



Research article

Preparation and characterization of egg shell bhasma by using modern analytical techniquesPatil Kundan*¹, Vadnere Gautam²

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ABSTRACT

Calcium is one of the essential elements for living beings. As a supplement, it is used to treat Calcium deficiencies due to a calcium deficient diet. In *Rasaratnasamuchchaya* Calcium bhasma (Eggshell bhasma) is included as a rich calcium supplement. There is a need for work on the determination of the percentage of Calcium in the eggshell and its limit of acceptance. Easy absorption of bhasma in the body is possible when its preparation is carried out in an acidic medium. Lemon juice is one of the acidic mediums employed for this purpose at pH 2.4. The eggshell powder is subjected to five calcination cycles to convert it into the Bhasma. Analysis of Eggshell Bhasma has been done by various modern analytical techniques to determine its exact chemical compositions. Various instrumental methods like XRD, FTIR, and SEM have been incorporated for analysis of raw materials, intermediates as well as final products. The calcium carbonate present in eggshells is in calcite form. In the present work, structural and chemical characterization of eggshell bhasma was carried out to develop an analytical profile of it.

Keywords: Ayurvedic, Calcination, XRD, Egg shell Bhasma.

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INTRODUCTION

Ayurveda is one of the ancient medicine systems practiced in India. Rasashastra deals with the study of metals, nonmetals as well as herbomineral formulations known as Bhasmas^[1]. Bhasma actually is ash. These are inorganic preparations, which transform minerals and metals into carbonates and oxides^[2]. Potency, Stability, lower therapeutic dose is certain advantages of bhasmas over other herbal formulations. The validation issue of these conventional medicines put a question mark on their authenticity.

In Ayurveda, the Egg Shell Bhasma is referred to as a calcium-rich mineral medicinal formulation^[3]. At the present large amount of eggshells were wasted as disposal in landfills which contains a high amount of Calcium as well as Magnesium. Literature study reveals that this eggshell can be utilized as an important source for the preparation of Calcium-rich supplements. The calcium form of eggshell bhasma is well absorbed; also the efficiency of this natural calcium from bhasmas is far better than the synthetic one. To find out the biological role of eggshells it is necessary to determine their chemical composition^[4]. Chemical evaluation of eggshells confirms that about 97% Calcium carbonate is present in it^[5]. The synonym for Egg shell bhasma is *Kukutandatwak* bhasma. The ayurvedic

calcium preparations were widely used as healing packages. *Kukutandatwak* bhasma possess higher acid-neutralizing capacity^[6]. As per the classical Ayurvedic text, the eggshell powder is heated to transform it into bhasma. Analytical studies of eggshell powder confirm the presence of calcium carbonate in calcite form^[7]. Investigation of the analytical profile of Eggshell bhasma is necessary to find out the nature of the final formulation. The present work was undertaken to reveal the analytical profile of Eggshell bhasma by assessing physicochemical parameters and using modern analytical techniques such as XRD, FTIR, and SEM.

MATERIALS AND METHODS

Hen egg shells were collected from local market of Amalner. Purification of egg shells was done by following classical guidelines^[8]. Raw egg shells was taken and washed with potable water and dried under shade for 12 hr. Purification was carried out by boiling (Swedana) in salt water for 3 hr. And then, it was cooled. After cooling, it was rubbed with hands and washed with hot water until separation of the inner layer from egg shell.

Preparation of egg shell bhasma

The egg shell powder was purified and converted to micro fine size. Then this powder was transformed to egg shell bhasma by

ayurvedic process of bhasmi karana. Lemon juice was employed for providing acidic media. The adequate amount of lemon juice was used for soaking the egg shell powder. The mixture of powder and lemon juice was triturated for three hours to convert it in paste, which was then filtered using Whatman filter (number 40) to separate solvent part. Then this dried paste was placed in muffle furnace for heating and increasing the temperature until we obtain the white product. This process is referred as puta. The sample obtained after first puta was reserved for analysis. This sample was processed again in similar manner as mentioned above for four more times and reserve the sample for further analysis which is obtained after puta number 2, 3, 4 and 5.

RESULTS AND DISCUSSION

Table 1: Physicochemical parameters of Kukkutanda Tvak Bhasma

Parameter	Result
Loss on drying (%)	1.56
Ash Value (%)	73.38
Acid insoluble ash (%)	0.72

SEM ANALYSIS

Difference in size and agglomeration of the particles was clearly observed in SEM images of Egg Shell powder and Bhasma. The E.S. Powder shows well-defined fibre like structures while the E.S Bhasma showed slightly agglomerated fibers, which are compact microcrystalline aggregates. Agglomeration of the particles is as a result of repeated calcination cycles involved in preparation.

Figure 1: SEM image (E. S. powder)

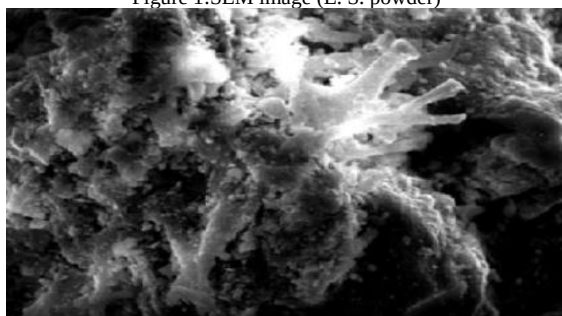
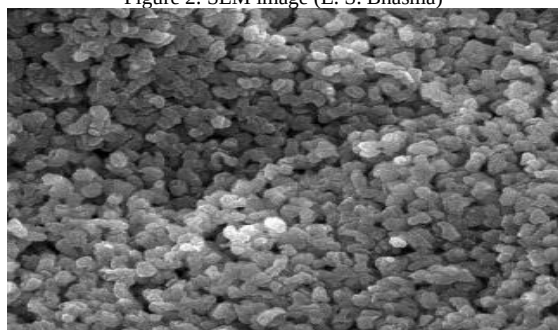


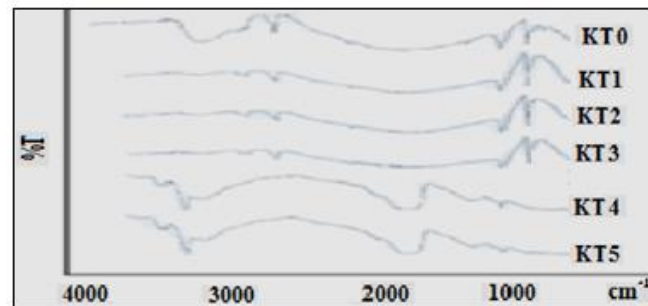
Figure 2: SEM image (E. S. Bhasma)



IR SPECTRUMS

Sharp and intense bands were observed in IR spectra of egg shell powder, which indicate existence of organic component. While in case of egg shell bhasma broad spectra were observed after processing to each putas. Therefore after heating organic component of biomaterial is lost.

Figure3: IR Spectra of E.S Bhasma



X RAY DIFFRACTION INVESTIGATIONS

Raw Egg Shell was found to be in calcite (calcium carbonate [CaCO_3]), and the crystal structure was rhombohedral in nature. While Egg Shell Bhasma was found to contain portlandite and calcium hydroxide $\text{Ca}(\text{OH})$ and hexagonal in nature. The result shows sharp lines with different intensities indicates crystalline nature. The Particle size falls in the range 13 nm to 40 nm indicating their nanometric nature.

Figure 4: XRD Pattern of Egg Shell Powder

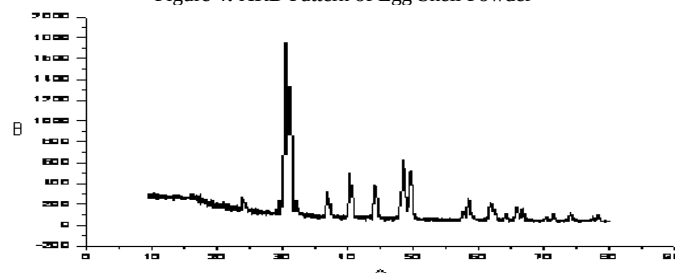


Figure 5: XRD Pattern of Egg Shell Bhasma

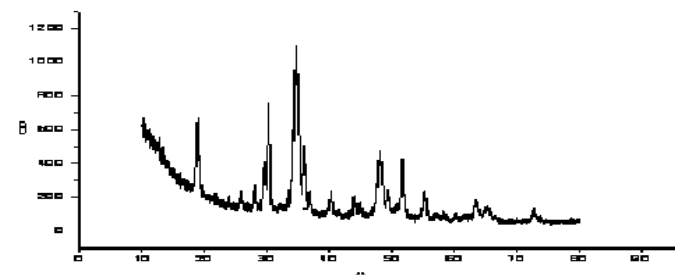


Table 2: Particle size analysis of egg shell Bhasmas

Compound	FWHM	Angle (2θ)	Size of Particles (nm)
Egg Shell Powder	0.3213	25.9268	23.9679
E. S. Bhasma	0.6217	33.8672	13.2371

CONCLUSION

The eggshell bhasma was prepared using acidic media and it satisfies all criteria that should be possessed by an authentic bhasma. It passes the floating test as it easily floats over water. Most importantly it is transformed to very soft and very fine particle size. The spongy particles of E.S powder were noted with agglomerates having diversified nature. These large size particles were converted into very fine size particles having identical shapes. This is possible because of repeated calcination (bhasmikaarana) and as a result, microscopic size particles of E.S powder were converted into nano-size particles. This transformation of particle size enhances medicinal potency bhasma. The size and morphology of particles were mainly affected due to the use of acidic media for the synthesis bhasma. The SEM images of

eggshell bhasma reflect these changes. Therefore the use of acidic media prominently affects the parameters like size, shape as well as morphologies of the particles. SEM, FTIR, and XRD reports suggest that both samples are crystalline with a mixture of different organic and inorganic compounds.

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