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Comparative study of *mukta bhasma* & *mukta pishti* With reference to their particle size

Research Article

Sawant R S[1*]

1* Corresponding Author: Assistant Professor, Dept. of Rasashastra & Bhaisajya Kalpana, Smt. K. G. M. P. Ayurved Mahavidyalaya, Mumbai, M.S.
Email-drranjeet.sawant@gmail.com

Abstract:

Mukta (pearl) is used as its derived form viz *Mukta Bhasma* **[MB]** & *Mukta Pisthi* **[MP]** in treatment of various chronic diseases such as *Rajayakshma* (Tuberculosis), *Prameha* (Diabetes Mallitus), *Shwasa* (Asthma), *Vatavyadhi* (Neuro-muscular disorders). *Mukta bhasma* is prepared using direct heat as media of transformation while *Mukta Pishti* is prepared using indirect heat (trituration). So an attempt was made to compare both preparations to find out role of *agni* (heat) as well as *Mardana* (frictional force) in conversion of particle size of final product. The Raw pearl powder, prepared samples of *Bhasma* and *Pishti* were subjected to analysis using DLS (Dynamic Light scattering) & NTA (Nano-particle Tracking Analyzing) methods. The study shows that particle size of *Mukta Pishti* is reduced more than *Mukta bhasma* same that it can be concluded that Properties of *Mukta* are preserved as there is no direct contact with heat and will be useful in diseases vitiated by *Pitta*.

Key Word: *Mukta, Mukta Bhasma, Mukta Pishti*, DLS, NTA

Introduction:

The gem Pearl has unique place in *Rasashastra* as it plays a significant role in *Parad bandhana* (Mercury binding procedures), (1) *Rasa chikitsa* (Therapeutic use) & astrology. *Mukta* (pearl) is used as its derived forms viz. *Mukta Bhasma* [MB] & *Mukta Pisthi* [MP] in treatment of various chronic diseases such as *Rajayakshma* (Tuberculosis), *Prameha* (Diabetes Mallitus), *Shwasa* (Asthma), *Vatavyadhi* (Neuro-muscular disorders). (2) Classical texts of *Rasashastra* although not in favor of *Ratna marana* (incineration of gems) as it leads to loss of their *Veerya* (potency) still some texts has mentioned its incineration procedure and therapeutic uses too. *Mukta bhasma* is prepared using direct heat as media of transformation. There are some references which indicates preparation of *Anagni Bhasma* (preparation of *Bhasma* using indirect heat) i.e. *pishti* as to preserve qualities of gems. Likely *Mukta Pishti* is prepared using indirect heat (heat generated while trituration). So, an attempt was made to discover the role of *Agni* (heat) in conversion of particle size of final product.

Aim

The aim was to compare the particle size of Mukta Bhasma & Mukta pishti prepared by conventional method

Objectives

Preparation of *Mukta Bhasma*

- *Shodhana* (Rasendra Chintamani)
- *Marana* (Rasa Tarangini)

Preparation of *Mukta Pishti*

- *Shodhana* (Rasendra Chintamani)
- *Pishti* Formation (Rasa Prakashika)
- Comparision of *Mukta Bhasma & Mukta Pishti*

Materials & method

Procurement of Raw material

Raw Materials were procured by All India Pharmacy Store, Paydhonie, Mumbai, (M.S), India. Pearls were authenticated at Gems and Diamond Testing Laboratory, Mumbai. Lemon and Rose were procured from local market. Leaves of Jayanti were collected from Keshav srushti, Bhayander, Mumbai, India. These were subjected to ancient and modern selection criteria. The raw herbal drugs were authenticated in Pharmacognosy Department of Nicolas and Piramal, Mumbai, India. Their identification is summarized in **[Table 1]**

Table 1: Identification of Raw Drugs

Sr. No.	Raw drug	Latin name	Part used
1.	Lemon	*Citrus acida* Linn	Fruit juice
2.	*Jayanti*	*Sesbania sesban* (Jacq.) W. Wight	Leaves
3.	Rose	*Rosa centifolia* Linn	Flower (petals)

Simple & Special Purification of Pearl

Simple Purification was done by *swedan* in Lemon juice for 3 hours. It was then washed with Luke warm water and dried. Special purification was done by processing pearls obtained in previous method in freshly prepared juice of *Jayanti* for 3 hours. It was then washed with Luke warm water and dried. (3)

Preparation of MB

MB prepared by triturating purified Pearl with Rose water per day 6 hours for 3 Days till a homogenous paste was formed. After triturating, small pellets of uniform size (3×3 cm) and thickness were prepared and dried in sunlight. Pellets were kept inside a *sharava* (shallow earthen disc) and another *sharava* was inverted over it. The joint between the two discs was sealed with mud smeared cloth to ensure proper closure. The properly sealed and dried *samputa* was subjected to *puta* system of heating with approximately 1.5 kg cow dung cake. Maximum temperature was 600-700 °C with total duration of 8 hours. The process was repeated for 2 more times to obtain *bhasma* of desired quality. MB obtained from above process was subjected to analytical tests. (4)

Preparation of MP

MP prepared by triturating purified Pearl with Rose water per day 6 hours for 21 Days. MP was then dried in shed and filled in an air tight glass jar. MP obtained from above process was subjected to analytical tests. (5)

Analysis using parameters described in *Ayurveda* texts

The final *bhasma* was analyzed for quality control as described in ancient texts (6) and results found were as follows:

- *Nishchandratva*: MB & MP were taken in a petri dish and observed for any luster in daylight through magnifying glass. No luster was observed in both samples.
- *Rekhapurnatva*: A pinch of MB & MP was taken in between the thumb and index finger and rubbed.
- *Varitartva*: A small amount of the prepared MB & MP was sprinkled over the still water in a beaker. It was found that the MB particles

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floated over the surface of the water.

Thus MB & MP were found suitable as per *Ayurvedic* texts and further subjected to modern parameters for comparing their particle size.

Analysis using modern parameters

The raw Pearl powder, MB & MP was analyzed using the following techniques:

- Particle size by DLS
- Particle size by NTA

Particle size by DLS

DLS studies were performed at Shraddha Analytical Services, Ghatkopar, Mumbai for determination of particle size of raw Pearl powder.

Instrument: Malvern Mastersizer

Procedure:

The raw Pearl was coarsely powdered and subjected to Dynamic light scattering. When light hits small particles, the light scatters in all directions (Rayleigh scattering) as long as the particles are small compared to the wavelength (below 250 nm). If the light source is a laser, and thus is monochromatic and coherent, then one observes a time-dependent fluctuation in the scattering intensity. This fluctuation is due to the fact that the small molecules in solutions are undergoing Brownian motion, and so the distance between the scatterers in the solution is constantly changing with time. This scattered light then undergoes either constructive or destructive interference by the surrounding particles, and within this intensity fluctuation, information is contained about the time scale of movement of the scatterers. The dynamic information of the particles is derived from an autocorrelation of the intensity trace recorded during the experiment. (7) **[Table 2]**

Particle size by NTA

NTA for particle size of MB was performed at Institute of Science, Churchgate, Mumbai.

Instrument:

Nano-particle Tracking Analysis (NTA) Version 2.3 Build 0013

Procedure:

The powdered sample was dissolved in 1cc distilled water and subjected to sonication for 1 minute. One drop of solution was injected in the column of ultra microscope. NTA is a method for visualizing and analyzing particles in liquids that relates the rate of Brownian motion to particle size. The rate of movement is related only to the viscosity and temperature of the liquid; it is not influenced by particle density or refractive index. NTA allows the determination of a size distribution profile of small particles with a diameter of approximately 10-1000 nanometers (nm) in liquid suspension. The technique is used in conjunction with an ultra microscope and a laser illumination unit that together allow small particles in liquid suspension to be visualized moving under Brownian motion. The light scattered by the particles is captured using a CCD or EMCCD camera over multiple frames. Computer software is then used to track the motion of each particle from frame to frame. The rate of particle movement is related to a sphere equivalent hydrodynamic radius as calculated through the Stokes–Einstein equation. The technique calculates particle size on a particle by particle basis, overcoming inherent weaknesses in ensemble techniques such as dynamic light scattering. Since video clips form the basis of the analysis, accurate characterization of real time events such as aggregation and dissolution is possible (8) **[Table 3].**

Result

The result obtained from analysis is summarized as following. **[Table 2 & 3]**

Table 2: Particle size of raw Pearl by DLS

Sample	Observations	
Raw Mukta powder	10% particles below	114.019 µm
	50% particles below	466.819 µm
	90% particles below	1170.290 µm
	100% particles below	1998.590 µm

Table 3: Particle size of raw Pearl by NTA

Sr. No.	Sample	Average Particle size (in nm)
1.	MB	156
2.	MP	62

Discussion

Marana (Calcination) is the set of procedures obtained for reduction of particle size of any metalo-mineral substance to that extent which will be easily assimilate by human body. Role of Agni is to conversion and bring *Laghu, Ushna, Tiksha* properties to substance which comes contact in it. Some substances having *Sheeta virya* might lose its *sheeta guna* in calcination procedure. To preserve their property "pishti" formulation is evolved.

Average size of raw Pearl used was 8.7× 5.4× 4.4 mm. After coarse powdering, particle size of 10% particles was below 114.019 µm. MB achieved particle size as 156 nm **[Figure 1]** by rigorous trituration, levigation and heat treatment; MP achieved average particle size as 62 nm only by rigorous trituration [6 hours daily] for 21 Days which was confirmed by NTA. **[Figure 2]**

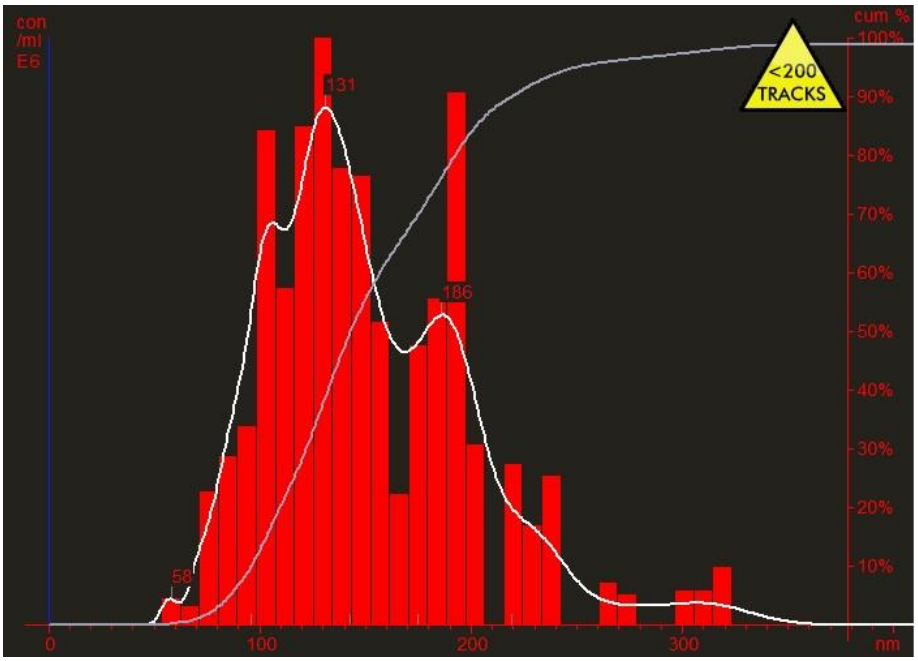

Figure 1 – NTA graph of Manikya Bhasma showing presence nano particles.

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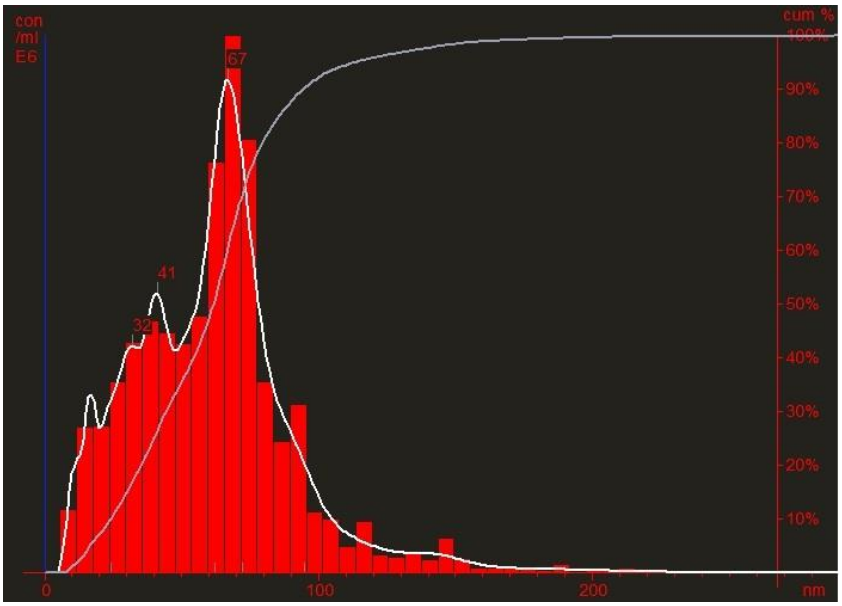

Figure 2 – NTA graph of Manikya pishti showing presence nano particles.

Both samples showed significant reduction of size and that allows the phenomenon of *Rekhapurnatva* and *Varitartva* to develop. But final products of both procedures were subjected to XRD analysis.

In raw Pearl major peaks were of $CaCO_3$ in Aragonite form. **[Figure 3]** Even in MP similar peaks were detected. As per inorganic chemistry, if calcium carbonate prepared in solutions at temperatures exceeding 300°C, crystals corresponding with Aragonite are formed, and if temperatures below 300°C, crystals of Calcite are formed. Hence, Aragonite at temperatures below 300°C is in a Meta stable condition. No change in form can be attributed to the fact that preparation of Pishti is devoid of heat and thus preserves innate properties of prepared drug.

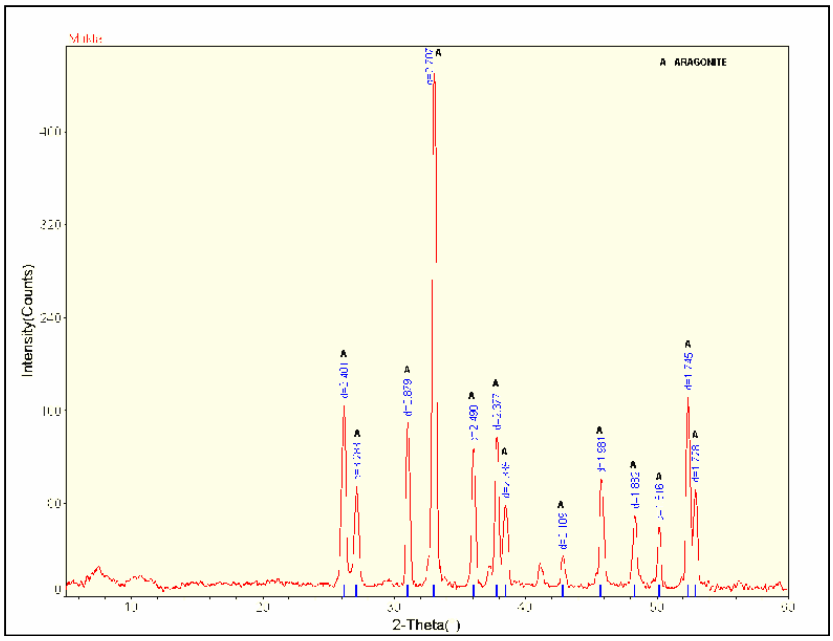

Figure 3 – XRD graph of Raw Pearl showing presence of Aragonite peaks.

If Aragonite is heated at temperatures 400 °C, it will spontaneously convert to Calcite form. Further high pressure and low temperatures, Aragonite will almost certainly alter to Calcite. Thus the transformation of Aragonite form of raw Pearl to Calcite form in MB can be attributed to the closed oxidation at the temperature above 400 °C. **[Figure 4]**

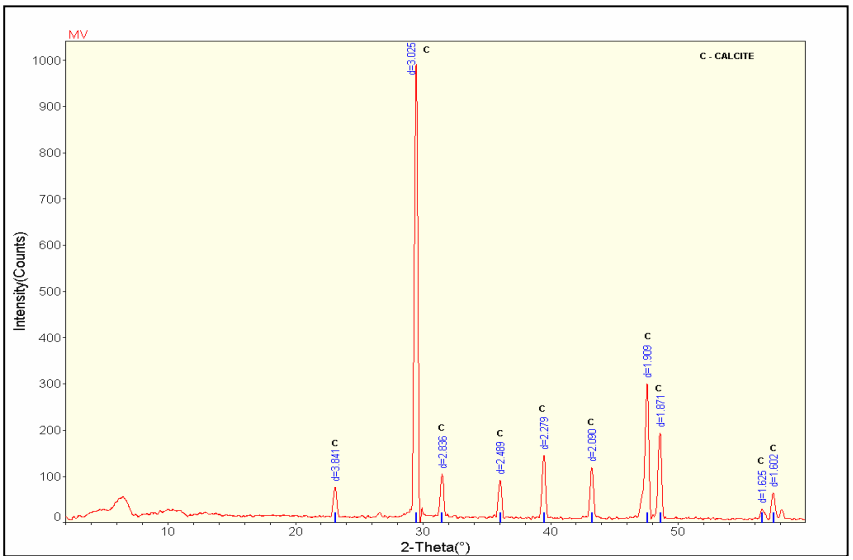

Figure 4 – XRD graph of Manikya bhasma showing presence of Calcite peaks.

Generally Pishti is prepared to stabilise the inherent properties of drug with immense reduction in its particle size allowing penetration of that drug at cell level. It was confirmed by presence of $CaCO_3$ in both samples as Aragonite and presence of nano particles in MP. **[Figure 5]**

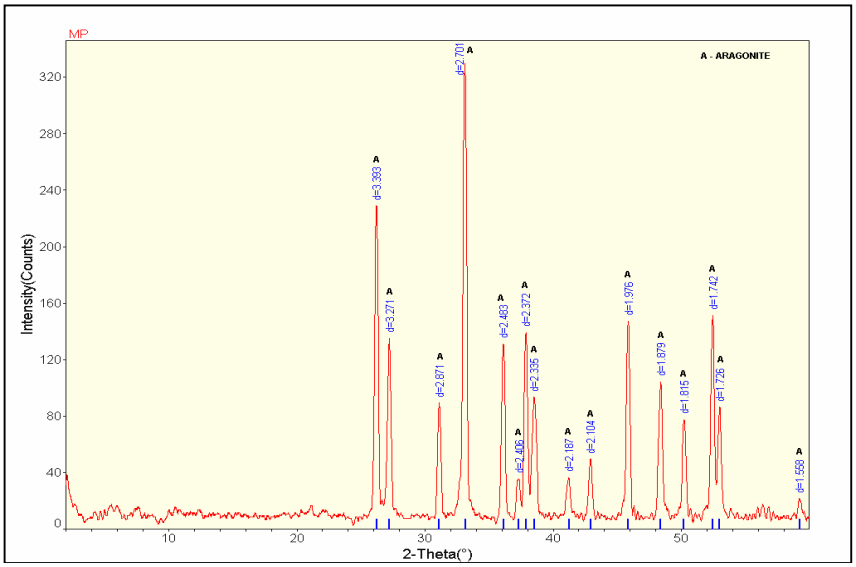

Figure 5 – XRD graph of Manikya Pishti showing presence of Aragonite peaks.

In MB, As a result of different stages of processing techniques like Simple purification, Special purification, Trituration, Levigation and Heat treatment, the particle size reduces significantly. This may facilitate easy absorption and assimilation of the drug into the body system. This facilitates its intracellular activities, cell penetration and cell alteration.

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Conclusion

- Trituration plays vital role in reducing particle size.
- In preparation of Bhasma - Agni just plays role of conversion which is important for assimilation of drug in body.
- Pishti stabilize the inherent properties of drug with immense reduction in its particle size allowing penetration of that drug at cell level.

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