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# Preparation and investigation of analytical profile of Indian traditional medicine: Mukta shouktic bhasma by using modern analytical techniques

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**Abstract**
*Among* the various essential elements calcium is important for human being. Various natural and synthetic calcium supplements are in market. According to Rasaratnasamuchchaya Calcium *bhasma* is rich calcium supplements. *Mukta shouktic bhasma* is a traditional Ayurvedic formulation. Raw *Muktashukti* is subjected to calcination to transform it into *MSB*. In raw *mukta shoukti* calcium carbonate is present in aragonite form. After transformation of *Mukta shoukti* into *MSB*, the aragonite form changes to a calcite form. The *MSB* should be analysed for percentage of calcium content. Physicochemical analysis of *MSB* is studied by modern analytical tools as SEM, XRD, and FTIR. In present work structural and chemical characterization of *MSB* was performed to develop analytical profile of it. There is marked improvement in the therapeutic efficacy of bhasma due to reduction of particle to nano size. XRD analysis revealed that calcium is the major element present in *Mukta shouktic bhasma.*

**Keywords:** mother of pearl, shodhana, marana, calcination, XRD

## Introduction
In India various traditional systems of medicine were practiced, Ayurveda is one them. Ayurveda first recognized important role of metals, marine substances and minerals in curing ailments. *Bhasmas* are inorganic formulations of mineral and metal which transform them to their carbonates, oxides, etc [1]. Lead, calcium, iron, silver, gold, zinc are commonly employed for formulation *of Bhasmas*. Potency, stability and lower therapeutic dose make the *Bhasma* superior than any other preparations [2]. The improper understanding and processing of traditional methods put a question mark on genuineness of preparations. *MSB* is reported as rich sources of calcium. The *MSB* is formulated by calcination of raw mother of pearl [3]. *MSB* is mainly used as calcium supplement in deficiency. It is also useful for an antacid and anti-pyretic and anti-inflammatory activity [4, 5]. Analytical studies of *MSB* confirm presence of calcium carbonate in calcite form. Thus it is worthwhile to investigate the analytical profile of *MSB* so as to find out nature of raw material as well as final formulation [6]. The aim of present work is to develop analytical profile of *MSB* by assessing physicochemical parameters and using modern analytical techniques such as XRD, FTIR, and SEM.

## Methodology
### Preparation of *Muktashukti Bhasma*
*Muktashukti* (mother of pearl) is procured from local market of Nashik (Maharashtra), India. The *MSB* is formulated as per method mentioned in classical Ayurvedic texts. The formulation process includes following main stages.

### a. Shodhana
First *Mukta-Shukti* was crushed with the help of mortar and pestle. These fragments were placed in clean cloth *Pottali.* The *Pottali* was suspended with the help of glass rod into an earthen container containing *Kanji* so that *pottali* will not touch the inner surface of container. Then boil it for about 3 hours, during boiling adequate amount of kanji was added so as to maintain its level. After boiling pottali was removed from container and let the content cool. After cooling, fragments were removed and washed with warm water and then allowed to dry [7, 8].

### b. *Marana*
After shodhana the purified *Mukta-Shukti* was sandwiched between cow dung. Then it was heated and after cooling fragments was removed from ash. These fragments were triturated for 2 days. After trituration pellets are formed and put in between two *Shoraws* which was sealed with clay dipped clothes. The *Shoraws* were processed in *Gazaputa* for *Marana.* The *Mukta Shukti* obtained from the *Sharava* was subjected to *Bhasma Pariksha*. If sample does not pass the *Bhasma Pariksha***,** then it is processed in same manner for 4 more time to obtain *Mukta-shukti bhasma* [9].

## Result and Discussion

**Table 1:** Organoleptic evaluation

| Sr. no. | Parameter | Observation |
|---|---|---|
| 1 | Number of Putas required | 5 |
| 2 | Weight of Shodhita *Muktashukti* | 200 gm |
| 3 | Weight of *Muktashukti Bhasma* | 45 gm |
| 4 | Weight loss | 155 gm |
| 5 | Colour | white |
| 6 | Odour | Odorless |
| 7 | Taste | Tasteless |
| 8 | Touch | Soft smooth |
| 9 | Nature | Very fine powder |

**Table 2:** Physicochemical Evaluation

| Sr. No. | Parameter | Result |
|---|---|---|
| 1 | Total Ash (%w/w) | 96.243 |
| 2 | Water soluble Ash (%w/w) | 27.103 |
| 3 | Acid insoluble Ash (%w/w) | 0.143 |
| 4 | Loss on drying (%w/w) | 0.048 |
| 5 | $P^H$ | 9.3 |

**XRD Analysis**

XRD analysis reveals that the raw *MSB powder* is present as aragonite, while *Muktashukti Bhasma* present as calcite of calcium carbonate. Thus when raw material was heated, aragonite form of calcium carbonate changes to calcite. The sharp peaks are observed for calcite phase where as broader peaks are obtained for calcium hydroxide. The XRD study of the *bhasma* shows presence of only calcite form. Thus hydroxide and oxide are completely converted to calcium carbonate.

Thus, the peaks obtained are more sharper results in highly crystalline product [10].

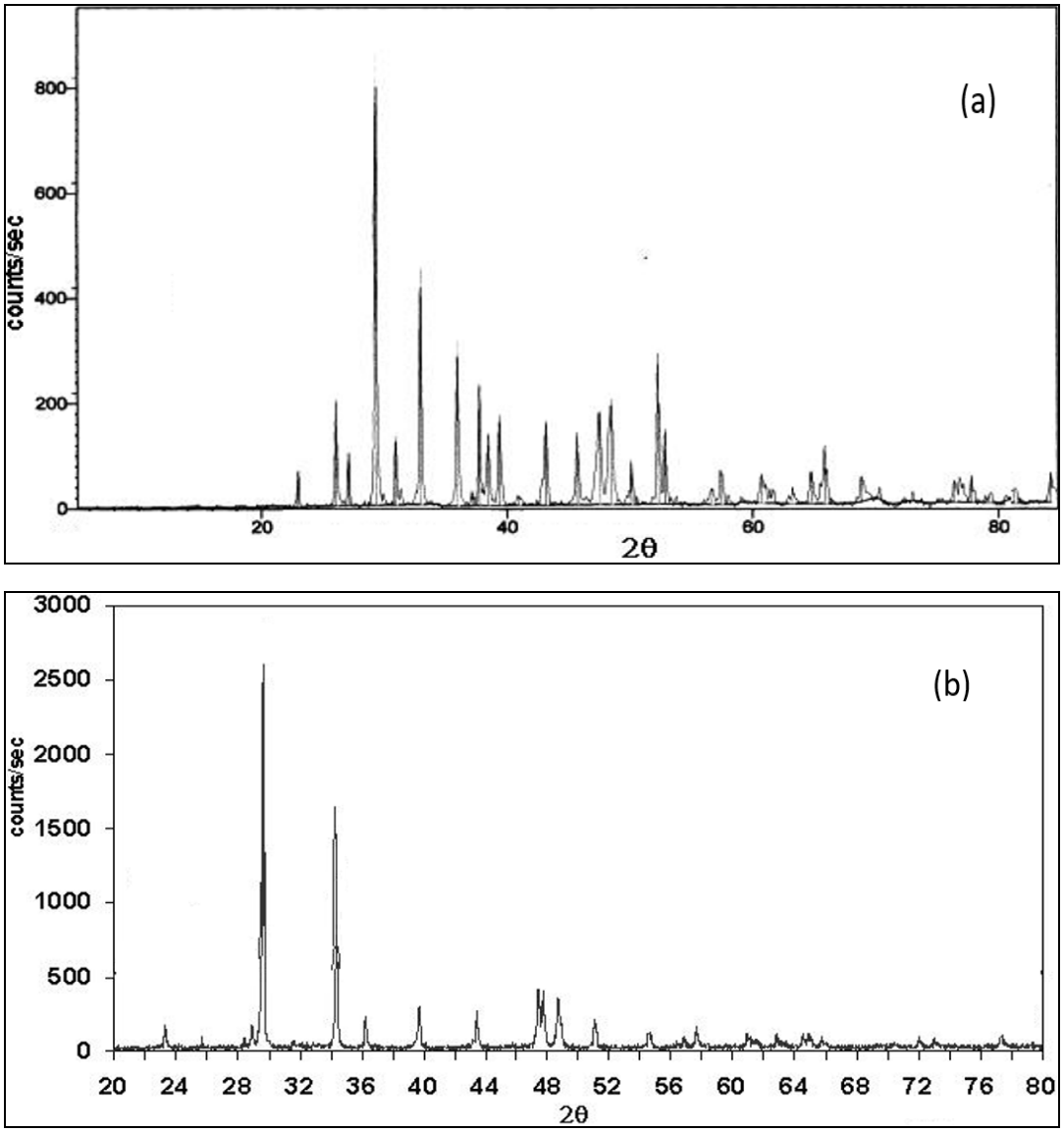


**Fig 1:** (a) XRD of Muktashukti powder (b) XRD of *Muktashukti Bhasma*

**Scanning electron microscopy**

SEM study of *Muktashukti powder as well as bhasma* reveals that the arrangement of particles in *Muktashukti powder* was not uniform. While in *Muktashukti bhasma* particles were arranged uniformly. In *Muktashukti bhasma* smaller particle size was observed. Due to calcination, compact microcrystalline aggregates of calcite were observed which on further calcinations cycle increased in particle size was observed due to increased agglomeration.

While after last calcinations cycle well defined shaped particle were observed in *Muktashukti bhasma*. Hence to stabilize the particle, repeated calcinations cycles are required [11].

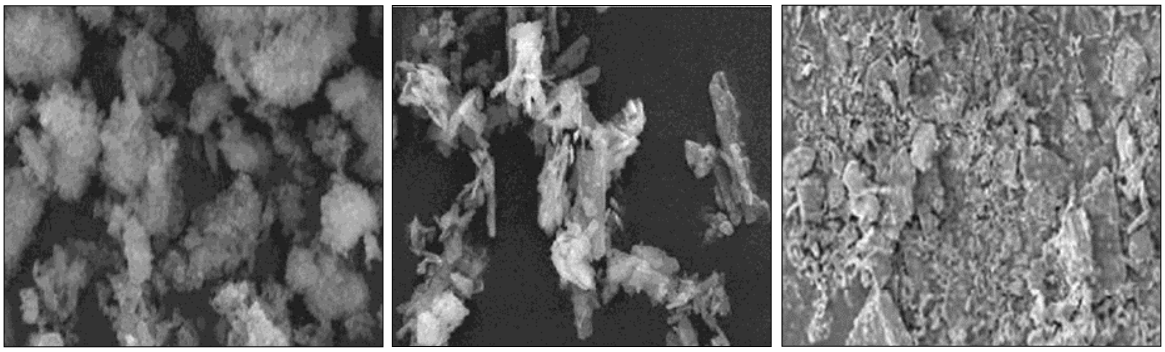

**Fig 2:** a) SEM of $CaCO_3$, b) SEM of *MS powder*, c) SEM of *MSB*

**Infrared analysis**

FTIR spectra of the *Muktashukti powder* and the *Muktashukti bhasma* are shown in figure 4. The IR Spectra of the *Muktashukti* shows bands resembling the spectrum of the aragonite form of calcium carbonate. There is no absorption bands corresponding to the organic material indicate complete combustion of the organic phase during calcinations of the *Muktashukti bhasma*.

The IR spectrum of *Muktashukti bhasma* shows presence of peaks corresponding to only calcium carbonate in the calcite form [12].

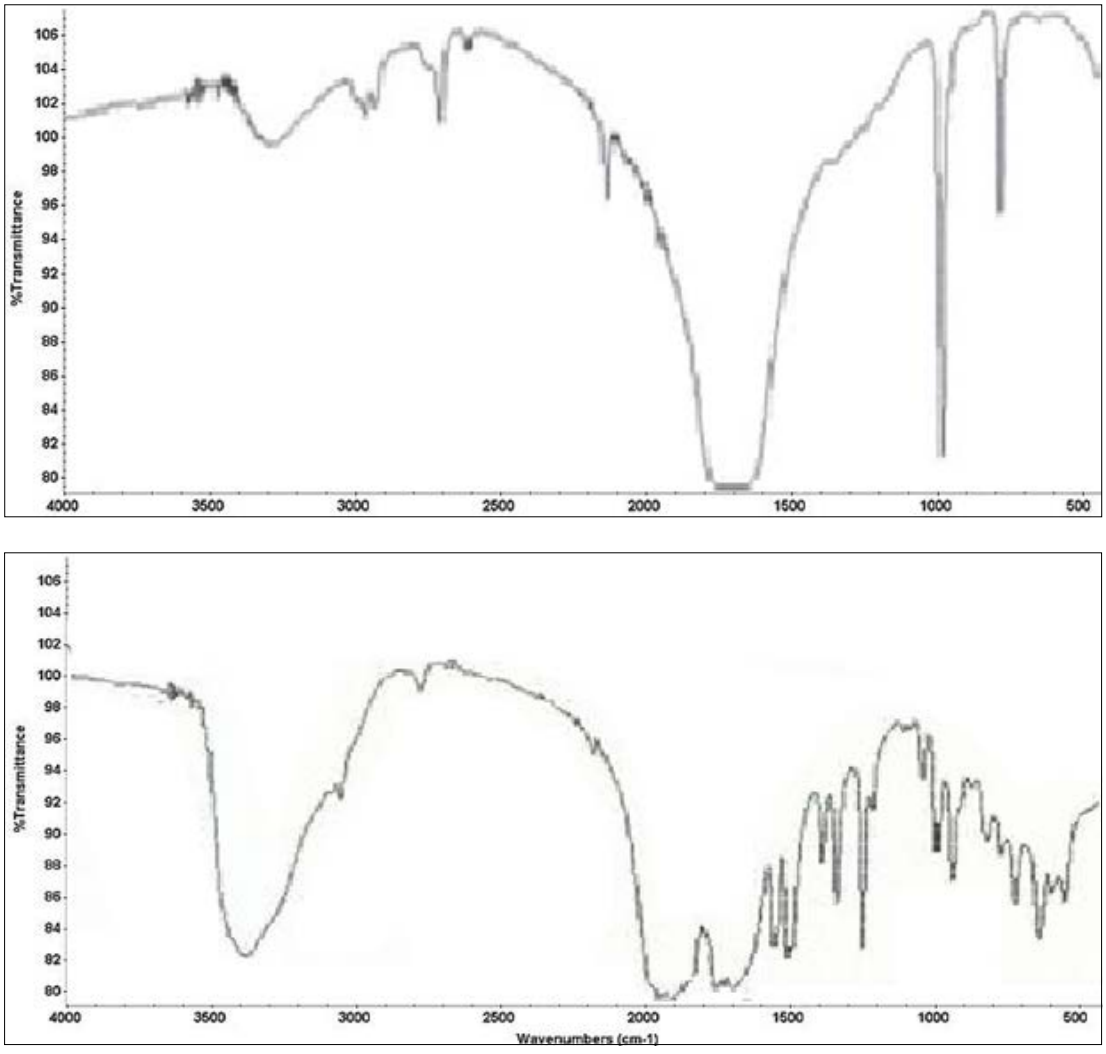


**Fig 3:** a) FTIR spectrum of *Muktashukti powder*, b) FTIR spectrum of *Muktashukti bhasma*

**Conclusions**

Dirt and organic matter present in *Muktashukti* were removed by cleaning it with lemon juice. It was processed with lemon juice for maximum 90 min, as on further exposure there will be excessive loss of calcium. Throughout the calcination process the aragonite was transformed to calcite form of calcium carbonate. *MSB* is chemically composed of calcite form and about 2% of calcium hydroxide. XRD studies reveals that due to repeated calcination the particles size of *MSB* is less than standard calcite. Absorption of nanosized particles is easy as they can attach with the cell surface and can diffuse easily inside the

cells. Thus, these nanosized particles enhances efficacy. The SEM studies show that particles become more stable on repeated calcination. From observations, it can be concluded that specific physicochemical characters acquired by *MSB* due to repeated calcination cycles, as a result there is enhancement of stability and potency of *Muktashukti bhasma*.

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