

Nano Technology and its relevance to Aushadha Manakam

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Abstract

In India, Ayurveda is a medical system that dates back thousands of years. Ayurveda uses a variety of metals, non-metals, and botanicals as medicines. According to Ayurveda, a number of metallic concoctions known as *Bhasma* have been used in medicine since the eighth century AD. By repeatedly using these techniques, the *Bhasma* (incinerated metals) is produced. The metals' harmful effects are not only eliminated throughout this procedure, but they are also changed into physiologically active nanoparticles. The study of incredibly small structures, which spans a wide range of topics at sizes of roughly 1 to 100 nanometres, is known as nanotechnology. The century's greatest creation, nanoparticles have created new opportunities for use in a wide range of industries

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Introduction

One important component of the Ayurvedic medical system is the use of metallic and mineral nanomedicines. The creation and therapeutic application of nanomedicines, especially those made from metallic and mineral nanoparticles, are the main focus of *Rasashastra*, a branch of Ayurveda. These nanomedicines are made by turning metals or minerals into ashes, which are then heated repeatedly and treated with different organic compounds in order to make organically structured nanoparticles. These organometallic or organo-mineral nanoparticles are called *Bhasma* in Ayurvedic nomenclature. According to studies, these preparations are safe for ingestion by humans and show a variety of biological actions¹.

However, traditionally, the Indian scientific community has offered little assessment of Ayurvedic ideas, which has prevented

Ayurveda and contemporary science from working together in a meaningful way. Despite their promising promise, this resulted in the downfall of several Ayurvedic practices, including the use of metallic and mineral nanoparticles. However, there has been a resurgence of interest in recent years, supported by more solid scientific data. It is now evident that in order to apply Ayurvedic concepts effectively, a deeper comprehension of them is necessary. A new generation of pro-Ayurvedic activists has emerged as a result of this increased knowledge, and they are striving to dismantle semantic obstacles and advance the scientific legitimacy of Ayurveda. Consequently, a bridge has been built between Ayurveda and contemporary science, enabling improved communication between the two systems while maintaining Ayurveda's distinctive methodology. The significance and possibilities of nanomedicine have only now come to light.

Although nanomedicine has several uses,

its main ones at the moment are the development of safe and efficient drug delivery systems for targeted therapy and the diagnosis of diseases that are challenging to identify using traditional techniques. Furthermore, the application of nanomedicines to investigate molecular changes and cellular motions in synthetic cells, enzymes, and genes is growing. Another way to describe nanomedicines is as tiny carrier systems that carry various chemicals, such as drugs, imaging agents, diagnostic agents, and antibodies. Because it makes it possible to create smaller, more effective drug delivery vehicles, nanotechnology is seen by researchers as a game-changing tool that can enhance treatment plans for a number of illnesses².

One of the main benefits of nanotechnology is its adaptability, which enables the creation of many kinds of nanomedicines, such as liposomes, dendrimers, nanoparticles, and nanocrystals, each of which is customized to fulfil particular biological requirements. Nanomedicine is a major topic of interest for both the scientific and commercial sectors, especially in the field of human health care, because it has the potential to significantly improve illness diagnosis and treatment as it develops.

History of Nanotechnology

Although nanotechnology has been around since antiquity, the field's formal development is relatively new. The scientific field of nanotechnology deals with the manipulation and control of matter at the atomic and molecular levels, usually at sizes between 1 and 100 nanometres (1 nanometre is equivalent to one billionth of a meter). An outline of the significant turning points in the development of nanotechnology may be seen below.

The fundamental ideas of nanotechnology have been around for millennia, despite the fact that the name "nanotechnology" was created considerably later. Unbeknownst to

them, ancient societies used nanomaterials in a variety of ways. In the 1990s, nanomedicine became a recognized academic discipline. Researchers started looking at the potential medical uses of nanomaterials, such nanoparticles, as a result of developments in nanotechnology. The first significant advances in the application of nanotechnology in healthcare were made during this time³.

Nanomedicine began to receive a lot of attention in the early 2000s due to its potential uses in the detection and treatment of a number of illnesses, most notably cancer. Significant advances were made as a result of the investment made in nanomedicine research by large research institutions and pharmaceutical corporations.

Nanotechnology in Ayurveda

The *Rasaratna Samuchaya* mentioned above is an elaborate ancient culmination to the latest, impending discoveries of nanoparticles. In a captivating way, it exalts *Bhasma* (ashes) properties of being able to revitalize the body, eradicate illness, counteract poison, balance the doshas, and effectively enter all the dhatus.

मृतानि लोहानि रसीभवन्ति निघ्नन्ति युक्तानि महामयांश्च ।
अभ्यासयोगाद् दृढदेहसिद्धिं कुर्वन्ति रुग्जन्मजराविनाशम् ॥

All the metals in their *Bhasma* from readily mix with parade (and such other metals). They can eradicate deadly diseases if administered properly. If they are consumed for many days regularly, they build up the body and prevent the diseases as well as senility. (R.R.S. 5/135)

लोहानां मारणं श्रेष्ठं सर्वेषां रसभस्मना ।
मूलीभिर्मध्यमं प्राहुः कनिष्ठं गन्धकादिभिः ॥
अरिलोहेन लोहस्य मारणं दुर्गुणप्रदम् ॥

It is best to perform *Marana* of *Svarna* and other metals with the help of *Parada Bhasma*. The *Marana* of such metals carried out with the assistances of herbal drugs is supposed to be medium and with the help of *Gandhak*, it is said to be inferior. However, the *Marana* of the metals if

performed with help of *Arilohas* (*Haratala*, *Manahshila* and *Anjana*, i.e. the minerals with antagonistic characters) can lead to adverse effects. (R.R.S. 5/14)

Numerous reports indicate that gold nanoparticles are driving an impressive comeback in medicinal and diagnostic applications. Researchers at Harvard Medical School have discovered that special forms of gold, platinum and all the therapeutic metals function by releasing bacteria and virus particles from the grip of crucial immune system proteins. The typical immune response is triggered by these pathogens, which alerts other immune system cells known as lymphocytes. This immune system reaction is normally restricted to the dangerous bacteria and viruses, but, occasionally, this process can go haywire, and the body itself becomes the target of the immune system, leading to autoimmune disorders. Through series of experiments, it is reinforced that gold compounds might inactivate immune system antigen presenting cells in the culture⁴.

Shodhana

Shodhana is a crucial pharmaceutical intermediate procedure used to purify minerals and metals. This detoxification procedure uses both physical and chemical methods.

When defects and harmful substances are removed, the material is ready for additional processing. Since the majority of the raw materials utilized in Rasa Shastra come from the soil, there is a constant possibility of contaminants, toxins and other heterogeneous characteristics. Humans are put through the *Shodhana* procedure when using medications in order to boost their potency and get rid of their doshas. *Shodhana*, then, is a process in which a drug's undesirable or toxic qualities are eliminated and new or altered qualities are seen in addition to modifications in the drug's physical, chemical or biological

characteristics.

It involves the following steps⁵:

- *Kshalana* (washing)
- *Mardana* (pounding)
- *Bhavana* (levigation)
- *Swedana* (boiling)
- *Bharjana* (frying)
- *Nirvana* (heating and dipping in certain solutions) etc.

Main Objectives of Shodhana

1. Elimination of physical & chemical impurities
2. Neutralization of toxins
3. Induce & enhance therapeutic qualities
4. To impart organic qualities.

Marana

The *Marana* process is a key step where metals and minerals are transformed into potent medicinal forms. Metals would be too poisonous and not bioavailable for the body to absorb without this step. *Marana* assists in maximizing the metals' therapeutic potential while reducing their negative effects by chemically changing them and breaking them down into a fine, powdered form⁶.

The *Marana* process, which turns minerals and metals into powerful therapeutic substances. Following *Shodhana* (purification) and *Jarana* (intermediate processing), this step aims to transform metals into a form that is safe, bioavailable, and suitable for therapeutic use.

Crucial Phases in the Marana Procedure

1. Heating and Calcination: Usually in a *Musha* (crucible) or *Bhatti* (furnace), the cleansed metal is heated to a high temperature. The metal's physical and chemical characteristics change as a result of this extreme heat. Particularly if plant-based powders or *Dravyas* (herbal compounds) are introduced during the procedure, the metal may oxidize or react with other substances in the environment.

2. **Oxidation and Reduction:** Oxidation happens when a metal is heated outside, and it frequently raises the metal's melting point. Simultaneously, the metal's structure is broken down and made more fine and absorbable by reduction reactions brought on by the interaction with plant powders.
3. **Repeated Heating:** The procedure often calls for several heating and cooling cycles. The metal is further refined with each cycle, becoming smaller and finer. This stage is essential because it facilitates the metal's absorption into the body, lowering toxicity and enhancing therapeutic benefits.
4. **Formation of *Bhasma*:** The metal becomes a fine, calcined powder known as a *Bhasma* following the last heating. The *Bhasma* utilized in Ayurvedic remedies is this one. Compared to the raw metal, *Marana* is far more effective and safe for human intake due to its tiny particle size and unique chemical structure.
5. **Herbal Powder Addition:** To aid in the metal's transformation and strengthen its therapeutic properties, particular herbal powders are added during the *Marana* procedure. In addition to acting as catalysts for the chemical reactions that occur, these herbs aid in neutralizing any harmful qualities, resulting in a safer and more efficient finished product.

Importance of *Marana*

- Because it renders metals and minerals safe for medicinal use, the *Marana* process is essential.
- Metals would be too poisonous and not bioavailable for the body to absorb without this step.
- *Marana* assists in maximizing the metals' therapeutic potential while reducing their negative effects by chemically changing them and breaking them down into a fine, powdered form.

Amritikaran

Amritikarana literally means 'changing in to Nectar' In most of the *Rasagranthas* the definition of *Amritikarana* is explained as "*Amritikarana*" is a special procedure followed to remove the *Shista* doshas (remained toxins) from the *Mrutha Loha* (*Bhasma*) even after *Shodhana* and *Maranadi* procedures. In *Rasashastra* raw metals and minerals are processed by following *Shodhana* etc procedures to convert them in to body absorbable form and to remove their toxicity. Amongst these procedures *Amritikarana* play very important role in removing toxins from the *Bhasma*, which results in reduction of toxicity of metals and minerals. *Amritikarana* procedure is followed mainly for *Abhraka*, *Swarna Makshika*, *Loha* and *Tamra*⁷.

The *Amritikaran* process is an advanced Ayurvedic method that makes metals and minerals safer, more powerful, and more life-enhancing. The procedure transforms the materials into potent *Rasa* and *Rasayana* remedies by neutralizing toxins and releasing their rejuvenating qualities through the use of plant-based ingredients and specific techniques. A chemical that supports health, longevity, and vitality—all of which are highly prized in Ayurvedic treatment traditions—is the result of the *Amritikaran* procedure. It is one of the primary techniques for utilizing metals and minerals for holistic wellbeing, making sure that they are both safe and efficient in fostering vitality and well-being.

Bhasma Pariksha

Bhasma Pareeksha is one of the quality control parameter mentioned in the classics for the standardization of *Bhasma*. These tests are helpful in the assessment of safety and efficacy of the drugs.

Relevance of Nanotechnology to Aushadh Manakam

The manipulation of matter on an atomic or molecular scale, usually between 1 and 100

nanometres, is referred to as nanotechnology. It involves developing novel materials, tools and systems with special qualities brought about by their small size and large surface area. Applications of nanotechnology are extensive and span a wide range of industries, including materials science, electronics, medicine, and energy.

Bhasma Pariksha	Character
Varitara, Unama, Susukshma, Dante Kachkachaabhava, Rekhapurnata, Slakshnatvam and Anjana Sannibha Pariksha	The fitness of particle size of Bhasma
Nishchandratvam, Amla Pariksha, Apnarbhava ⁸ , Niruttha Pariksha ⁹	Presence of any free metal
Nirodhoomatva Prariksha	Fumes indicate further incineration
Niswadu	Palability
Awami	Acceptability
Susukshma Pariksha	Absorption and assimilation

Conversely, the name *Aushadh Manakam* can refer to medicinal plants or substances utilized in healing procedures and is probably derived from old Indian medical systems, especially Ayurveda or Siddha. Translated as "the source of medicinal cures" or the "treasure of medicines," "*Aushadh Manakam*" emphasizes the use of natural ingredients or remedies in traditional medicine¹⁰.

Nanotechnology's Significance for Aushadh Manakam

Traditional medical systems like Aushadh Manakam and nanotechnology can interact in a number of significant ways, particularly when it comes to the advancement and modernization of traditional medicine. *Aushadh Manakam* can benefit from nanotechnology in the following ways:

1. **Increased Bioavailability:** - Active compounds in traditional medical herbs and treatments are sometimes big molecules or poorly soluble, making them difficult for the body to

absorb. By encapsulating these active ingredients in nanoscale carriers (such as liposomes or nanoparticles), nanotechnology might enhance their bioavailability and facilitate more efficient distribution to target tissues.

2. **Targeted Drug Delivery:** By enabling more accurate delivery of herbal or medicinal components to particular bodily areas, nanotechnology might increase therapeutic impact while lowering negative effects. For example, some herbs may be used to treat inflammation, but they can more efficiently target inflammatory tissues when supplied via nanocarriers than when utilized in conventional ways.
3. **Creating Pharmaceutical Formulations:** Traditional medicines can be made more user-friendly, stable, and possibly more effective by employing nanotechnology to create new forms like gels, lotions, or even inhalable powders. This can help close the gap between traditional methods and contemporary pharmaceutical advancements.
4. **Shelf-life and stability:** Over time, the active chemicals in certain medicinal plants may deteriorate due to their sensitivity to light, air, or moisture. By encapsulating these delicate substances in protective nanoparticles, nanotechnology can improve their stability and shelf life without sacrificing the medication's effectiveness.
5. **Synergy with Contemporary Diagnostics:** Advanced diagnostic instruments that assist in identifying particular biomarkers or medical disorders can be developed using nanotechnology. Through improved comprehension of the ailment being treated and more focused application of traditional treatments, this can support Aushadh Manakam.
6. **Safety and Standardization:** Variability in the potency and quality of natural products is a problem in

traditional medicine. By guaranteeing uniform dosages and lowering the possibility of contamination, nanotechnology can assist with standardizing the preparation of medicinal plants, improving the safety and dependability of treatments¹¹.

7. **Eco-friendly and sustainable solutions:**

Additionally, nanotechnology can support sustainable methods in the manufacturing of plant-based medicines. When harvesting and processing medicinal plants, nanomaterials may be utilized to enhance extraction procedures, cut waste, and lessen the environmental impact.

8. **Nanocapsules for Drug Delivery:**

Some plant-based medications, such as curcumin (found in turmeric), are not well absorbed by the body. This is an example of how nanotechnology is being used in herbal medicine. Curcumin's bioavailability and therapeutic potential can be greatly increased by delivering it via nanocapsules. The purpose of nanoemulsions is to increase the solubility and absorption of hydrophobic plant extracts, such as essential oils, to make them more useful in treating illnesses like digestive or skin ailments.

In conclusion, there is a lot of promise for enhancing the effectiveness, security, and accessibility of herbal medications through the incorporation of nanotechnology with conventional therapeutic approaches like Aushadh Manakam. Nanotechnology can help modernize conventional healing methods and provide more powerful, efficient treatments while conserving the knowledge of existing therapeutic systems by improving the delivery and absorption of medicinal ingredients.

Discussion

Nanotechnology has been able to lower the amount of medicine that must be loaded, it

can prevent a variety of dose-related side effects. This will also aid in addressing the safety concerns and efficacy of Ayurvedic medications and formulations. Different Physical and chemical Bhasma Pariksha is also utilized to evaluate the authenticity of the specimen.

Conclusion

Ayurvedic Medicine preparations and *Bhasma's* are the best example of Nano technology & Nano medicine practiced during the ancient period. Shata puta, Sahasra puta Bhasma's are the indirect reference for the concept of conversion of drug to Nano medicine. Ancient knowledge of *Bhasmeekarana* may cover the current scientific validation of Nano Technology.

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