtered it with a clean cloth and dehydrates on mild temperature to get kshara.

Bhasmas⁶: Bhasmas are the ancient Nanomedicine explained in Rasashastra the part of Ayurveda which can be corroborated with ultramodern parameters like AAS, TEM etc. Bhasmas are prepared with many metals, minerals & aquatic substances by using various degree of temperature depending on their properties like hardness, specific gravity, melting point & so on subjecting to different no. of Putas which in turn help the drug to attain the desired size. Acharyas had a clear idea about procuring best combination of minerals and metal to form Ideal medicine by different methods. Procedure adopted in the preparation of bhasma is unique. Here organo-metallic complex molecule formation is achieved by the combined effect of Bhavana and Puta.

“RaseebhavantiLohaniMrutaniSuravandite”⁷

The above shloka makes clear that end product of Marana is so fine and effective that it becomes one with Rasa. Apart from this there are several such

references stating the importance of effect of the drug rather than the physical form. Even the parameters set in classics to evaluate the end product were sufficient and competent enough to match with modern day analytical techniques and Nanotechnology.

SYNTHESIS OF NANOPARTICLES: There are two main approaches

1. Top - down technique (Dispersion based process)

- Involves breaking larger micrometer sized particles into nanoparticles
- The use of manufacturing processes such as milling or grinding which means reducing the size of the smallest structures to the nanoscale.

2. Bottom - up approach (Precipitation based process)

Ions/atoms are grown from smaller to bigger particles. This involves manipulating individual atoms and molecules into nanostructures and more closely resembles chemistry or biology.

NANOTECHNOLOGY

- **Nanotechnology**, or “nanotech”, is the study of the Controlling of matter on an atomic and molecular scale. It deals with structures sized between 1 to 100 nanometer.
- **Federal gov’s definition:** Nanotechnology is the creation of functional materials, devices, and systems through control of matter on the nanometer scale, exploiting novel phenomena and properties.
- **Physical, Chemical & biological** present at that scale only. Nanotechnology is the manipulation of individual atoms, molecules, or molecular clusters into structures to create materials and devices with **new or vastly different properties**.

Properties at Nanoscale:

Physical

Nano particle has completely different physical behavior than the bulk. Similar phenomenon can be expected in bhasmas by combined effect of repeated bhavana and puta. Here it is evident by seeing the reduction in the particle size and change in the consistency and colour.

Changes in Physical properties Evident by following Bhasma Pareeksha

- Varna
- Rekhapurna
- Vareetara
- Unnama
- Nischandra
- Sukshma
- Slakshna
- Niswadu or Gatarasatwa

Chemical

Reactivity may depend on surface area. Reduction in the particle size gives larger surface area in bhasmas to react. From the XRD of bhasmas it is evident that it attains series of changes during procedure to attain stable, efficacious and safe compound form.

“A catalyst of 10 nm size is 100 times more reactive than the same amount of material in 1 micron particles.”

Chemical Changes:

- Apunarbhava
- Nirutha
- Gravimetric & Volumetric analysis
- Instrumental analysis

Biological:

- Nanoparticles can cross the blood brain barrier.
- Properties of bhasmas in the Classics are evident of the biological application.

Nanotechnology in Rasaushadhis — Particle size (Nanoparticles)

Nanoparticles —Bhasmas

Properties of Bhasmas:

- Rasayana - Immunomodulation & Antiaging.
- Yogavahi - Targeted drug delivery.
- Rasibhava- Readily absorbable, Adoptable, Assailable & non toxic.
- Shegravyapi - Spreads quickly & fast acting.
- Agnideepana-Bhasma increases metabolism at cellular level & acts as catalyst.

These attributes of Bhasmas are comparable with the action of NPs in the body.

- Nanoparticles (NPs) are biodegradable.
- Biocompatible.
- Non-antigenic in nature.
- NPs in general can be used to provide selective/Targeted/Controlled delivery of drugs to specific site of action in the body even across the blood brain barrier.

Detection of Nano particles in Bhasma:

Methodologies used to test Nanoparticles are:

- Scanning electron microscopy (SEM)
- Transmission electron microscopy (TEM)
- Fluorescence Optical microscopy
- Energy dispersive x-ray analysis (EDAX)
- Atomic absorption spectroscopy (AAS)
- X-ray induced Photoelectron Spectroscopy (XPS)

The process of Nanoparticle testing in Ayurvedic Products may involve steps:

- Testing Nanoparticles in the sample.
- Qualitative and quantitative estimation.
- Chemical form, Structure and presence of organo-metallic bonding.

- Analyzing bioactivity.

Standardization:

- Interms of particle size , Nanoparticles will aid in determining standardization.
- Apart from Bhasma siddhi lakshanas, presence of nanoparticles in the bhasma has to be tested and parameters has to be fixed in order to standardize the bhasma in terms of nanoparticles.
- Each bhasma has to be placed in a particular nanometer range.

Eg: YashadaBhasma 10-40 nm (IIT)

Swarna Bhasma:

Gold in traditional Indian Ayurvedic medicine as Swarna bhasmas (gold ash) has been characterized as globular particles of gold with average size between 56 to 57 nanometer (nm) detected by transmission electronic microscopy(1TEM). Same study also revealed Swarna bhasma to be devoid of any other heavy metal or organic material by its AAS and Infrared spectroscopy. This also proves the safety of our Bhasmas against Heavy metal toxicity. (Bajaj S & Vohora S.B, Analgesic activity of gold preparations used in Ayurveda and Unani,- Indian journal of medical research)

Rasasindoora:

Rasa-Sindora (sublimed mercury compound) containing mercury sulphide has nanocrystalline size between 25 to 50 nm and is associated with several organic macromolecules derived from plant extract used during processing of drug. (Dr.AnandChaudhari and S.K.Sharma,IMS,BHU," preparation and characterization of Mercury based indian traditional drug — Rassindoora, Indian journal of traditional knowledge.)

CONCLUSION:

- Nanotechnology is truly a new revolutionary technology, having its application in various fields.
- Nanotechnology provides the field of medicine with promising hopes for assistance in diagnostic and treatment technologies as well as improving quality of life.

- Bhasmas are the best examples for Nanotechnologies in Ayurveda, as these are comparable with the action of nanoparticles.
- Traditional method of Ayurvedic Bhasma preparation involves "top down" approach of Nanoparticle synthesis.
- Standardization of Bhasmas has to be done on the basis of particle size using Nanotechnology.
- This will in turn help to clarify the blames on Ayurvedic drugs and even be fruitful in globalizing our science.

References:

- [1] <http://www.nanomedicine.com/NMI.htm>
- [2] Sharangadhara Acharya, Sharangadhara Samhita, Commentry by Adhamalla and Kashiram Vaidya, Edited by Pt. Parashuram Shastri Vidyasagar, Varnasi, Chaukhambha Surabharati Prakashana, 2018, Madhyama Khanda, 6th Chapter, Verse 1, 178 Pp.
- [3] Agnivesha, Charaka Samhita, Varnasi, Chaukhambha Surabharati Prakashana, 2017, Chikitsastana, 1st chapters, 3rd Pada, Verses 15-23, 384 Pp.
- [4] Sharangadhara Acharya, Sharangadhara Samhita, Commentry by Adhamalla and Kashiram Vaidya, Pt. Parashuram Shastri Vidyasagar, Varnasi, Chaukhambha Surabharati Prakashana, 2018, Madhyama Khanda, 6th Chapter, Verse 1, 232 Pp.
- [5] Sushruta Acharya, Sushruta Samhita, Commentry by Dalhana, by Narayana Ram Acharya 'Kavyatirtha', Varnasi, Chaukhambha Surabharati Prakashana, 2018, Sutrastana, 11th Chapter, Verse 11, 46Pp.
- [6] Vaidya Yadavji Trikamji, Dravyaguna Vignan Aoushadhi Khanda, Varnasi, Chaukhambha Surabharati Prakashana.
- [7] Vagabhata Acharya virachita, Rasa Ratna Samucchya, Commentry by DA KulKarni, New Delhi, Maeharchand Lachhmands Publications, Reprint 2017, 5th Adhyaya, Shloka 139,120 Pp.