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# Nanotechnology - Revolutionary phase in prospective of Ayurvedic medicine

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## ABSTRACT

Nanotechnology based on Nanoscience is the technology of 21<sup>st</sup> century; the terms Nanotechnology and Nanoscience are often used synonymously. The literal meaning of 'nano' is 'dwarf' or an abnormally short person. However, in scientific language it is a billionth (10<sup>-9</sup>) part of some unit scale, example nano meter or nano second means 10<sup>-9</sup> meters or 10<sup>-9</sup> seconds respectively. The Nano is the newly used word but in Ayurveda in the form of Bhasma, the Nano particle of metals & minerals are being used as an effective medicine. It is the need of the moment for Ayurveda to conduct the researches to extend the use of our Nano medicines (Bhasma) in various aspects like detection & diagnosis of the diseases to make them more effective in serving the society. The evaluation of engineered nanoparticles in terms of Ayurvedic Rasa Shastra norms for Bhasma in terms of various physico-chemical attributes can be useful.

**Key words:** Nanotechnology, Bhasma, Nano-medicine.

## INTRODUCTION

Nanotechnology is the manipulation of matter on an atomic, molecular, and supra molecular scale. The term 'nanotechnology' was derived by Greek word "nanos" that means "dwarf". Nano device and nano strategy are one billionth of a meter or 10<sup>-9</sup> m. Nanotechnology clumps of atoms, molecules, and molecular fragments into extremely small particles between 1 and 100 nm and puts forward to the interactions of molecular level matters.

Nanotechnology is the new branch of advanced science and emerging technology in the drug

discovery and it has the property of selftargeting in the sense at particular place that without the attachment and this can be used for targeting, due to their distinctively small size, at the infected pathological areas. Some of such formulations are already present in the market and many more are expected to come by 2020 after their success in ongoing clinical trials. In this appraisal, this new approach is developing the interest of number of scientists to improve and to accelerate the joint drug discovery and development of novel nano delivery systems for herbal extracts.

In Rasashastra & Bhaishajya Kalpana, it covers the entire field of inorganic pharmaceutical preparations like metallics, non-metallic & herbo-mineral compound of various Ayurvedic formulations. These Rasasadhis are esteemed to their smaller & effective long durability for various disorders. Bhasma is the herbo-mineral metallic drug preparations unique to the Ayurveda, Unani, and Siddha systems of alternative or traditional medicines. These are prepared with herbal juices and used for treating diverse chronic ailments. These are considered products of classical alchemy; inorganic compounds of

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certain metals and present in a fine powdered form like oxides in gems. Bhasma literally meaning ash is a mineral preparation that is made from precious metals and their naturally occurring salts. In this connection so many Ayurvedic medicine are being developed and will be developed gradually by the scientists through the different ways taking the help of Nanotechnology with advanced instrument. Nanoparticles, as they are very small, are easy to inject and targeted towards specific portion in a body.

In recent years gold nanorods which have strong scattering and absorption property in the infrared are used successfully to detect and destroy cancer cells without affecting the healthy cells. This is possible because healthy cells required twice the laser power as compared cancer cells destruction. It is quite important as it would avoid killing of healthy cells unlike in chemotherapy. Thus, by using low power for imaging and destroying cancer cells no side effects due to destruction of healthy tissues can occur. This is key concept in curing cancer by nanoparticles.<sup>[1]</sup>

#### Nanotechnology for Ayurveda medicine

Overall, traditional medicines include herbal, Ayurveda, Siddha & Unani medicine. Terminology of Nanotechnology is still at an early stage or newer one in the field of Ayurveda. However, the concepts are thousand years old in Ayurveda which implies the nanotechnology. Indian craftsmen, artisans used nanotech 2000 yrs ago in the form of Kajal preparation, Rasanjana, Ayurvedic bhasma oldest form of nanotechnology. The development of Rasashastra (7<sup>th</sup> century AD) has revolutionized Ayurvedic system of medicine. Many new pharmaceutical techniques are developed like Shodana, Jarana & Marana by which metals & minerals are converted in to very very fine, absorbable, therapeutically most effective & least or non toxic form of medicines Known as Bhasmas. Bhasma are defined as powder form of a substance obtained by Calcination.<sup>[2]</sup>

All Bhasma have some common properties such as *Rasayana* (immunomodulation and anti-aging quality), *Yogavahi* (target drug delivery), *Alpamatra*

(prescribed in minute doses i.e., 15–250 mg/day), *Rasibhava* (readily absorbable, adaptable, assimilable, and nontoxic), *Shigravyapi* (spreads quickly and fast acting), and *Agnideepana* (increases metabolism at cellular level and acts as catalyst). Bhasma can be employed for selective/targeted/controlled drug delivery as they are biocompatible, nontoxic, and nonantigenic in nature. Bhasma is biologically produced nanoparticles with quick and targeted action e.g., gold nanoparticles in *Swarna Bhasma* at  $27 \pm 3$  nm size have been found effective in ameliorating symptoms of arthritis and at 4 nm size helped in increased apoptosis in B-chronic lymphocytic leukemia.<sup>[3]</sup>

Ayurvedic Bhasma may hold strong relevance in the emerging era of nanomedicine and can serve as an excellent template for the development of nanomedicine for an efficient therapeutic cure.

#### Nanotechnology as a novel drug delivery strategy:

Drug delivery system fetched a novel drug delivery system, a novel approach to overcome the drawbacks of the traditional drug delivery systems. The treatment of the chronic diseases such as cancer using targeted drug delivery nanoparticles is the latest achievement in the pharmaceutical drug delivery field. In recent years there is vast advancement has been done by the scientists to modify the backdrop of the pharmaceutical industries for the predictable future.

Nano materials are finding their way in the form of drug carriers because of large surface area of materials and small size by which easily transported into cells and nuclei and specificity to the target can be achieved as desired. This is achieved by 3 ways i.e. 1) Nanospheres 2) Nanocapsules 3) Nano pores.<sup>[4]</sup> Drugs can be encapsulated in Nanocapsules and targeted towards desired parts of a body. Drug can then be fast or slowly delivered, as desired, by opening the capsule using some external stimulus like magnetic field or infrared light or under some physiological conditions. The action of the nano particle drug system can be seen in the following forms.

**Nano Particle - Drug Systems:** Oral Administration, Nasal Administration and Occular Administration.

#### **Rationale behind Nanotechnology in herbal medicine:<sup>[5]</sup>**

Herbal remedies were selected as feasible drug candidate for delivery through a nano delivery system because of the following properties:

- These are the bulk drugs (having many ingredients) so dose reduction is proposed for final product. Currently marketed formulations lack target specificity for various chronic diseases.
- Patient non-compliance due to large doses and long duration for the treatment and sometimes less effectiveness (may be due to *savirytaavadhi*) with the available formulations.
- They appear to be able to deliver high concentrations of drugs to disease sites because of their unique size and high loading capacities.
- The concentration seems to persist at the sites for the longer periods.
- It will act as a passive targeting to the disease site.
- It would be helpful in reducing the side effects.
- Decrease in the dose of the drug formulation. Minimum dose will have its active composition.

#### **Nodal Labs of on developments of Nanotechnology in India**

- National Chemical Laboratory, Pune
- National Physical Laboratory, Delhi
- National Environmental Engineering Research Institute, Nagpur
- National Metallurgical Laboratory, Jamshedpur
- Structural Engineering Research Center, Chennai
- National Institute of Science, Technology and Development Studies, New Delhi.

#### **DISCUSSION**

All over the world the research has been going on herbal remedies and various Ayurvedic formulations. The development of herbal remedies in the drug delivery system in a number of institutes is being carried out at basic and clinical trial levels. The only requirement is to develop the better systems for the proper delivery of such drugs at the sites and in the whole body in the doses which will not compromise with the existing treatment. Toxicity & hypersensitivity reactions as associated with currently marketed i.v. formulations. Something, that would not only give relief with such side effects but also will also increase the patient's strength from inside are very much desirable. Nanotechnology is approaching a new paradigm for drug delivery system by their unique small size and controlled release of the drug. Hence using 'herbal remedy' in the nano carriers will increase its potential for the treatment of various chronic diseases and health benefits. Many successful examples with experienced evidences are present among us in the direction of nano research.

The properties that make nano particles unique and responsible for their importance in industrial and biomedical application also raise the safety concerns. The nano forms have unique properties in terms of magnetic, catalytic, optical, electrical, and mechanical attributes when compared to conventional, that is, non-nano or bulk form.<sup>[6]</sup> According to Bhabha Atomic Research Centre (BARC), Mumbai, the *Bhasmas* used in Ayurveda for treatment of various diseases for the past several centuries is the oldest form of nanotechnology. Use of nanotechnology has already been started in food technology and medical technology.

The government and nongovernment agencies like The International Centre for Technology Assessment, Centre for Food Safety, Friends of the Earth, and Institute for Agriculture and Trade Policy considered it to be of prime importance to put it before the regulatory bodies like FDA to consider nanoparticles as a new compound and not consider it safe as such because the native form is recognized as safe.<sup>[7]</sup>

## CONCLUSION

The current scenario of popularity and safety concerns regarding nanoparticles, the use of ancient metal-based forms like, Bhasma is reentered in the present article. Since the benefits of nanotechnology are undisputable and safety concerns are also not grounded, there is a demanding need to revisit the ways nanoparticles are manufactured and to carry out safety assessment by the techniques specially adapted for this novel compound as this may be future generation medicine.

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