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Research Article

Mukta Pishti

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Comparative Analytical Study of Mukta Bhasma and Mukta Pishti: A Pharmaceutico-Analytical and Therapeutic Perspective

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Mukta (Pearl) holds a prestigious position in Rasashastra due to its Shita (cooling), Pittahara, Hridya (cardiac tonic), and Rasayana (rejuvenating) properties. It is extensively used in various forms, notably Mukta Bhasma and Mukta Pishti, both derived from the same raw material yet differing significantly in their method of preparation, physicochemical properties, and likely therapeutic outcomes. Mukta Pishti is prepared through a cold process involving levigation with rose water, preserving its organic and aqueous solubility traits. In contrast, Mukta Bhasma is obtained by a high-temperature Marana (incineration) process following proper Shodhana (purification), which transforms the raw material into a fine, stable, and bio-absorbable form. This comparative analytical study aims to evaluate both forms using classical Bhasma Pariksha (such as Rekhapurnatva, Varitaratva, and Nischandratva) and modern analytical techniques like X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR), Particle Size Analysis, Zeta Potential, and Atomic Absorption Spectroscopy (AAS). The results revealed significant differences: Mukta Bhasma exhibited a finer particle size, higher crystallinity, and better dispersion stability, while Mukta Pishti retained organic traces and presented a relatively larger particle size. These findings highlight the importance of choosing the appropriate form based on clinical indication, desired bioavailability, and patient condition. While both formulations serve vital therapeutic roles, Mukta Bhasma may be more effective in chronic systemic disorders, and Mukta Pishti is preferable for acute Pitta-dominant conditions. This study contributes to evidence-based decision-making in Ayurvedic pharmaceutics and supports the rational, therapeutic use of mineral formulations in clinical practice.

Keywords: Mukta Bhasma, Mukta Pishti, Rasashastra, Analytical Study, Bhasma Pariksha, Ayurvedic Pharmaceutics

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Introduction

Mukta (pearl) has held a significant place in *Rasashastra* due to its high therapeutic value, especially in *Pittaja vyadhi*, *Hridroga*, and *Rasayana* chikitsa. It is considered one of the finest *Ratnas* used in Ayurveda, described as *Shita*, *Madhura*, *Pittahara*, and *Medhya*. Classical texts such as *Rasa Tarangini*, *Rasa Ratna Samucchaya*, and *Ayurveda Prakasha* have mentioned its uses in various disorders, including psychiatric, cardiovascular, and digestive ailments. The two most commonly employed forms are *Mukta Bhasma* and *Mukta Pishti*, which differ in their pharmaceutical processes and possible therapeutic responses.**[1]** The preparation of *Mukta Bhasma* involves *Shodhana* and *Marana*, which include incineration using traditional *Puta* systems to enhance the bioavailability, reduce toxicity, and ensure *Samskara* transformation. On the other hand, *Mukta Pishti* is prepared by levigating purified *Mukta* with organic liquids like *Gulab Arka* under controlled conditions, avoiding thermal incineration and thereby retaining more of its original molecular and crystalline structure. These divergent preparation techniques are likely to alter the final product's physical, chemical, and pharmacological properties.**[2]** Modern research supports that *Bhasma* preparations undergo profound changes at microscopic and molecular levels during incineration. Analytical tools such as XRD, SEM, FTIR, and Zeta Potential analysis have demonstrated that such formulations may exhibit nanoparticle dimensions and altered crystalline nature, influencing their biological interaction and absorption mechanisms. Hence, understanding the comparative analytical profiles of *Mukta Bhasma* and *Mukta Pishti* is vital for evidence-based and safe Ayurvedic prescribing.**[3]** There is a growing need to validate traditional Ayurvedic formulations using modern scientific parameters, especially those involving mineral and metallic preparations. Despite *Mukta* being widely used in both classical and modern formulations, there is limited comparative literature evaluating its *Pishti* and *Bhasma* forms using both classical *Bhasma Pariksha* and advanced instrumentation. This creates a significant gap in standardization and rational clinical application.**[4]** Therefore, this study is designed to conduct a comparative analytical evaluation of *Mukta Bhasma* and *Mukta Pishti* using classical and contemporary parameters. This will help understand their pharmaceutico-analytical differences and offer insights into their therapeutic relevance, ensuring safety, efficacy, and rationality in Ayurvedic practice.**[5]**

Materials and Methods

Procurement and Authentication of Raw Material

Raw *Mukta* (natural pearl) of marine origin was procured from a certified Ayurvedic pharmacy that deals in genuine *Ratnas* and *Uparatnas*. The raw drug was carefully handpicked based on traditional organoleptic features such as *Shankha-Sadrusha Varna* (conch-like white color), *Nirmalatva* (clarity and absence of impurities), and *Dridhatva* (hardness). Only medium-sized, white, non-porous pearls were selected for this study. The selected samples were further subjected to preliminary testing under a stereo-zoom microscope to identify any cracks or organic impurities. Pearls with cracks or irregular surfaces were discarded. The final authenticated *Mukta* was used for both *Pishti* and *Bhasma* preparation. All equipment used was cleaned thoroughly to avoid cross-contamination.**[6]**

Preparation of Mukta Pishti

The classical process of *Mukta Pishti* preparation involves a non-thermal levigation technique to preserve the natural properties of *Mukta*. The purified pearls were ground to a coarse powder using a stainless steel mortar and pestle. This powder was then triturated (*Bhavana*) with *Gulab Arka* (distillate of Rosa damascena) in a marble mortar. Levigation was performed for 6–8 hours per day continuously for three days. Each day, freshly prepared *Gulab Arka* was used to maintain the cooling potency and prevent microbial contamination. After three days of continuous *Mardana* (grinding), a smooth, lusterless, white *Pishti* was obtained. The final product was stored in a desiccator to avoid moisture absorption.**[7]**

Preparation of Mukta Bhasma

The *Shodhana* and *Marana* processes were followed according to classical *Rasashastra* protocols. For *Shodhana*, the raw *Mukta* was soaked in *Churnodaka* (lime water) for 24 hours, after which it was washed with warm water and dried in shade. The dried pearls were then powdered using a mechanical grinder.

For *Marana*, the powdered *Mukta* was triturated with *Kumari Svarasa* (Aloe vera juice) and made into uniform pellets (*Churna-Lavana*). These pellets were dried under shade and placed in a *Sharava Samputa* (sealed earthen dish). The *Samputa* was subjected to *Gajaputa* - a traditional incineration process using approximately 100 cow dung cakes. This procedure was repeated three times to ensure complete transformation into *Bhasma*.**[8]**

Each cycle of *Puta* lasted 8–10 hours, followed by natural cooling for another 12 hours. After the final *Puta*, the *Bhasma* was collected and stored in airtight glass containers. The yield and weight loss during each cycle were recorded for evaluation.

Classical Bhasma Pariksha

The finished *Mukta Bhasma* and *Mukta Pishti* were subjected to the following classical tests to ensure pharmaceutical quality:

- ***Rekhapurnatva:*** The ability of the formulation to enter the fine lines of the skin, indicating micro-fineness.
- ***Varitaratva:*** The capacity of the sample to float on still water, indicating lightness and micro-particulate size.
- ***Nischandratva:*** Absence of metallic luster when observed under sunlight, reflecting incineration completion.
- ***Apunarbhava:*** Mixing the sample with *Nava Neeta* (fresh butter) and heating with silver foil to confirm non-regeneration of metallic form.
- ***Niruttha:*** Resistance to reaction with strong alkaline substances, confirming stable transformation.**[9]**

Modern Analytical Parameters

To scientifically validate the classical findings, modern instrumentation techniques were used:

- **X-ray Diffraction (XRD):** To analyze the crystallinity and confirm conversion to calcium oxide or carbonate forms.
- **Scanning Electron Microscopy (SEM):** To observe surface morphology, agglomeration, and particle size at the micro/nano scale.
- **Fourier Transform Infrared Spectroscopy (FTIR):** For identification of functional groups such as carbonate, hydroxyl, or residual organic elements.
- **Particle Size Analysis (PSA):** For exact size distribution across samples, revealing bioavailability potential.
- **Zeta Potential Measurement:** To evaluate the stability of particles in dispersion, which is essential for cellular absorption.
- **Atomic Absorption Spectroscopy (AAS):** For determining the elemental composition such as calcium (Ca), magnesium (Mg), zinc (Zn), and trace heavy metals.**[10]**

Documentation and Data Analysis

All data obtained through analytical tests were documented systematically. The results of classical tests were tabulated using a binary (pass/fail) system, whereas modern results were expressed in absolute values and graphically represented. Comparative evaluation was done to highlight the differences in particle size, elemental composition, morphology, and stability between *Mukta Pishti* and *Mukta Bhasma*.**[11]**

Statistical tools such as mean, standard deviation, and percentage difference were applied where necessary to validate the analytical outcome. Observations were interpreted in the context of *Ayurvedic pharmaceutics* and therapeutic implications.

Results

The present study evaluated *Mukta Bhasma* and *Mukta Pishti* through both classical *Bhasma Pariksha* and modern scientific techniques. The outcomes were compared in terms of particle size, texture, morphology, crystalline structure, elemental composition, and physicochemical behavior.

1. Classical Bhasma Pariksha Results

Both samples underwent standard classical tests as per *Rasa Shastra* guidelines:

Test Name	Mukta Pishti	Mukta Bhasma	Interpretation
Rekhapurnatva	Positive	Positive	Both samples were micro-fine
Varitaratva	Partially	Clearly	Bhasma floated more consistently
Nischandratva	Slight lustre	Lustreless	Bhasma completely lost original shine
Apunarbhava	Not applicable	Passed	Confirmed complete incineration
Niruttha	Not tested	Passed	Indicated chemical stability

Mukta Bhasma met all five classical test parameters efficiently. *Mukta Pishti* was suitable for tests like *Rekhapurnatva* and *Varitaratva* but could not be subjected to *Apunarbhava* and *Niruttha* due to its non-incinerated nature.

2. Organoleptic and Physical Observations

Parameter	Mukta Pishti	Mukta Bhasma
Color	Glossy white	Dull white
Texture	Smooth, slightly sticky	Dry, fine, soft touch
Taste	Sweet, slightly astringent	Tasteless
Odor	Mild rose aroma	Odorless
Solubility	Partially dispersible	Poor solubility, high dispersibility

The presence of rose water in *Mukta Pishti* influenced the aroma and slight tackiness, while *Mukta Bhasma* appeared neutral and dry with complete transformation in texture.

3. Modern Analytical Findings

A) Particle Size Analysis

- *Mukta Pishti:* Particle size ranged between 500–900 nanometers.
- *Mukta Bhasma:* Particle size ranged between 100–250 nanometers.

The smaller particle size of *Mukta Bhasma* suggests enhanced surface area, which could improve bioavailability and systemic absorption.

B) Scanning Electron Microscopy (SEM)

- *Mukta Pishti:* Showed irregular, layered flakes and mild agglomeration.
- *Mukta Bhasma:* Revealed uniform, spherical, well-dispersed nanoparticles with smoother surface.

The morphological analysis confirmed the finer and more consistent texture of *Bhasma* compared to *Pishti*.

C) X-ray Diffraction (XRD)

- *Mukta Pishti:* Showed semi-crystalline nature with major peaks of $CaCO_3$.
- *Mukta Bhasma:* Showed increased crystallinity and well-defined peaks of $CaCO_3$ and possible traces of CaO.

This suggests successful transformation of raw material into a more stable crystalline structure in *Bhasma*.

D) Fourier Transform Infrared Spectroscopy (FTIR)

- *Mukta Pishti:* Detected carbonate, hydroxyl, and minor organic functional groups.
- *Mukta Bhasma:* Displayed strong carbonate peaks, absence of organic compounds.

Organic traces in *Pishti* are due to *Gulab Arka*; *Bhasma* showed inorganic, stable, and purified characteristics.

E) Zeta Potential

- *Mukta Pishti:* −18 mV (moderate stability)
- *Mukta Bhasma:* −28 mV (high stability)

Higher zeta potential in *Bhasma* suggests greater colloidal stability and lesser particle aggregation.

F) Atomic Absorption Spectroscopy (AAS)

Element	Mukta Pishti (%)	Mukta Bhasma (%)
Calcium (Ca)	36.0	38.5
Magnesium (Mg)	0.25	0.18
Zinc (Zn)	0.02	0.03
Lead (Pb), Arsenic (As), Mercury (Hg)	Not Detected	Not Detected

Mukta Bhasma showed slightly higher calcium concentration and complete absence of heavy metals, indicating proper incineration and detoxification.

4. Comparative Summary Table

Parameter	Mukta Pishti	Mukta Bhasma
Process	Cold levigation	Thermal incineration
Particle Size	500–900 nm	100–250 nm
Stability (Zeta Potential)	Moderate (−18 mV)	High (−28 mV)
Organic Content	Present (rose water)	Absent
Classical Tests	Partial	Fully passed
Calcium Content	Slightly lower	Slightly higher
Suitable for	Acute Pitta conditions	Chronic systemic disorders

This comparative analysis clearly demonstrates that *Mukta Bhasma* offers superior features in terms of particle size, purity, crystallinity, and physicochemical stability, whereas *Mukta Pishti* preserves organic traits and may be useful in mild, cooling applications.

Discussion

The current study was designed to critically evaluate the physicochemical, classical,

And analytical profiles of *Mukta Bhasma* and *Mukta Pishti*, two prominent formulations prepared from natural pearl (*Mukta*) in *Ayurvedic pharmaceutics*. Though both originate from the same raw material, their unique preparation methods—*Bhasma* through incineration and *Pishti* through levigation - result in considerable differences in their physical properties, chemical composition, and potential therapeutic behavior.Classical *Bhasma Pariksha* revealed that *Mukta Bhasma* passed all standard tests with more clarity and consistency than *Mukta Pishti*. The absence of luster (*Nischandratva*), the ability to float on water (*Varitaratva*), and the micro-fineness (*Rekhapurnatva*) were more prominent in *Bhasma*, suggesting effective conversion through *Marana*. *Mukta Pishti* also showed fine quality but retained mild luster and did not meet the incineration-specific tests like *Apunarbhava* or *Niruttha*. From a modern analytical perspective, *Mukta Bhasma* exhibited finer particle size (100–250 nm) compared to *Mukta Pishti* (500–900 nm), which is a significant determinant for bioavailability. The spherical morphology observed in SEM analysis and the higher zeta potential value further indicated greater dispersion stability of *Bhasma*. These features support the concept that incineration, when done properly, transforms minerals into more absorbable and biologically compatible forms. FTIR analysis showed that *Pishti* retained organic functional groups, likely from *Gulab Arka*, contributing to its cooling and soothing properties. *Bhasma*, in contrast, displayed pure carbonate signatures, suggesting complete inorganic transformation, and possibly a more sustained systemic effect. The difference in calcium concentration between the two was marginal but slightly higher in *Bhasma*, affirming the efficiency of incineration in concentrating mineral content. Therapeutically, the distinction is crucial. *Mukta Pishti* -owing to its partially organic nature and larger particle size - may act more locally and swiftly in *Pitta*-related acute conditions like hyperacidity, burning sensation, and mental irritability. Meanwhile, *Mukta Bhasma*, with its nano-sized, crystalline, and stable characteristics, may be more effective in chronic systemic diseases such as cardiovascular disorders, osteoporosis, anxiety, and neurodegenerative conditions. Furthermore, *Bhasma*'s complete transformation ensures its longer shelf life, easier formulation in tablets and capsules, and improved compatibility with other *Rasoushadhis*.

Pishti, on the other hand, is better suited for pediatric, geriatric, or highly sensitive patients due to its mild action and absence of thermal processing. Overall, the comparative data affirm that both formulations have unique strengths and should be selected judiciously based on clinical requirements. Rational use, guided by analytical validation and traditional knowledge, enhances both safety and efficacy of *Rasaushadhi* preparations in Ayurvedic therapeutics.

Conclusion

This comparative analytical study of *Mukta Bhasma* and *Mukta Pishti* highlights the significant differences arising from their distinct pharmaceutical processes. While both are derived from the same mineral source—natural pearl—their transformation through incineration (*Marana*) or levigation (*Bhavana*) leads to markedly different physicochemical properties. *Mukta Bhasma* exhibited smaller particle size, higher crystallinity, better zeta potential, and complete absence of organic residues, making it more suitable for chronic systemic disorders and as a potent *Rasayana* agent. In contrast, *Mukta Pishti*, being rich in organic components and possessing moderate particle size and cooling qualities, serves as an excellent option for acute *Pittaja* conditions and in sensitive individuals where a milder action is desirable. Both formulations have unique clinical utilities when used judiciously and rationally. This study reaffirms the importance of integrating classical *Ayurvedic* wisdom with modern analytical tools to enhance safety, efficacy, and global acceptability of *Rasaushadhis*. The findings support standardization and evidence-based use of these valuable mineral formulations in clinical practice.

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