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PHARMACEUTICO-ANALYTICAL STUDY OF CLASSICAL SHANKHA BHASMA COMPARING WITH DIFFERENT MARKET SAMPLES BY RAMAN SPECTROSCOPY

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ABSTRACT

Shankha Bhasma is an important Ayurvedic mineral preparation derived from Shankha and is traditionally prepared through specific pharmaceutical procedures including Shodhana, Bhavana and Marana. Proper pharmaceutical processing is essential for achieving the desired physicochemical characteristics and therapeutic suitability of the final product. With increasing availability of commercially marketed Bhasma preparations, scientific analytical methods are necessary to assess their quality and to identify similarities or differences between traditionally prepared and marketed samples. **Aim:** To prepare Classical Shankha Bhasma according to classical Ayurvedic references and to compare the prepared Bhasma with different marketed samples using pharmaceutical and analytical parameters, with special emphasis on Raman spectroscopy. **Materials and Methods:** Shankha was subjected to classical Shodhana followed by Marana using appropriate Bhavana Dravya and repeated incineration procedures as described in classical Rasashastra texts. The prepared Classical Shankha Bhasma was evaluated using classical Bhasma Pariksha and physicochemical parameters. Six marketed samples were collected and subjected to comparative analysis. Analytical evaluation included pH, loss on drying, total ash, acid-insoluble ash, water-soluble ash, particle-size-related observations, SEM–EDX and Raman spectroscopic analysis. **Results:** The prepared and marketed samples showed variation in physicochemical and analytical characteristics. The pH values of the evaluated marketed samples ranged from 8 to 14. Total ash values ranged from 94.06% to 100%, while acid-insoluble ash values ranged from 97.2% to 99.7%. Water-soluble ash

showed greater variation, ranging from 64.16% to 100%. Loss on drying ranged from 0.3% to 1.2%. SEM–EDX demonstrated differences in elemental composition and surface morphology among the samples. Raman spectroscopy provided characteristic spectral information useful for comparative identification and differentiation of the samples. **Conclusion:** The study demonstrates the importance of integrating classical Ayurvedic pharmaceutical principles with modern analytical techniques for the standardization of Shankha Bhasma. Raman spectroscopy, together with physicochemical and microscopic techniques, may serve as a useful rapid and non-destructive analytical tool for comparative evaluation and quality assessment of Shankha Bhasma.

KEYWORDS: Shankha Bhasma, Shodhana, Marana, Rasashastra, SEM–EDX, Raman spectroscopy, standardization, physicochemical analysis.

INTRODUCTION

Ayurveda is a traditional system of medicine that emphasizes the maintenance of health and the management of disease through a comprehensive understanding of the body, mind and environment. Rasashastra is an important branch of Ayurveda concerned with the pharmaceutical processing and therapeutic application of metals, minerals, gems, marine substances and other inorganic materials.[1]

Shankha, a marine-derived substance, occupies an important place among Ayurvedic mineral and marine-origin drugs. Although naturally occurring Shankha possesses therapeutic relevance, it is traditionally subjected to specific pharmaceutical processing before medicinal administration. These procedures include Shodhana, Bhavana and Marana, which are intended to transform the raw material into a suitable Bhasma form.[3,2]

Shankha Bhasma is traditionally described as a fine, processed preparation obtained after appropriate pharmaceutical procedures. The quality of a Bhasma is not determined merely by its appearance; rather, proper pharmaceutical processing and fulfillment of classical Bhasma Pariksha are important indicators of the completed transformation.[2]

The increasing availability of commercially prepared Ayurvedic medicines has created a need for systematic quality assessment. Variations may occur because of differences in raw material, pharmaceutical processing, Bhavana Dravya, heating conditions, number of Puta and other manufacturing factors. Therefore, comparison between a classically prepared

sample and marketed samples can provide useful information regarding their physicochemical and structural characteristics.[4]

Modern analytical techniques can supplement classical Ayurvedic assessment. SEM–EDX provides information regarding surface morphology and elemental composition, whereas Raman spectroscopy can provide characteristic molecular and structural information in a rapid and non-destructive manner. Such analytical approaches may help in developing a more comprehensive profile for the standardization of Shankha Bhasma.[6,7,8]

The present study was therefore undertaken to prepare Classical Shankha Bhasma according to classical references and compare it with six different marketed samples using pharmaceutical, physicochemical and instrumental analytical parameters, particularly Raman spectroscopy.[4]

AIM

To prepare Classical Shankha Bhasma according to classical references and compare it with different marketed samples by pharmaceutical and analytical parameters, including Raman spectroscopy.

OBJECTIVES

1. To prepare Classical Shankha Bhasma according to classical Ayurvedic pharmaceutical procedures.
2. To document the pharmaceutical stages involved in the preparation of Shankha Bhasma.
3. To perform classical Bhasma Pariksha of the prepared sample.
4. To evaluate the prepared and marketed samples using physicochemical parameters.
5. To study the morphological and elemental characteristics using SEM–EDX.
6. To obtain and compare Raman spectra of Classical Shankha Bhasma and marketed samples.
7. To assess the usefulness of Raman spectroscopy as a comparative analytical tool for Shankha Bhasma.

MATERIALS AND METHODS

Collection and Authentication of Raw Material

Shankha was procured and authenticated before commencement of the pharmaceutical procedures. Approximately 438 g of Shankha was used for the preparation. The required

pharmaceutical materials and Bhavana Dravya were collected and authenticated according to standard procedures.[1]

Pharmaceutical Preparation

The preparation of Classical Shankha Bhasma was carried out in sequential stages according to classical Rasashastra principles.[2]

1. Shodhana

The raw Shankha was subjected to Shodhana using Jambir Nimbu (Citrus limon) Swarasa as the processing medium. Approximately 3.5 litres of Jambir Nimbu Swarasa was utilized during the pharmaceutical procedure.[2]

Shodhana was carried out with the intention of removing undesirable components and preparing the raw Shankha for subsequent Marana.[2]

2. Drying

After completion of Shodhana, the processed Shankha was appropriately dried before proceeding to the Marana procedure.

3. Marana

The purified Shankha was subjected to Marana following classical pharmaceutical principles. Appropriate Bhavana was given using the prescribed liquid medium, followed by preparation of pellets and controlled heating/incineration.[2]

The process was repeated as required until the desired characteristics of Bhasma were achieved.

4. Classical Bhasma Pariksha

The prepared Shankha Bhasma was evaluated using relevant classical tests to assess the completion and quality of Bhasma preparation.[5,6]

COMPARATIVE MARKET SAMPLE STUDY

Six commercially available Shankha Bhasma samples were procured from different Ayurvedic pharmaceutical sources and coded as Sample A, B, C, D, E and F.[4]

The samples were subjected to comparative pharmaceutical and analytical evaluation under similar laboratory conditions.

ANALYTICAL PARAMETERS

The following analytical parameters were considered:

- Organoleptic characteristics
- pH
- Loss on drying
- Total ash
- Acid-insoluble ash
- Water-soluble ash
- Particle-size-related observations
- SEM–EDX analysis
- Raman spectroscopy

RESULTS

Physicochemical Analysis

The comparative physicochemical evaluation demonstrated variation among the six marketed samples.

Parameter	A	B	C	D	E	F
pH	10	8	14	14	12	14
Total Ash (%)	99.33	99.66	99.39	100	94.06	99.91
Acid-Insoluble Ash (%)	97.20	99.05	99.30	99.70	98.80	99.60
Water-Soluble Ash (%)	70.64	76.10	100	64.16	91.75	100
Loss on Drying (%)	0.50	0.30	0.70	0.30	1.20	0.40

The particle-size-related assessment showed the desired reduction in particle size across the evaluated samples.

SEM–EDX Analysis

Sample	Major Elements	Ca Content (%)	Impurities Detected	Purity Assessment
Sample A	C, O, Ca	5.23	Mg, Si, Fe	Lowest calcium content; comparatively higher impurities
Sample B	C, O, Ca	27.63	Na, Si, S	Good purity with minor trace impurities
Sample C	C, O, Ca	34.98	None detected	Highest calcium content; excellent purity
Sample D	C, O, Ca	30.45	None detected	High purity and good compositional uniformity
Sample E	C, O, Ca	21.37	None detected	Moderate calcium content; chemically pure
Sample F	C, O, Ca	28.83	Cl (trace)	Good purity with trace chloride

SEM–EDX analysis demonstrated differences in the morphology and elemental profile of the

samples. The prepared and marketed samples showed variations in surface characteristics, particle morphology and elemental distribution.[7]

The findings indicate that pharmaceutical processing may influence the morphological and elemental characteristics of Shankha Bhasma. SEM–EDX therefore provides useful supplementary information for characterization of the finished product.

Raman Spectroscopy

Raman spectroscopy was performed for comparative characterization of Classical Shankha Bhasma and the marketed samples.[8]

The Raman spectra demonstrated characteristic spectral features that could be utilized for comparative assessment of the samples. Differences in spectral patterns may reflect variations in pharmaceutical processing, physicochemical characteristics or composition.

The technique was particularly useful because it enabled rapid and non-destructive assessment of the samples.[8]

Results of Raman spectra of *shankha bhasma*-

Sample	Wavelength 1086cm-1(v1 co3)	Wavelength 712cm-1 (v4 co3)	Crystallinity	Notes
A	Strong, sharp	Clear, well defined	High	Excellent calcite; well-prepared
B	Strong, slightly broad	Moderate clarity	Moderate-High	Good phase, slight amorphous nature
C	Weak, low intensity	Low resolution	Low	Incomplete transformation, possible impurities
D	Sharp, strong	Well-resolved	High	High-Quality Bhasma
E	Clear with minor extra peak	Moderate clarity	Moderate	Trace aragonite /other phases
F	Strong, clean	Well defined	High	Pure calcite well-treated

RAW DRUGS



Fig. No. 1: Shankha.



Fig. No. 2: Nimbu.



Fig. No. 3: Kumari.

SHODHAN



Fig. No. 4: Ashuddha Shankha.



Fig. No. 5: Nimbu Swaras.



Fig. No. 6: Pottali Nirman.



Fig. No. 7: Swedan by Dolayantra.

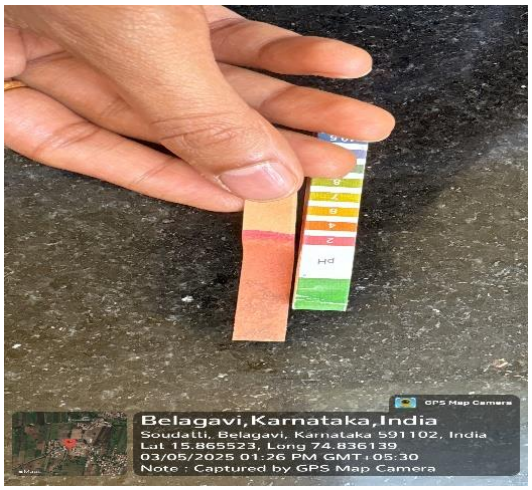


Fig. No. 8: ph during swedan.



Fig. No. 9: After Shodhan.

MARAN



Fig. No. 10: Before Gajaputa.



Fig. No. 11: Sharav filled with.

Shudha shankha



Fig. No. 12: Sharav Samputa.



Fig. No. 13: Preparation for sun drying Gajaputa.



Fig. No. 14: Gajaputa.



Fig. No. 15: Sharav taken out.

after swanga sheeta



Fig. No. 16: Chakrika Nirman.



Fig. No. 17: Chakrika sun dried.



Fig. No. 18: Chakrikas kept into sharav.



Fig. No. 19: sharav samputa and sun dried.



Fig. No. 20: After Gajaputa.



Fig. No. 21: After gajaputa.



Fig. No. 22: Rekhapurnatva.

DISCUSSION

The preparation of Shankha Bhasma involves a systematic transformation of the raw marine substance through classical pharmaceutical procedures. Shodhana followed by Marana is an

important part of this transformation, and the final characteristics of the product depend upon appropriate execution of each pharmaceutical stage.[2]

The use of Jambir Nimbu Swarasa during Shodhana provides an acidic processing medium and represents an important pharmaceutical step in the classical preparation. Subsequent Bhavana, pelletization and controlled heating facilitate further transformation of the processed material into Bhasma.[2]

The physicochemical findings showed considerable variation among the marketed samples. The pH values ranged from 8 to 14. Such differences indicate variation in the physicochemical nature of the commercial samples and may be associated with differences in processing and manufacturing conditions.

Total ash values were high in most samples, ranging from 94.06% to 100%. High ash values are consistent with the predominantly inorganic nature of the samples. Sample D showed 100% total ash, whereas Sample E demonstrated comparatively lower total ash at 94.06%.

Acid-insoluble ash values were relatively high in all samples, ranging from 97.2% to 99.7%. Sample D demonstrated the highest value, whereas Sample A showed the lowest among the evaluated samples.

Water-soluble ash demonstrated greater variability, ranging from 64.16% to 100%. Sample C and Sample F showed 100% water-soluble ash, whereas Sample D showed the lowest value of 64.16%. This variation highlights differences in the physicochemical characteristics of the marketed products.

Loss on drying ranged from 0.3% to 1.2%. Samples B and D showed the lowest values of 0.3%, while Sample E demonstrated the highest value of 1.2%.

SEM–EDX analysis provided additional information regarding morphology and elemental composition. The differences observed between samples may be attributed to variation in raw material characteristics and pharmaceutical processing. The technique therefore complements classical and physicochemical methods in the characterization of Bhasma.[7]

Raman spectroscopy provided an additional analytical dimension by allowing comparative evaluation of the samples based on their spectral characteristics. Conventional

physicochemical tests provide information regarding general quality parameters, whereas Raman spectroscopy can provide a characteristic spectral fingerprint. Thus, Raman analysis may have potential utility in the standardization and authentication of Shankha Bhasma.[8]

Among the evaluated samples, some demonstrated comparatively satisfactory characteristics, while certain samples showed notable differences. The observations suggest that commercial samples may not necessarily possess identical physicochemical and structural characteristics despite being marketed under the same formulation name.

The study therefore supports the importance of combining classical Ayurvedic quality assessment with modern instrumental analytical techniques. Such an integrated approach can strengthen the scientific evaluation and standardization of Shankha Bhasma.

CONCLUSION

The present study demonstrated the importance of systematic pharmaceutical processing in the preparation of Classical Shankha Bhasma. Shodhana, Bhavana and Marana constitute important stages in the transformation of raw Shankha into a finished Bhasma preparation.[2,4] Comparative evaluation of six marketed samples revealed variation in pH, total ash, acid-insoluble ash, water-soluble ash and loss on drying. SEM–EDX further demonstrated differences in morphology and elemental characteristics.

Raman spectroscopy provided characteristic spectral information and was useful for comparative evaluation of the samples. As a rapid and non-destructive technique, it may have considerable potential in the quality assessment and standardization of Shankha Bhasma.

The study emphasizes that classical pharmaceutical procedures combined with physicochemical and modern instrumental analytical techniques can provide a comprehensive approach for the standardization and quality control of Shankha Bhasma.

LIMITATIONS

The present study was based on comparison of a limited number of marketed samples. Further studies involving a larger number of commercial batches, advanced structural characterization and correlation of analytical findings with pharmaceutical variables may provide more comprehensive standardization parameters.

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