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Preparation and Physiochemical Characterization of Indian Traditional Medicine: Praval Bhasma by using Modern Analytical Techniques

Patil KC[1]*, Dr. Vadnere G, Dr. Rageeb MD[3]
Smt. S. S. Patil College of Pharmacy, Chopda, Maharashtra
kcpatil40@gmail.com

Abstract

Praval is the calcareous skeleton of the marine organism called Anthezoa polypus and belongs to phylum Coelenterate. It is a natural source of rich calcium. In Indian Ayurvedic medicine it is widely used in Amlapitta, Netra Roga and Hridaya Roga and Ca deficiency. To ensure efficacy and safety parameters of prepared bhasma, the quality control tests of Rasa shastra like Varitara Rekhapurnatvam, Nishchandrata were performed. But these traditional tests do not ensure efficacy & safety of Bhasmas. Therefore modern techniques were used to study Chemical investigations of some commercial samples of Praval bhasma. The Praval bhasma was prepared strictly as per procedure prescribed in Ayurvedic formulary of India. To evaluate quality aspects of Praval bhasma the modern analytical techniques were used. The Physicochemical characterization of Praval bhasma was carried out using EDAX, SEM, IR, UV and XRD analysis. The study shows that repeated calcinations cycles are very necessary to stabilize the particle to a minimum particle size. In case of commercial sample it showed that there were relatively compact microcrystalline aggregates with increased agglomeration as indicated by the increased particle size. This detailed investigation of lab prepared Praval bhasma suggests and prompts the rational utility of lab prepared Praval bhasma over commercial formulations. Physico-chemical analysis provides the parameters to set the standards for quality of raw material as well as finished products.

Keywords: Praval bhasma, Calcination, XRD, EDAX, Calcium carbonate

Introduction

Praval which is known as coral is used in the form of bhasma in Ayurveda. Praval bhasma is mainly used as calcium supplement in treating various bone metabolic disorders associated with calcium deficiency [1]. In Ayurveda the variation in procedure may result in same bhasma with different characteristic features. Sometime inferior quality products may produce due to improper manufacturing procedure. In such cases efficacy as well as safety parameters of products may adversely affected [2]. So to maintain uniformity and improve the quality of products, proper standardization of bhasma becomes necessary. [3, 4]

In present study Praval bhasma was formulated by traditional method [5, 6]. To

ensure efficacy and safety parameters of prepared bhasma, the quality control tests of Rasa shastra like Varitara Rekhapurnatvam, Nishchandrata, Unamas, Niswadu, Nirdhumatva, and Apunarbhava were performed. But these traditional tests do not ensure efficacy & safety of Bhasmas. Therefore modern techniques are used to study Chemical investigations of some commercial samples of Praval bhasma. In the present work XRD, EDAX, Solid state UV, Solid state IR, SEM and TGA studies were performed [7]. Two commercial samples are selected from reputed manufacturers to focus on chemical composition as well as structural properties of Praval bhasma. Literature survey reveals that work on chemical investigations of some Ayurvedic bhasmas of mineral origin are reported but relatively less work is reported on bhasmas of marine origin [8].

Materials and Methods

Powder of Praval was purchased from Ayurvedic pharmacy, standard CaCO3 was purchased from Lobachem and two different commercial samples of Praval bhasma (P1, P2) are purchased from local market. The process of sysnthesis of bhasma is divided broadly into two stages. Shodhana (Purification), Marana (Calcination), and Bhavana (Trituration).

The lab prepared bhasma & commercial samples of bhasma were analyzed by physicochemical parameters and advanced sophisticated instrumental technologies such as particle size detection, Fourier transfer infrared spectroscopy, X-ray diffraction (XRD) and Scanning electron microscopy.

Results and Discussion

Collection of samples

Table No.1: List of the Commercial Samples of *Praval Bhasma*:

Sr. No.	Sample No.	Name of the Company
1	Praval Bhasma (P_0)	Research formulation.
2	Praval Bhasma (P_1)	Dhootapapeshwar Ltd, Panvel
3	Praval Bhasma (P_2)	Baiydyanath, Nagpur

X-Ray powder Defraction

The XRD patterns of Praval bhasma (P0) and two commercial samples of Praval bhasma (P1& P2) are shown below. From these XRD patterns study reveals that all the samples include CaCO3 as their major component [9]. In these patterns sharp lines with different intensities are present; hence all these samples are crystalline in nature [10]. The Particle size falls in the range 22 nm to 54 nm indicating their nanometric nature.

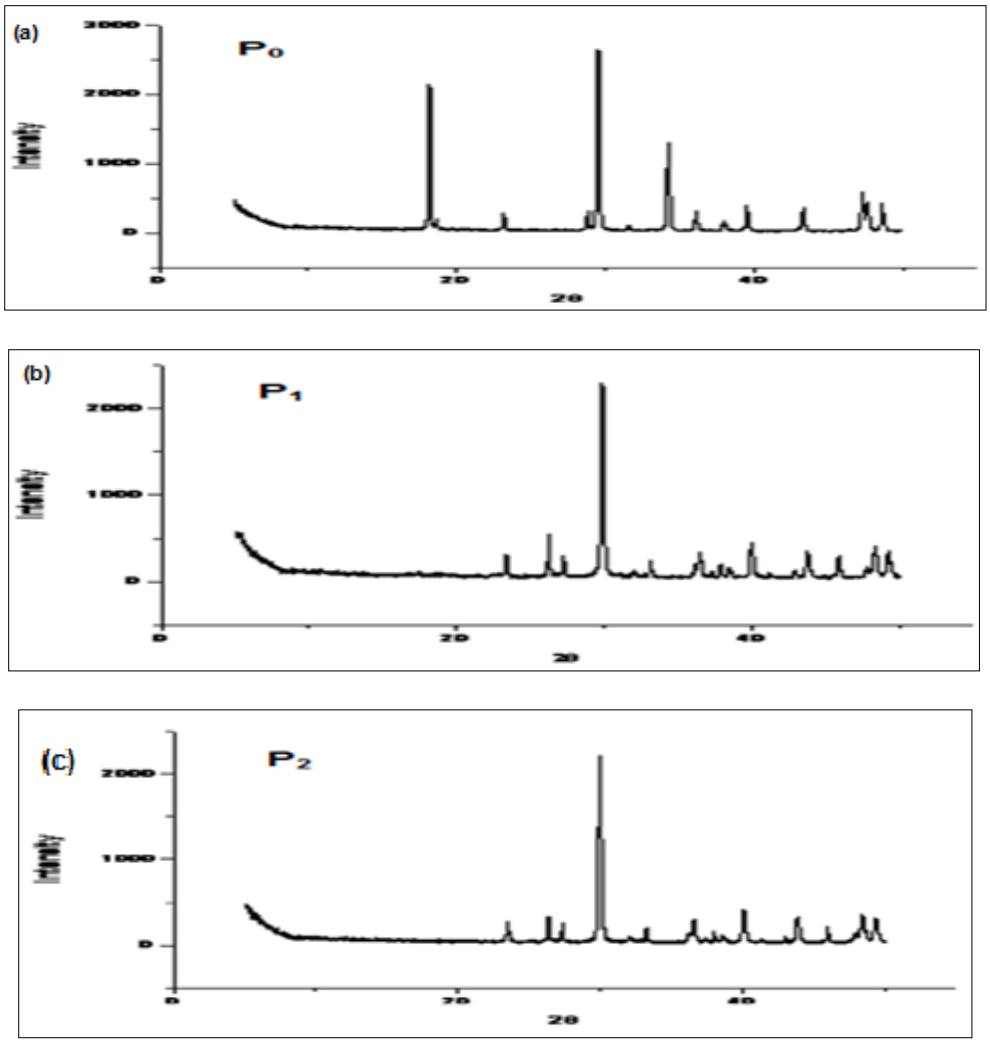


Figure No.1: Powder XRD patterns of (a) P0, (b) P1, and(c) P2.

Table No.2: Size of particles of Praval Bhasma & its commercial samples

Sr.no	Compound	Particle Size in nm
1	P_0	22.65
2	P_1	52.32
3	P_2	38.42

SEM studies

SEM photographs of the Praval bhasma (P0) as well as commercial samples (P1& P2) were recorded. The SEM photographs of samples of Praval bhasmaat three different magnifications are shown in Fig.2 It shows that repeated calcinations cycles are necessary to stabilize the particle to a minimum particle size [10] The SEM photographs of the

commercial samples of Praval bhasma P1, P2, are different from each other as well as SEM photographs of prepared bhasma. This may be due to the different methods used by the respective manufacturers. Since the details of the procedure used by these manufacturers are not known, it is difficult to point out the exact reasons behind these different properties.

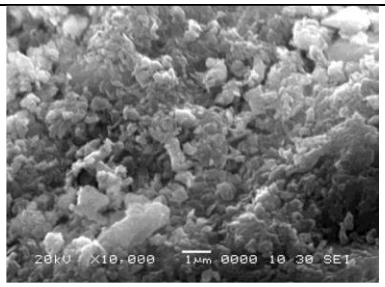
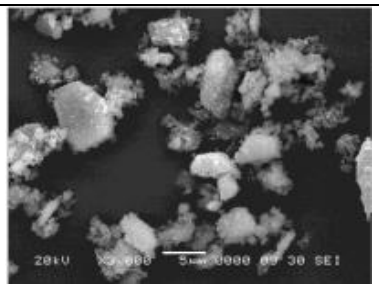
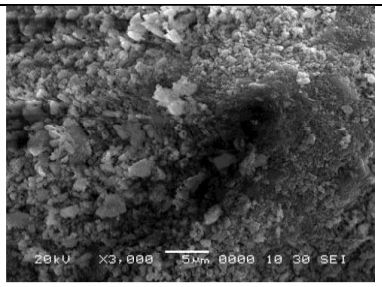
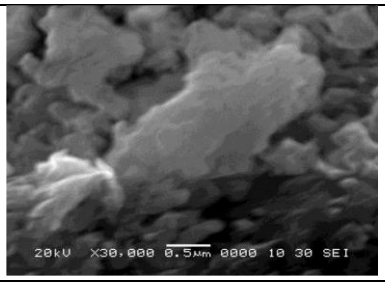
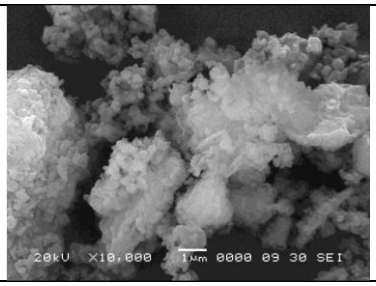
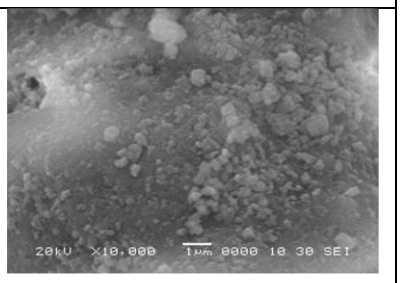
SEM Photographs of P_0	SEM Photographs of P_1	SEM Photographs of P_2
		
20 Kμ X 3000 magnification	20 Kμ X 3000 magnification	20 Kμ X 3000 magnification
		
20 Kμ X 10000 magnification	20 Kμ X 10000 magnification	20 Kμ X 10000 magnification

Figure No. 2: Comparative SEM Photographs of Praval bhasma P_0, P_1, and P2

Infrared Spectroscopy

IR spectra of Praval Bhasma (P0) and commercial samples of Praval bhasmas (P1& P2) are shown below. The IR spectrum of Praval Bhasma (P0) shows characteristic peaks in the region 713-1432 cm-1 confirms the presence of calcite which is the polymorphs of calcium carbonate [11]

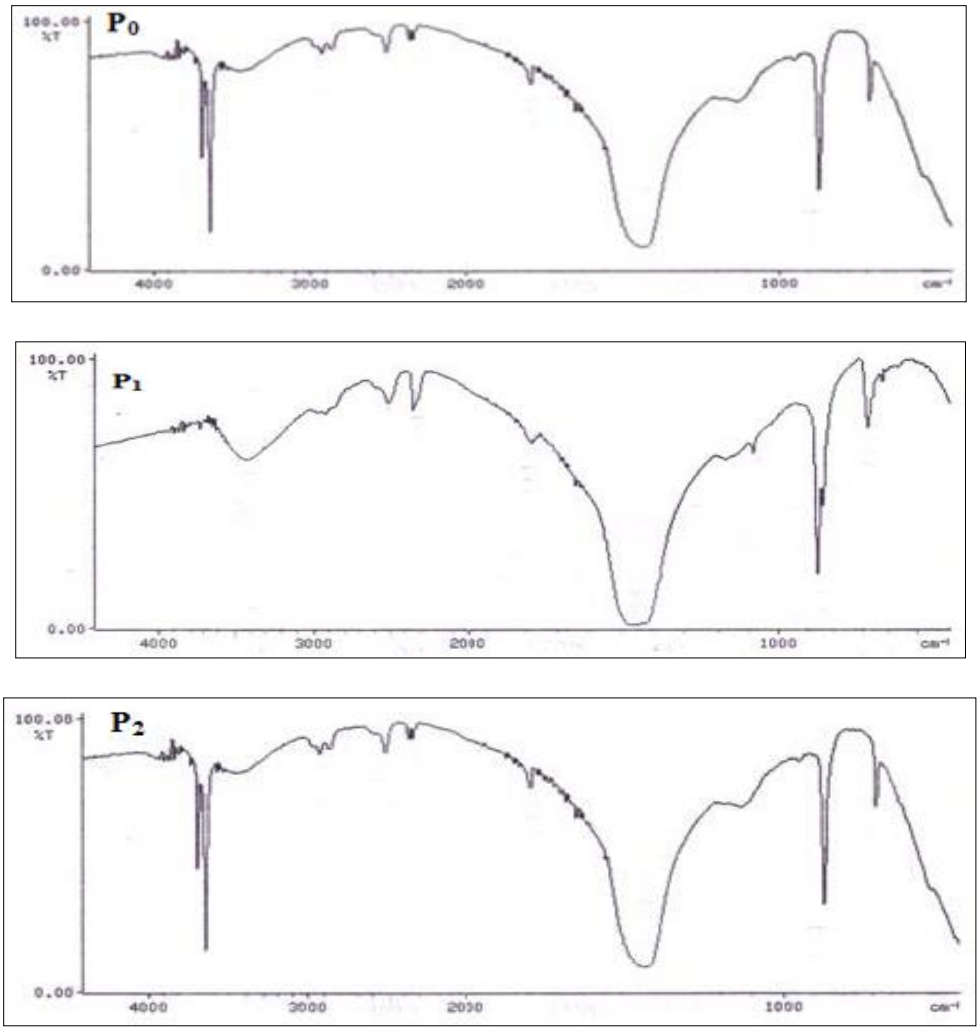


Figure No.3: Infrared spectra of *Praval bhasmas*P_0, P_1&P_2

Conclusion

Powder X-Ray Diffraction Analysis indicates complete conversion of the hydroxide and oxide into calcium carbonate. However, the peaks are even sharper than those of the commercial samples and reflect high crystallanity of the final product. The IR spectrum of P0, P1& P2are similar. However, the intensity of the peak corresponding to calcium hydroxide is less than that observed in the P0. The calcite peaks are prominent. The IR spectrum of P0 shows presence of peaks corresponding to only calcium carbonate in the calcite form. SEM analysis shows that repeated calcinations cycles are very necessary to stabilize the particle to a minimum particle size. In case of commercial sample it showed that there were relatively compact microcrystalline aggregates with increased agglomeration as indicated by the increased particle size. Small particle size with high crystallanity of P0 increases easy absorption, distribution, metabolism and excretion as well as its therapeutic potential.

Significance of Study

Presently various commercial formulations of bhasma are found to be adulterated or with insufficient amount of active chemical constituents which does not initiate any therapeutic effects in human beings, as the very low dose is required. The quality of raw materials utilized in preparation of bhasma also affects the final product. Analytical study on bhasma is very important to evaluate all physicochemical parameters to validate the therapeutic potential of raw material as well as final product. This detailed investigation of lab prepared Praval bhasma suggests and prompts the rational utility of lab prepared Praval bhasma over commercial formulations.

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