Ayurveda Sahiti Prabha's
International Journal of Ayurvedic Medicine
ISSN No: 0976-5921

Research Article

# Analytical Characterization and Standardization of *Bol Parpati*: Ensuring Quality and Efficacy in Ayurveda

**Omkar Alure[1], Nilima Dharkar[2*], Suraj Patil[3]**

1. PG Scholar, Department of Rasashastra evum Bhaishajya Kalpana, Dr. D. Y. Patil Vidyapeeth deemed to be University, Dr. D. Y. Patil College of Ayurved & Research Centre, Pimpri, Pune. India.
2. HOD, Department of Rasashastra evum Bhaishajya Kalpana, Dr. D. Y. Patil Vidyapeeth deemed to be University, Dr. D. Y. Patil College of Ayurved & Research Centre, Pimpri, Pune. India.
3. PG Scholar, Department of Rasashastra evum Bhaishajya Kalpana, Dr. D. Y. Patil Vidyapeeth deemed to be University, Dr. D. Y. Patil College of Ayurved & Research centre, Pimpri, Pune. India.

Received: 10-09-2025 Accepted: 16-03-2026 Published: 30-06-2026

## Abstract

Aim: To prepare *Bol Parpati*, a traditional herbo-mineral Ayurvedic formulation, and establish its quality control standards for safe and effective use in gynecological hemorrhagic disorders. Objective: Combine classical pharmaceutical methods with modern analytical techniques for the preparation, characterization, and standardization of Bol Parpati. Method: Bol Parpati was prepared by purifying mercury and sulfur, forming Kajjali (mercury-sulfur compound), incorporating Aloe vera ash (Bol churna), and converting the mixture into thin, flake-like sheets. Comprehensive physicochemical testing, X-ray fluorescence (XRF), powder X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, and particle size analysis were conducted to evaluate its composition, structural attributes, and bioavailability. Observation: Physicochemical tests indicated moisture loss of 5.0–6.5%, total ash content of 15.0–17.0%, and acid-insoluble ash between 1.5–2.5%. Extractive values ranged 19.0–23.0% in water and 23.0–26.0% in alcohol with an aqueous pH of 5.0–5.5. XRF measured major elements of light elements (69.3%), sulfur (18.1%), and mercury (10.4%) with trace elements present and no toxic heavy metals. XRD confirmed crystalline phases of metacinnabar and cinnabar (HgS). FTIR detected sulfur and herbal functional groups validating the matrix. Particle size analysis showed ultra-fine, near-spherical particles with low agglomeration ($d_{50}$ = 1.23 µm; $d_{90}$ = 2.24 µm). Results: Integrated traditional and modern methodologies ensured the safety, efficacy, and reproducibility of Bol Parpati. The physicochemical and instrumental analyses confirmed consistent composition with minimal impurities, stable mercury sulfide crystalline phases, preserved herbal constituents, and particle characteristics favoring enhanced dissolution and bioavailability. These findings support its standardization for contemporary Ayurvedic practice.

**Access this article online**

Website: https://ijam.co.in

DOI: https://doi.org/10.47552/ijam.v17i2.6552

**Keywords:** *Bol parpati,* Herbo-mineral formulation, SoPs, Chemical analysis, XRD patterns, FTIR

## Introduction

*Rasashastra* is a specialized branch of Ayurveda that deals with the formulation prepared from mineral and metal (1). In this discipline, *Parada Murchchana* is classified into four main types: *Kharaliya Rasayana, Parpati Rasayana, Kupipakva Rasayana,* and *Pottali Kalpana*. Among these, *Parpati* is considered one of 25 *Parada Bandha* and recognized as *Pota Bandha* (2).

*** Corresponding Author:**
**Nilima Dharkar**
HOD, Department of Rasashastra evum Bhaishajya Kalpana, Dr. D. Y. Patil Vidyapeeth deemed to be University, Dr. D. Y. Patil College of Ayurved & Research centre, Pimpri, Pune. India.
Email Id: dharkar.nilima07@gmail.com

It is distinguished by its thin, flake-like form, made using a specialized method that involves melting and pressing *kajjali* (a mercury-sulfur compound) between plant leaves (3). The earliest reference to Parpati preparations is found in *Rasendra Mangala* (8th century CE), where mercury–sulfur formulations are described for a variety of therapeutic uses (4). Later, parpati formulations were thoroughly explained in scholarly works like *Chakradatta* (5), *Rasa Ratna Samuccaya* (6), *Bhaishajya Ratnavali* (7) and Acharya Hariprapanna Sharma's *Rasayogsagara* (8) from the 19th century, which highlighted certain compositional variations and specific medicinal indications.

Bol Parpati is specifically mentioned in the *pradara chikitsa* of *Yogaratnakar,* indicating its traditional use in gynecological bleeding disorders (9). Bol parpati, a traditional herbo-mineral composition indicated for abnormal uterine bleeding disorders, including menorrhagia, dysfunctional uterine bleeding, and other gynecological hemorrhagic conditions. The formulation consists

of three essential components - purified mercury, purified sulfur, and *Bol churna* (9). It possesses astringent, bitter, and pungent properties, along with cooling potency, which impart hemostatic and *Kapha-Pitta Shamaka* effects, making it useful in excessive uterine bleeding.

This study is designed to formulate *Bol Parpati* by classical Ayurvedic procedures along with its detailed analytical profiling for the establishment of standardized quality control parameters which is not yet done (10). In order to enable the safe, efficient and evidence-based use of Bol parpati in clinical practice while preserving its traditional medicinal validity, this work aims to combine ancient pharmaceutical expertise with contemporary scientific validation.

## Materials and methods

**Pre-preparation of Bol Parpati**

The raw ingredients for the preparation of *Bol Parpati*, including mercury and sulfur, were sourced from authenticated suppliers to ensure quality and efficacy. The herbal component consisted of *Kumari*, collected as a whole plant from *Alandi, Pune, India*. All raw ingredients were tested in a GMP-certified pharmacy in accordance with the standards of the Ayurvedic Pharmacopoeia of India (API).

**Preparation of Bol Parpati**

The ingredients of *Bol Parpati* are *Shuddha Gandhaka* (purified sulfur), *Shuddha Parada* (purified mercury), and *Kumari* (Aloe vera). The preparation was carried out at Dr. D. Y. Patil College of Ayurved and Research Centre, Pimpri, Pune. The process involves five steps:

**Step 1: Purification of Mercury (**11)

There was a clean, dry morter and pestle used to purify impure mercury. The mercury was mixed with an equal amount of fresh garlic paste and the mixture was rigorously triturated until it turned black, signifying detoxification. Subsequently, the triturated mass was washed with hot water, allowing the mercury to settle at the bottom while the impurities floated on the surface.

The water was carefully drained off, and the mercury was filtered through a clean cloth. Ten times this procedure was carried out with new garlic paste each time. Safety and suitability of mercury for pharmaceutical use is enhanced after purification. The sulfur compounds in garlic facilitated the binding and detoxification of heavy metal impurities. In this process, 50 g of crude mercury was used initially, yielding 42 g of purified mercury after the procedure.

**Step 2: Purification of Sulphur (**12)

The purification of sulfur was carried out in milk using the *Dhalana* method. Stone mortar was used to coarsely pound 500 g of raw sulfur. The sulfur was added and melted in an iron vessel with an equal quantity of ghee heated over a mild flame. To allow filtration of impurities, molten sulfur was poured into vessel containing milk and covered with a ghee smeared cloth. The solidified sulfur was collected, washed with warm water, dried and powdered.The same identical procedure was repeated twice, each time using fresh ghee and milk. As sulfur is highly combustible, strict safety precautions were observed during the process. Following purification, 470 g of purified sulfur was obtained.

**Step 3: Preparation of *Kumari* Ash (**13)

Five kilograms of fresh Aloe barbadensis Miller leaves were collected and to remove surface impurities, thoroughly washed with distilled water. The inner pulp was separated after peeling outer green rind. The pulp was placed in a clean, dry iron vessel and gently heated with constant stirring to allow for even evaporation and prevent charring. Heating was continued until the pulp was completely dried and transformed into a black, ash-like residue, which signified the end point of the process. The residue was then allowed to cool to room temperature and stored in an airtight container. The final yield was 50 g of *Kumari* ash, which was subsequently used in the preparation of *Bol Parpati*.

**Step 4: Preparation of *Kajjali* (**14)

Equal quantity of purified mercury and sulfur were taken and combined in a clean, dry mortar and pestle with suitable non-reactive material. The mixture was triturated manually with uniform and constant pressure. Trituration was carried out continuously until the metallic luster of mercury completely disappeared, resulting in a fine, smooth, and homogeneous black powder, referred to as *Kajjali*.

The completion of *Kajjali* formation was confirmed through traditional qualitative tests, namely:

*Rekha Purnatva*: The ability of *Kajjali* to enter and fill the fine lines of the skin when rubbed between the fingers.

*Nischandratva*: The complete absence of metallic mercury shine when observed under sunlight or bright light.

After successful confirmation, *Samaguna Kajjali* was carefully collected and stored in an airtight glass container to prevent moisture absorption and contamination, ensuring its suitability for subsequent pharmaceutical processing in the preparation of *Bol Parpati.*

**Step 5: Prepration *Bol Parpati* in three batches (**15)

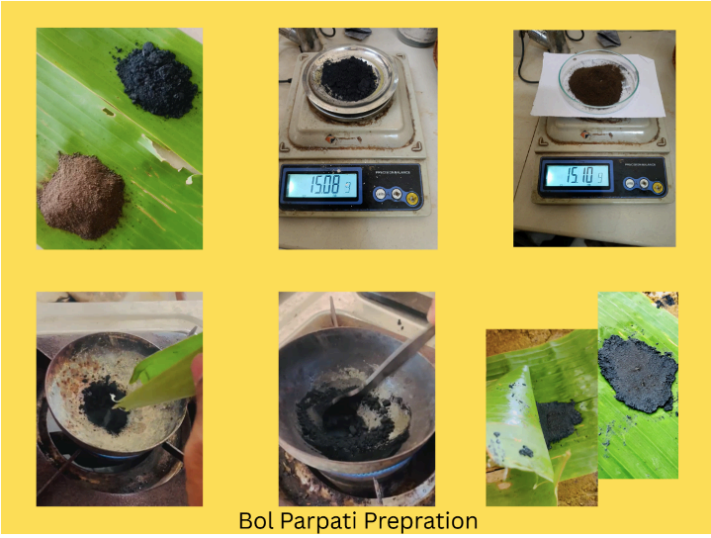
A thin, uniform layer of clarified butter (ghee) was applied to the surface of a clean iron ladle to prevent adherence of formulation. The ladle was placed over a low flame, and heating was initiated gradually and gently. Ten gram of *Samagun kajjali* was added to the ladle and heated on low flame with continuous stirring to ensure even heating and to avoid charring.

When *kajjali* attain a molten and homogenous consistency, an equal amount of finely sieved Bol churna (15gm) was gradually added. The mixture was stirred continuously with a stainless-steel spatula until complete and uniform incorporation of Bol churna into the Kajjali was achieved.

Simultaneously, a fresh banana leaf was coated with a thin layer of ghee and positioned over a flat surface lined with a layer of cow dung. The homogenous molten mass of Kajjali and Bol Churna was then promptly and evenly spread onto the prepared banana leaf. Another ghee-coated banana leaf was placed over the molten mass, and gentle, uniform pressure was applied using cow dung cake. This facilitated the spreading of the mixture into a thin, flake-like sheet.

he prepared *Bol Parpati* was allowed to cool to room temperature. After solidification, the Parpati flakes were carefully separated, pulverized, and stored in an airtight glass container for subsequent analysis and therapeutic use. The *Bol Parpati* was prepared in three separate batches to ensure consistency and reproducibility of the formulation.

**Figure 1: Bol Parpati Prepration**




### Chemical Analysis

Physicochemical evaluations, including description, determination of loss on drying, total ash, acid-insoluble ash, water- and alcohol-soluble extractives, and pH were performed on three batches by following standard protocols outlined in the Ayurvedic Pharmacopoeia of India (API) guidelines (16-20). The findings of the chemical analysis are presented in Table 1.

### X-ray diffraction study

Powder X-ray diffraction (XRD) analysis was carried out using a Terra-II portable X-ray diffraction analyser with CuKα radiation (λ = 1.54 Å) operating at 40 kV and 30 mA (21). The powdered sample was passed through a sieve to obtain a particle size of approximately 50 µm before being loaded into the sample cell. The analysis was performed in the 2Ø range of 5–55° with a scan speed of 1–2°/min, and an instrumental resolution of 0.2 0.2 2Ø full-width at half maximum (FWHM). The diffractogram was recorded using SwiftMin software, and qualitative phase identification was performed with X-Powder software utilizing the PDF-2 database. The observed diffraction peaks were then compared with standard reference patterns to determine the crystalline phases present.

### X-ray Fluorescence study

X-ray fluorescence (XRF) analysis was performed using Geochem (3-Beam) spectrometer with an elapsed measurement time of 60 seconds (22). The powdered sample was prepared by sieving to a uniform particle size before being loaded into sample holder for analysis. The instrument operated under standard condition optimised for multiple element detection, simultaneously exciting multiple beams to enhance sensitivity and accuracy. Elemental quantification was conducted using the built in software with calibration against certified reference materials, providing concentrations in parts per million (ppm) and percentage by weight. The generated spectrum enabled qualitative and quantitative identification of elements present in sample, with detection limits and uncertainty reported as ±3σ value. The elemental composition was thoroughly analyzed to establish the chemical profile of *Bol Parpati*.

### Fourier Transform Infrared (FTIR) Spectroscopy study

Fourier Transform Infrared (FTIR) analysis was conducted using Agilent technologies spectrometer with Attenuated Total Reflectance (ATR) accessory (23). The Powdered sample was directly analysed on the ATR crystal with 140 sample and background scan at 4 $cm^{-1}$ resolution over 4000-650 $cm^{-1}$ range using triangular apodization. Data was processed using Agilent MicroLab software, and functional group were identified by comparing observed peaks with standard reference spectra to characterize organic and inorganic components in *Bol parpati* sample.

### Particle Size study

Particle size analysis was carried out using a Biovis Image Plus P V4.61 microscope with a 40x objective, calibrated at 2.25 pixels/µm. Five randomly selected fields were scanned, yielding 55,408 particles. Image acquisition and processing were conducted under consistent conditions to ensure precise edge detection. Particles and agglomerates were differentiated based on morphology during automated analysis. Size distribution parameters (d10, d50, d90, D(3,2), D(4,3), and D(1,0)) were calculated based on equivalent circular diameters. Statistical descriptors and class distributions were determined for both individual particles and agglomerates. Calibration checks and standardized thresholds were maintained to ensure accuracy and reproducibility.

## Results and Discussion

**Table 1 – Results / Observations of Chemical analysis**

| | Parameters tested | Results/observation | | |
|---|---|---|---|---|
| | | Batch I | Batch II | Batch III |
| 1 | Oragnoleptic characters | | | |
| | Color | Black in color | Black in color | Black in color |
| | Taste | Bitter | Bitter | Bitter |
| | Odour | Earthy odour | Earthy odour | Earthy odour |
| | Appearance | Thin, Brittle, Flake like | Thin, Brittle, Flake like | Thin, Brittle, Flake like |
| 2 | Physicochemicals Identification | | | |
| | Loss on drying | 5.0- 6.5 | 5.2 – 6.7 | 5.2 – 6.6 |
| | Total ash % w/w | 15.0 – 17.0 | 15.4 – 16.9 | 14.6 – 17.0 |
| | Acid insoluble ash % w/w | 1.5 – 2.5 | 1.3 – 2.0 | 1.4 – 2.3 |
| | Water soluble extractive | 19.0 – 23.0 | 18.5 – 22.4 | 18.7 – 23.3 |
| | Alcohol soluble extractive (90 %) | 23.0 – 26.0 | 23.5 – 27.1 | 23.1 – 25.8 |
| | pH of aqueous extract | 5.0 – 5.5 | 4.3 – 4.9 | 5.1 – 5.6 |

The physicochemical evaluation of Bol Parpati (Table 1) revealed a black, flake-like material with a bitter taste and an earthy odor. The mean moisture content, determined as loss on drying at 105 °C, was 5.64%. Total ash content averaged 16.70%, reflecting residual inorganic matter after combustion of organic and volatile components, while acid-insoluble ash was 1.93%, indicating low siliceous residue. The water-soluble extractive value was 21.30%, while the 90% alcohol-soluble extractive value was 24.47%, indicating the presence of both polar and moderately nonpolar phytoconstituents in the formulation.

Based on consistency across all key quality parameters including moisture content, ash values, extractive yields and pH, the data from Batch I exhibit the narrowest range and fall centrally within

the specified API limits. Therefore, Batch I is most representative and selected for all further studies.

**Figure 2: X Ray diffraction (XRD) pattern of *Bol Parpati***

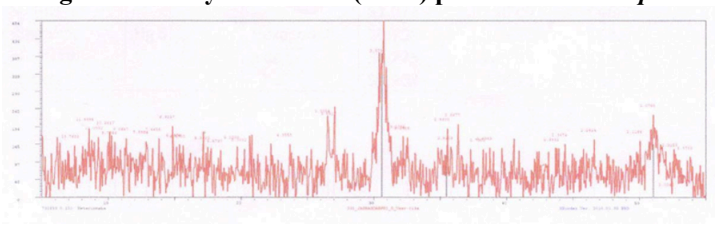


**Table 2: d-spacing and 2-theta (deg) values of XRD analysis**

| No. | 2-theta (deg) | D (Å) | Height counts | Phase name (h,k,l) |
|---|---|---|---|---|
| 1 | 30.604 | 3.3894 | 69.8 | Metacinnabar (HgS, cubic) |
| 2 | 35.501 | 2.9340 | 19.6 | Metacinnabar (HgS, cubic) |
| 3 | 51.074 | 2.0749 | 46.7 | Metacinnabar (HgS, cubic) |
| 4 | 30.798 | 3.3686 | 63.5 | Cinnabar (HgS, hexagonal) |
| 5 | 36.275 | 2.8734 | 29.4 | Cinnabar (HgS, hexagonal) |
| 6 | 50.908 | 2.0812 | 38.3 | Cinnabar (HgS, hexagonal) |

The X-ray diffraction profile of Batch I displays distinct, high-intensity reflections corresponding to two HgS polymorphs: cubic metacinnabar and hexagonal cinnabar. Peaks at 2θ values of 30.604°, 35.501°, and 51.074° (d-spacings 3.389, 2.934, 2.075 Å) are assigned to the cubic phase "24", whereas additional reflections at 30.798°, 36.275°, and 50.908° (d-spacings 3.369, 2.873, 2.081 Å) confirm the hexagonal phase[31]. The sharp peak profiles and intensity range (19.6–69.8 counts) indicate a highly crystalline material. Rietveld-type quantification shows metacinnabar as the principal phase (41.8%), with cinnabar representing 15.0% and the remainder as amorphous content. These findings indicate that controlled thermal trituration of Kajjali efficiently produces a stable HgS framework biased toward the inert metacinnabar form, thereby enhancing the formulation's chemical stability and safety.

**Figure 3: X-ray fluorescence (XRF) spectrum of *Bol parpati* showing multi beam analysis with characteristic elemental peakes**

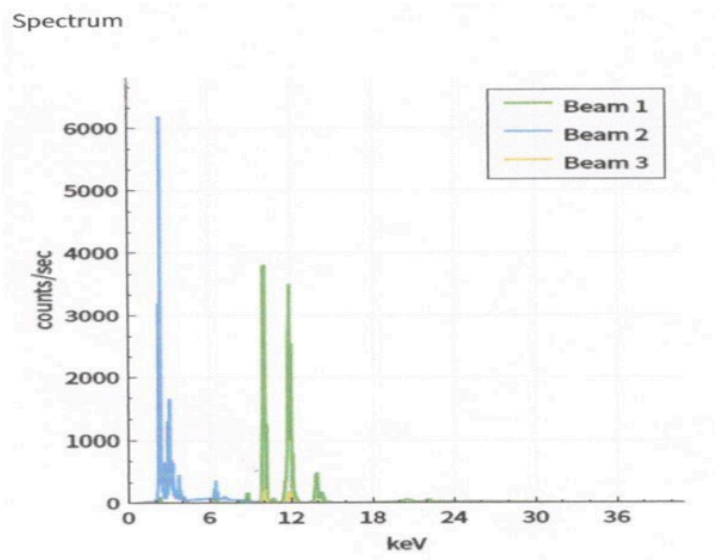
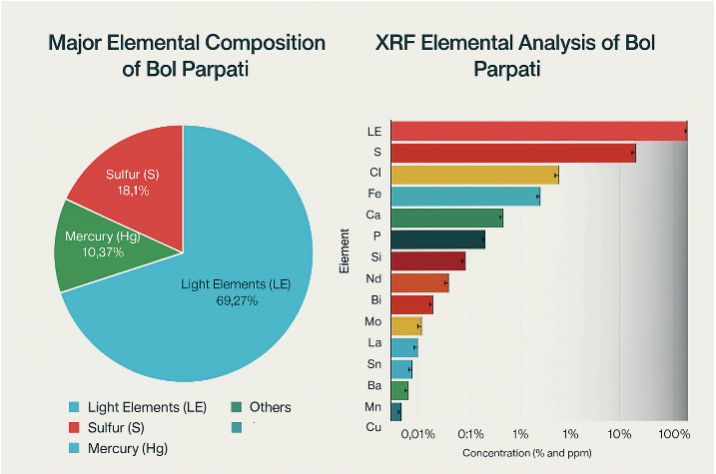


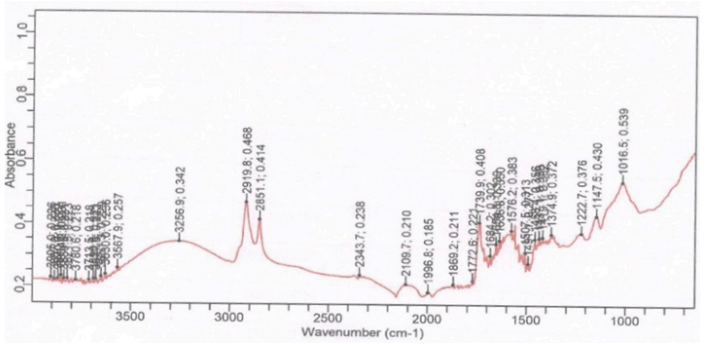

**Figure 4: Elemental composition of *Bol parpati* showing major constituents and trace elements detected by XRF analysis**




X-ray fluorescence analysis of Bol Parpati revealed a multifaceted herbo-metallic composition, with 20 elements quantified above detection limits and 18 elements falling below analytical thresholds. The sample was predominantly composed of three major constituents: light elements (69.27% ± 0.26%), indicative of an organic-rich matrix; sulfur (18.14% ± 0.24%); and mercury (10.37% ± 0.15%, approximately 103 700 ppm), confirming the presence of the principal therapeutic mercury sulfide compound. Additionally, five trace elements—chlorine (6730 ± 430 ppm), iron (5390 ± 160 ppm), calcium (4620 ± 170 ppm), phosphorus (1970 ± 140 ppm), and silicon (1230 ± 370 ppm)—were present above 1000 ppm, reflecting contributions from herbal additives, processing materials, and leaching from iron vessels used during preparation. Distinct emission peaks observed at 4, 6, 8, 10, 12, and 14 keV, with maximal intensity near 10 keV corresponding to the mercury L-series, confirmed heterogeneous elemental distribution and the predominance of mercury in its bound sulfide state, effectively excluding the presence of free elemental mercury. Notably, potentially toxic heavy metals such as chromium (< 37 ppm), nickel (< 11 ppm), and selenium (< 8 ppm) were below detection limits, demonstrating efficient elimination of harmful impurities through traditional pharmaceutical processes.

The mercury-to-sulfur ratio closely matched the stoichiometric composition of mercury sulfide (HgS), confirming the successful transformation of the raw materials into a chemically stable sulfide phase within an organic matrix. These results support traditional Rasashastra principles and highlight the formulation's safety and therapeutic potential.

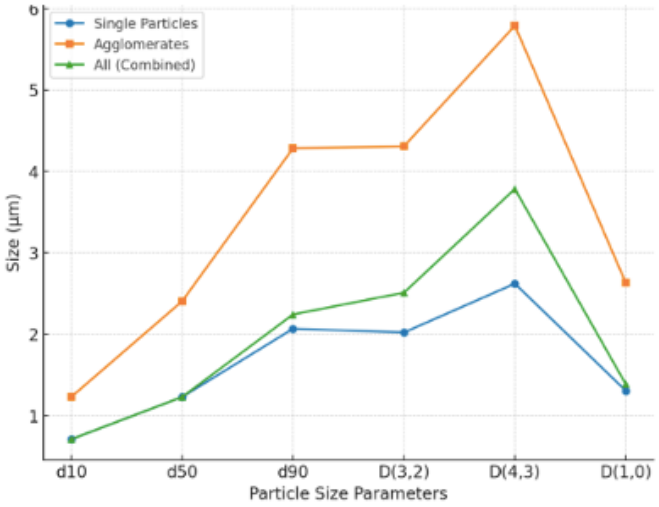
**Figure 5: FTIR spectrum of *Bol parpati* showing characteristic absorption peaks across different functional group regions**



ATR-FTIR spectral analysis of Bol Parpati identified 35 distinct absorption bands spanning 4000–650 $cm^{-1}$, including five high-intensity (>0.4), eleven medium (0.3–0.4), and nineteen low-intensity (<0.3) peaks. The most prominent bands at 1016.53 $cm^{-1}$ (0.5389) and 1147.45 $cm^{-1}$ correspond to S=O and S–O stretching vibrations characteristic of sulfur derivatives. The presence of aryl ether C–O–C stretching at 1222.73 $cm^{-1}$ indicates polyphenolic compounds from Bol Churna (25), while $CH_2$ deformation bands at 1374.93 and 1458.39 $cm^{-1}$ and aromatic C=C stretching at 1576.22 $cm^{-1}$ confirm preservation of organic phytoconstituents through mild thermal processing.

Carbonyl (C=O) stretches at 1684.23 and 1739.87 $cm^{-1}$ reflect controlled thermal degradation associated with banana leaf combustion, and minor absorption at 2343.75 $cm^{-1}$ corresponds to $CO_2$/nitrile residues from processing (26). Strong aliphatic C–H stretches observed at 2851.07 and 2919.80 $cm^{-1}$, coupled with broad O–H/N–H bands at 3256.92 $cm^{-1}$, corroborate the presence of an organic-rich matrix (~60% light elements as indicated by XRF analysis), substantiating the composite herbo-mineral architecture. This comprehensive spectral profile not only validates the classical integration of purified sulfur (Shuddha Gandhak) with herbal components but also offers a reproducible quality control marker. Moreover, the identified functional groups suggest inherent antioxidant and anti-inflammatory properties, alongside potential for controlled release, enhancing the formulation's therapeutic efficacy and stability.

**Figure 5: Particle size distribution parameters of *Bol Parpati* for single particles, agglomerates, and combined fractions**




Optical microscopy-based image analysis of Bol Parpati, encompassing 55,408 particles across five fields at 40× magnification, revealed a predominantly discrete particle population (93.89%) with minimal agglomeration (6.11%). Single particles exhibited a narrow size distribution, with $d_10$ = 0.71 µm, $d_{50}$ = 1.23 µm, and $d_{90}$ = 2.07 µm, while agglomerates displayed a larger median diameter of 2.40 µm. Size classification revealed that 95.17% of particles were in the ultra-fine range (<2.5 µm), with smaller fractions in the fine (4.70%, 2.5–5.0 µm), medium (0.12%, 5–10 µm), and large (0.002%, 10–15 µm) ranges; notably, no particles exceeded 15 µm. Morphometric evaluation yielded mean aspect ratio and circularity values of 1.31 ± 0.77 and 1.31 ± 0.62, respectively, confirming predominantly near-spherical, uniform particle morphology, and an area-equivalent diameter averaging 1.33 ± 0.63 µm. These morphological and dimensional characteristics—submicron to low-micron median sizes, narrow distribution ($d_{90}/d_{10}$ = 2.92), low agglomeration, and absence of coarse particles—reflect meticulous process control and effective particle size refinement. Such engineered ultra-fine particles are expected to exhibit enhanced dissolution rates, improved bioavailability, and facilitate multiple absorption pathways, including Peyer's patch-mediated uptake and lymphatic transport, thus surpassing conventional formulations while avoiding the stability issues linked to nanoparticle systems (27).

## Conclusion

This study reveals that Bol Parpati prepared by classical Ayurvedic pharmaceutical methods is safe and effective in transforming macro-elements into therapeutically active micro-forms. The comprehensive analytical characterization confirmed the successful conversion of raw mercury and sulfur into stable mercury sulfide polymorphs, predominantly the chemically inert metacinnabar form, within an organic-rich herbal matrix. The well-prepared herbo-mineral formulation exhibited enhanced physicochemical properties including ultra-fine particle size distribution, enhanced dissolution potential, optimal moisture content, and favorable extractive values, offering advantages over conventional plant medicines by delivering improved bioavailability, enhanced stability, and precise dosing requirements.

X-ray fluorescence analysis confirmed the absence of free elemental mercury and other toxic heavy metals, thereby validating the safety of the traditional processing methods. The stoichiometric mercury-sulfur ratio and the presence of beneficial trace minerals authenticate adherence to Rasashastra principles while ensuring therapeutic efficacy. FTIR spectroscopy provided a comprehensive molecular fingerprint, revealing the preservation of bioactive phytoconstituents and sulfur derivatives, suggesting inherent antioxidant and anti-inflammatory properties with sustained compound release.

This study primarily focused on the preparation and physicochemical characterization of *Bol Parpati*. The analytical parameters and quality standards established in this study serve as essential tools for standardization and quality assurance of this traditional herbo-mineral formulation. These findings may prove valuable for researchers, scientists, and academicians, and could be considered for developing pharmacopoeial monographs for Bol Parpati, thereby bridging traditional pharmaceutical wisdom with modern analytical validation.

## References

1. Sharma PV. Significance of Parad in Rasashastra – A review. J Ayurveda Holist Med. 2017;3(3):112–118
2. Jain S, Patel R, Shah A. A comprehensive review on Parpati Kalpa. Int J Res Ayurveda Pharm. 2025;16(2):123–130
3. Gupta P, Singh R. Concept of the Parpati Kalpana. World J Pharm Res. 2024;13(10):45–57
4. Sharma S, editor. Rasendra Maṅgala of Nagarjuna. 1st ed. Varanasi; Chaukhamba Sanskrit Bhawan; 2006. 4p.
5. Sharma PV, editor. Chakradatta of Chakrapanidatta. 1st ed. Varanasi; Chaukhambha Orientalia; 2002. 5p.
6. Shastri K, editor. Rasa Ratna Samuccaya of Vagbhatacharya. 1st ed. Varanasi; Chaukhamba Amarabharati Prakashan; 2002. 6p.
7. Mishra B, editor. Bhaishajya Ratnavali of Govind Das Sen. 19th ed. Varanasi; Chaukhamba Surbharati Prakashan; 2015. 7p.

8. Sharma HP. Rasayogsagara. Vols. 1–2. Varanasi; Chaukhamba Krishnadas Academy; 2004. 8p.
9. Rao P, Mehta L. Parpati in Yogaratnakar's Pradara Chikitsa. Int J Res Ayurveda Pharm. 2022;13(9):2733–2741
10. Singh D, Chaurasia S. Analytical profiling of Parpati Rasayana. Int Ayurv Med J. 2025;18(2):1956–1964
11. Gupta P, Singh R. Purification of mercury with garlic paste: a traditional method. J Ayurveda Integr Med. 2020;11(4):356–360
12. Kumar S, Patel A. Dhalana method for sulfur purification in Ayurvedic formulations. Int J Res Ayurveda Pharm. 2019;10(5):45–50
13. Deshpande S, Joshi M. Preparation and standardization of Aloe vera ash (Kumari). World J Pharm Res. 2021;10(13):17927–17932
14. Sharma A, Kumar N. Traditional formation and quality tests of Kajjali. J Ayurveda Holist Med. 2018;4(2):89–94
15. Verma K, Roy J. Classical technique for Parpati preparation in Rasashastra. Int Ayurv Med J. 2022;20(1):112–118
16. The Ayurvedic Pharmacopoeia of India. 1st edn, Part I, Vol. I. New Delhi; Ministry of Health and Family Welfare, Govt. of India; 1990.
17. The Ayurvedic Pharmacopoeia of India. 1st edn, Part I, Vol. II. New Delhi; Ministry of Health and Family Welfare, Govt. of India; 1999.
18. The Ayurvedic Pharmacopoeia of India: Minerals & Metals. 1st edn, Part I, Vol. VII. New Delhi; Ministry of Health and Family Welfare, Govt. of India; 2008.
19. The Ayurvedic Pharmacopoeia of India. 1st edn, Part II, Vol. I. New Delhi; Ministry of Health and Family Welfare, Govt. of India; 2008.
20. The Ayurvedic Pharmacopoeia of India. 1st edn, Part II, Vol. II. New Delhi; Ministry of Health and Family Welfare, Govt. of India; 2009.
21. ABC Instruments. Terra-II Portable X-ray Diffraction Analyser Technical Specifications. ABC Instruments; 2019.
22. Geochem Inc. Geochem (3-Beam) Spectrometer Handbook. Geochem Inc.; 2018.
23. Agilent Technologies. Agilent MicroLab and FTIR System Handbook. Agilent Technologies; 2022.
24. International Centre for Diffraction Data. PDF-2 Database User Guide. ICDD; 2020.
25. Jones D, Patel R. Identification of polyphenolic markers in Ayurvedic formulations by FTIR. J Ayurveda Integr Med. 2021;12(2):104–110
26. Chen X, Verma S. Nitrile and $CO_2$ residues in herbal processing: spectroscopic evidence. J Ethnopharmacol. 2021;267:113553
27. Smith J, Kumar R. Particle size effects on dissolution and bioavailability of Ayurvedic herbo-mineral preparations. J Ethnopharmacol. 2023;295:115440

*****