



A PHARMACEUTICAL AND ANALYTICAL STUDY OF KASISABADDHA RASA

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Article DOI: <https://doi.org/10.36713/epra28833>

DOI No: 10.36713/epra28833

ABSTRACT

Rasashastra is the ayurvedic science that primarily deals with mercury and its pharmaceutical processing. Kasisabaddha Rasa is a classical Rasauśadhi described in Rasa Ratna Samucchaya. It contains Rasa Sindoorā which stands out as a Saagni, Sagandha, Bahirdhuma, Kantastha Kupipakwa Rasayana and Shuddha Kasisa in a ratio of 1:5. The formulation is prepared by triturating the ingredients with Arjun Twak Kashaya as Bhavana Dravya, followed by Varaha Puta. Traditionally, it is indicated in Kilasa Kustha and Dadru.

Pharmaceutical evaluation revealed the attainment of classical Siddhi Lakshanas during Kajjali preparation, Kupipaka and marana process. Analytical studies were carried out on Kajjali, Rasa Sindoorā, Shuddha Kasisa and Kasisabaddha Rasa. Physicochemical analysis showed neutral pH and nil ash values in Kajjali and Rasa Sindoorā, whereas Kasisabaddha Rasa exhibited a nearly neutral pH, higher ash value, and low moisture content in all samples. XRD analysis confirmed the transformation of β -HgS in Kajjali to thermodynamically stable α -HgS in Rasa Sindoorā. SEM-EDS analysis demonstrated the presence of Hg, S, and Fe. Particle size analysis revealed particles in the submicron range, while FTIR studies confirmed retention of the inorganic framework along with the incorporation of functional groups attributed to Bhavana. NPST exhibited characteristic phased colour changes, confirming the identity of the formulation.

Overall, the pharmaceutical and analytical evaluation establishes Kasisabaddha Rasa as a stable and standardized mineral-based formulation. The study validates classical Rasashastra principles through modern analytical parameters and provides a scientific basis for further therapeutic exploration of the formulation in Kustha disorders.

KEYWORDS: Kasisabaddha Rasa, Kupipakwa Rasayana, Rasa Sindoorā, Varaha Puta, Kilasa Kustha, Dadru.

I. INTRODUCTION

The quality of pharmaceutical products depends not only on careful manufacturing practices but also on the correct identification and appropriate processing of raw materials. Ancient Ayurvedic Acharyas have systematically described various purificatory, detoxificatory, and incineration procedures to render metals and minerals therapeutically safe and efficacious. These processes result in significant physicochemical transformations, which enhance the bioavailability and therapeutic potential of herbal and mineral drugs.

Kasisabaddha Rasa is a distinctive mineral-based Kharaliya Rasayana described in Rasa Ratna Samucchaya. It consists of Rasa Sindoorā and Shuddha Kasisa in the ratio of 1:5, processed with Arjun Twak Kashaya as Bhavana Dravya and later subjected to Varaha puta. The formulation is indicated for the management of Kilasa Kushta and Dadru.

II. AIMS AND OBJECTIVES

A. Aim

Pharmaceutico-Analytical Study of Kasisabaddha Rasa

B. Objective

- 1) To critically analyse classical references about Kasisabaddha Rasa.
- 2) To prepare Kasisabaddha Rasa as per classical reference with due importance to SOP.

- 3) To conduct Physico-chemical analysis of Kajjali, Rasa Sindoorā, Shuddha Kasisa and Kasisabaddha Rasa.

C. Materials and Methods

Kasisabaddha Rasa 1 is a Kharaliya Rasayana mentioned in Rasa Ratna Samucchaya.

पलं रसं हि कासीसैर्युतं पञ्चगुणैः सह । मर्दयेद्यामपर्यन्तमर्जुनस्य त्वचो रसेः

शरावसम्पुटे रुद्ध्वा पुटेत्क्रोडपुटेन हि । रसः कासीसबद्धोऽयं मधुना वल्लतुल्यकः

शण्बकुचीयुक्तः सेवितो हन्ति निश्चितम् । त्रिभिर्मसैः किलासं हि दद्रूप्यपि विशेषतः

(R.R.S 20/135-137)

Sl. No	Name of the ingredients	Quantity
01.	Rasa Sindoorā	1 Pala
02.	Shuddha Kasisa	5 Pala
03.	Arjun Twacha Rasa	Q.S (for bhavana)

III. METHODOLOGY

- Raw drugs which were having similar Grahya lakshanas as mentioned in the Rasa classical texts, were collected from the market.
- Equal quantity of Hingulottha Parada² and Shuddha Gandhaka³ (150 gms each) were taken in a clean Khalva yantra and triturated till Kajjali siddha lakshanas were



- obtained, then *Kajjali* was subjected to *bhavana* with *Vatankura swarasa* for one *yama* and dried.⁴
- *Bhavita Kajjali* was filled in *Kachakupi* and subjected to *Kramagni paka* to obtain *Rasa Sindoor*⁵
 - *Kasisa Shodhana* was carried out with *Bhringaraja swarasa* by the *bhavana method*.⁶
 - 5 *Pala* of *Shuddha Kasisa* was added to one *Pala* of *Rasa Sindoor* and triturated till homogenous mixture was obtained.
 - The *mardita* above mixture was subsequently subjected to *bhavana* with *Arjun twak Kashaya*.⁸
 - After *Bhavana*, *chakrikas* were prepared, dried and enclosed in *sharava*, then subjected for *Varaha puta*.⁷
 - The final Product was collected and stored in airtight container.
 - *Kajjali*, *Rasa Sindoor*, *Shuddha Kasisa* and *Kasisabaddha Rasa* were sent to Analytical study.

IV.RESULTS

Pharmaceutico-Analytical study results are described under 2 headings.

A. Pharmaceutical Results

Showing results of *Hingula Mardana with Nimbu swarasa*-

Initial weight of <i>Hingula</i>	Weight of <i>Hingula</i> after <i>Mardana</i>	Gain	Yield in %
250 gm	262 gm	12 gm	104.8%

Showing results of *Hingulottha Parada*-

Wt of <i>Mardita Hingula</i> taken for <i>Urdhwapatana</i>	Wt of <i>Parada</i> obtained	Yield in %
262 gm	179 gm	68.32 %

Showing results from *Hingulottha Parada Shodhana*-

Wt of <i>Hingulottha Parada</i> taken	Wt of <i>Shoditha Parada</i>	Loss	Yield in %
179 gm	174.5 gm	4.5 gm	97.48%

Showing results from *Gandhaka Shodhana with Godugdha*-

Wt of <i>Gandhaka</i> taken	Wt of <i>Shoditha Gandhaka</i> obtained	Loss	Yield in %
470 gm	440 gm	30 gm	72.76%
440 gm	411 gm	29 gm	
411 gm	342 gm	68 gm	

Showing results of *Kasisa Bhavana with Bhringaraja Swarasa*-

Initial weight of <i>Kasisa</i>	Weight of <i>Kasisa</i> after <i>Bhavana</i>	Gain	Yield in %
500 gm	505 gm	5 gm	104%
505 gm	512 gm	7 gm	
512 gm	520 gm	8 gm	

Showing results from Preparation of *Kajjali*-

Wt of <i>Shuddha Parada</i>	Wt of <i>Shuddha Gandhaka</i>	Wt of <i>Kajjali</i> obtained	Loss	Yield in %
150 gm	150 gm	280.5 gm	19.5gm	93.50 %

Showing results from Preparation of *Rasa Sindoor*-

Weight of <i>Kajjali</i> taken	Quantity of <i>Rasa Sindoor</i> obtained	Loss	Yield in %
260 gm	162 gm	98 gm	62.30%

Showing results from *marana* of *Rasa Sindoor* and *Shuddha Kasisa*-

Weight of total <i>Rasa Sindoor</i> and <i>Shuddha Kasisa</i> taken	Quantity of <i>Kasisabaddha Rasa</i> obtained	Loss	Yield in %
288 gm	124 gm	164 gm	43.40%



2. Analytical Results

Showing Results of Organoleptic characters of Kajjali, Rasa Sindoor, Shuddha Kasisa and Kasisabaddha Rasa –

Physical test	<i>Kajjali</i>	<i>Rasa Sindoor</i>	<i>Shuddha Kasisa</i>	<i>Kasisabaddha Rasa</i>
Colour	Black	Reddish	Light greenish	Brown
Odour	Characteristic	Characteristic	Characteristic	Characteristic
Taste	Metallic	Metallic	Metallic	Metallic
Touch	Fine	Fine	Fine	Fine

Showing Results of Physical tests of Kajjali, Rasa Sindoor, Shuddha Kasisa and Kasisabaddha Rasa-

Parameter	<i>Kajjali</i>	<i>Rasa Sindoor</i>	<i>Shuddha Kasisa</i>	<i>Kasisabaddha Rasa</i>
pH (10 % Aqueous Solution)	7.1	6.9	4.2	6
Total Ash value	Nil	Nil	59.5%	98.5%
Acid insoluble ash	Nil	Nil	18%	93%
Water soluble ash	Nil	Nil	81.5%	6.5%
LOD at 105°C	0.29%	0.37%	0.88%	0.82%

Showing XRD results of *Kajjali*-

Sample	Compound Name	Chemical Formula	Crystal Structure
<i>Kajjali</i>	Metacinnabar	β HgS	Cubic
	Sulphur	S	Orthorhombic

Showing XRD results of *Rasa Sindoor*-

Sample	Compound Name	Chemical Formula	Crystal Structure
<i>Rasa Sindoor</i>	Cinnabar	α HgS	Trigonal

Showing XRD results of *Shuddha Kasisa*-

Sample	Compound Name	Chemical Formula	Crystal Structure
<i>Shuddha Kasisa</i>	Hydrated Ferrous sulphate	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	Monoclinic

Showing XRD results of *Kasisabaddha Rasa*-

Sample	Compound Name	Chemical Formula	Crystal Structure
<i>Kasisabaddha Rasa</i>	Cinnabar	α HgS	Trigonal/Hexagonal
	Ferrous oxide	Fe_2O_3	Cubic

Showing SEM EDS result of *Kajjali*-

Sl no.	Element	Weight %	Atomic %
1.	S	5.01	9.67
2.	Hg	35.59	10.99
3.	C	7.30	37.66
4.	O	1.24	4.81

Showing SEM EDS result of *Rasa Sindoor*-

Sl no.	Element	Weight %	Atomic %
1.	S	7.16	19.26
2.	Hg	86.59	37.25
3.	C	5.46	39.22
4.	O	0.79	4.26

Showing SEM EDS result of *Shuddha Kasisa*-

Sl. No	Element	Weight %	Atomic %
1.	S	0.88	0.65
2.	Fe	46.71	19.78
3.	C	4.31	8.48
4.	O	48.10	71.09

Showing SEM EDS result of *Kasisabaddha Rasa*-

Sl no.	Element	Weight %	Atomic %
1.	S	0.93	0.85
2.	Fe	58.82	30.94
3.	C	3.66	8.95
4.	O	29.42	54.00
5.	Mn	1.21	0.65
6.	Na	0.11	0.14
7.	K	3.08	2.31
8.	Hg	20.76	18.65

Showing Particle Size results of *Kajjali*, *Rasa Sindoor*, *Shuddha Kasisa* and *Kasisabaddha Rasa*-

Sample	Mean diameter(nm)
<i>Kajjali</i>	540.0 nm
<i>Rasa Sindoor</i>	391.0 nm
<i>Shuddha Kasisa</i>	1636.9 nm
<i>Kasisabaddha Rasa</i>	1734.3 nm

Showing FTIR results of *Kajjali*-

Wave number (cm ⁻¹)	Functional group / Bonds	Interpretation
3798.14	O-H stretching	Presence of Hydroxyl, possibly moisture/organic content
3565.65	O-H/N-H stretching	Hydrogen bonded hydroxyl or amine groups
2916.29	C-H stretching	Aliphatic organic compounds
2319.79	C≡N stretching or CO ₂	Trace gaseous or minor impurity absorption
667.04	Metal sulphur (Hg-s) vibration	Indicates sulphide bond formation characteristic of <i>kajjali</i>

Showing FTIR results of *Rasa Sindoor*-

Wave number (cm ⁻¹)	Functional group / bonds	Interpretation
2973	O-H stretching	Hydroxyl group
2167.72	Weak C≡N stretching	Indicate trace impurities
1500	Hg-S vibrations	Mercurial sulphide compounds
601.01	C-S stretching	Presence of organosulphur constituents
-	Absence of broad O-H peaks	Reduced hydrated or organic constituents or lack of moisture
-	Absence of strong C-H peaks	Predominantly inorganic mineral constitution.

Showing FTIR results of *Shuddha Kasisa*-

Wavenumber (cm ⁻¹)	Functional group / Bonds	Interpretation
3304.06	O-H stretching	Indicates water molecules or hydroxyl groups associated with hydrated ferrous sulphate
1639.11	H-O-H bending	Confirms the hydrated nature of the sample.
1072.06	S=O stretching	Characteristic of sulphate groups present in <i>Kasisa</i> .

Showing FTIR results of *Kasisabaddha Rasa*-

Wave number (cm ⁻¹)	Functional group / Bonds	Interpretation
3258.01	O-H stretching	Hydroxyl groups or absorbed moisture
1136.02	S=O stretching	Sulphate containing compounds characteristic of <i>Kasisa</i>
1017.50	S=O stretching	Sulphate groups
840.09	Metal-oxygen/sulphate vibrations	Inorganic mineral constituents
690.62	Metal-sulphur/Fe-o vibrations	Iron-containing mineral complexes



Showing NPST results of Kasisabaddha Rasa-

Sample	Phase	Observation (Colour Pattern)	Interpretation
Kasisabaddha Rasa	Phase 1 (0–5 mins)	Deep orange coloured central spot, surrounded by dark brown coloured margin of the central spot and a light yellow coloured thin peripheral margin.	Initial reaction and interaction of ingredients, marking the start of formulation changes.
	Phase 2 (5–20 mins)	The central spot gradually developed into distinct orange-brown colour, with a spreading yellow halo; margin becomes more prominent.	Progressive transformation and partial stabilization of components.
	Phase 3 (After 1 hour)	The central spot gradually becomes well defined brown colour, surrounded by a yellowish ring; spot remains stable without significant diffusion.	Complete reaction and final stabilization, confirming proper preparation and uniformity of the formulation.

III. DISCUSSION

A. Discussion On Pharmaceutical Study

Hingulottha Parada:

Mechanical trituration of Hingula with Nimbu Swarasa reduced particle size, increased surface area, and facilitated uniform Hg-S interaction, while citric acid chelated metallic impurities. Controlled Urdhvapātana enabled selective sublimation of mercury, with Jala-dhara aiding condensation and removal of volatile impurities. Subsequent trituration of Parada with Haridrā curna enhanced safety through curcumin-mediated chelation and antioxidant activity, imparting Dipana-Pacana properties and improving bioavailability. Overall, the process ensured purified, stabilized, and pharmaceutically active mercury.

Gandhaka Śodhana:

Goghrita and Godugdha acted as detoxifying and softening media, reducing Tikshnatva and facilitating impurity separation. Controlled heating using cow-dung cakes enabled sublimation of Gandhaka, leaving non-volatile impurities behind. Post-Shodhana changes-bright yellow colour, reduced odour, and softer texture-indicated successful detoxification and pharmaceutical suitability.

Kajjali Preparation:

Extended Mardana of Samaguna Shodhita Parada and Shodhita Gandhaka resulted in complete disappearance of mercury globules and fulfillment of classical Siddhi Lakshanas. Formation of a stable Hg-S complex reduced free mercury, enhancing safety and Kusthaghna potential, confirming the importance of prolonged trituration and optimal sulfur proportion. It took 190 hours of trituration to attain siddhi lakshanas.

Kasisa Shodhana

Bhringaraja Swarasa acts as a bioactive purification medium due to its phytoconstituents, which aid in detoxification and therapeutic enhancement of Kasisa. Bhavana facilitates particle

size reduction, improves homogeneity, and helps remove impurities. Repeated trituration may also impart Kushtaghna, Rakta prasadana, and Twachya properties.

Discussion on preparation of Rasa Sindoor

Rasa Sindoor was prepared by the classical Kupi Paka method over 26 hours. Controlled heating facilitated sublimation, removal of free sulfur, and deposition of Rasa Sindoor at the neck of the Kupi. Classical tests such as Tapta Shalaka, Sheeta Shalaka, copper coin test, and Suryodaya Lakshana confirmed proper processing and completion of the preparation.

Discussion on preparation of Kasisabaddha Rasa

Prolonged Mardana of Rasa Sindoor and Shuddha Kasisa promoted particle size reduction and enhanced physicochemical interaction between the ingredients. Bhavana with Arjun Twak Kashaya aided incorporation of bioactive phytoconstituents, while Varaha Puta facilitated phase transformation and mineral integration. These pharmaceutical processes contribute to improved stability, safety, bioavailability, and therapeutic efficacy of Kasisabaddha Rasa.

B. Discussion on Analytical Study

Organoleptic parameters confirmed progressive refinement from Kajjali to Kasisabaddha Rasa. Kajjali and Rasa Sindoor showed nearly neutral pH, whereas Shuddha Kasisa was acidic. Kasisabaddha Rasa exhibited a near-neutral pH, indicating modification during pharmaceutical processing. Its high total ash and acid-insoluble ash values confirm its mineral-rich nature, while the reduced water-soluble ash suggests the formation of stable compounds. Low LOD values in all samples indicate minimal moisture content and good stability of the formulations.

Instrumental Analysis

XRD:

XRD analysis confirmed the successful synthesis and crystalline nature of all samples. Kajjali showed the formation



of β -HgS, while Rasa Sindoor confirmed its conversion to stable α -HgS (cinnabar). Shuddha Kasisa exhibited crystalline $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, indicating effective purification. Kasisabaddha Rasa showed high crystallinity with 45–50 nm crystallite size, confirming the formation of a stable nanocrystalline organo-mineral complex.

SEM-EDS:

SEM-EDS analysis confirmed the elemental composition of all samples. Kajjali and Rasa Sindoor showed predominant mercury and sulfur, confirming HgS formation. Shuddha Kasisa exhibited mainly iron and oxygen, indicating its purified iron-rich nature. Kasisabaddha Rasa showed iron, mercury, and oxygen, confirming successful incorporation of Shuddha Kasisa with mercurial components.

Particle Size Analysis:

Particle size analysis showed that Kajjali (540.0 nm) and Rasa Sindoor (391.0 nm) had finer particles, indicating effective processing and potentially better bioavailability. Shuddha Kasisa (1636.9 nm) exhibited a larger particle size due to its mineral nature. Kasisabaddha Rasa (1734.3 nm) showed the largest particle size, likely due to incorporation of Shuddha Kasisa and particle aggregation during pharmaceutical processing.

FTIR

FTIR analysis confirmed the characteristic functional groups of all samples. Kajjali and Rasa Sindoor showed Hg–S vibrations, confirming mercurial sulfide formation. Shuddha Kasisa exhibited O–H and S=O peaks, indicating hydrated ferrous sulphate. Kasisabaddha Rasa showed S=O, Fe–O, and metal–sulphur vibrations, confirming successful incorporation of Kasisa into the formulation.

Overall Interpretation-

The combined pharmaceutical and analytical findings confirm that classical Shodhana, Bhavana, Kupipaka and marana processes induce controlled physico-chemical transformations, yielding a stable, safe, and therapeutically superior Kasisabaddha Rasa. This validates the classical methodology through modern analytical evidence.

Probable Mode of Action

Kasisabaddha Rasa is a unique *Kharaliya Rasayana* formulation containing *Rasa Sindoor* and *Shuddha Kasisa* in a ratio of 1:5, which are homogeneously mixed. The mixture is subjected to *Bhavana* with *Arjun Twak Kashaya* and later processed through *Varaha Puta*. These pharmaceutical

procedures facilitate proper integration of the ingredients, resulting in a chemically stable, homogeneous, and therapeutically active herbo-mineral formulation.

Kasisabaddha Rasa acts primarily on *Rasavaha*, *Raktavaha* and *Mamsavaha Srotas*, which are chiefly involved in the pathogenesis of *Kilasa Kushta*, and *Dadru*. Due to its *Kushtaghna*, *Raktashodhaka*, *Raktaprasadana*, and *Rasayana* properties, it helps in correcting *Rakta Dushti*, pacifying vitiated *Kapha-Pitta Dosha*, improving tissue metabolism, and promoting normal skin pigmentation and texture. The fine particle size and *Yogavahi* nature of the formulation facilitate deeper tissue penetration, enhancing bioavailability and therapeutic efficacy. Thus, it supports purification of *Rakta Dhātu*, restoration of skin health, and prevention of disease recurrence.

Analytical studies confirm structural integrity, minimal impurities, and nanoscale fineness, ensuring enhanced bioavailability and reduced toxicity. Pharmacologically, *Kasisabaddha Rasa* exerts Anti-microbial, Anti-oxidant, Anti-fungal, Anti-inflammatory and skin-regenerative effects, with herbal media enhancing absorption and overall efficacy

VI.CONCLUSION

The present study on *Kasisabaddha Rasa*, a *Kharaliya Rasâyana*, systematically evaluated its classical pharmaceutical preparation and modern analytical characteristics. The formulation, prepared using *Rasa Sindoor* (1 pala) and *Shuddha Kasisa* (5 Pala) with *Arjun Twak Kashaya* as *Bhavanā Dravya* after *varahaputa* was found to be chemically stable, homogeneous, and pharmaceutically sound.

Classical *Rasashastra* procedures ensured effective detoxification, incorporation of bioactive constituents, and formation of a stable mercuric sulfide matrix. The *Rasa Sindoor* and *Kasisabaddha Rasa* fulfilled classical *Siddhi Lakshanas* and demonstrated superior quality and safety.

Analytical investigations confirmed phase transformation from β -HgS to thermodynamically stable α -HgS, uniform sub-micron particle size, minimal impurities, and enhanced bioavailability. These findings validate the effectiveness of the classical *Kupipaka* process. Overall *Kasisabaddha Rasa* exhibits potential anti-microbial, anti-inflammatory, and dermatological benefits. The study bridges classical Ayurvedic principles with modern analytical evidence and provides a strong foundation for standardization, quality assurance, and future pharmacological, toxicological, and clinical evaluation.

ANNEXURE

Fig: 01



Fig: 02



Fig: 03



Fig: 04



Fig: 05



Raw Hingula Nimbu Swarasa Mardana After Mardana After drying

Fig: 06



Fig: 07



Fig: 08



Fig: 09



Hingula placed at base of Lower Pot Sandhibandhana Urdwapatana Vidhi Parada Sublimation

Fig: 10



Fig: 11



Fig: 12



Fig: 13



Raw Gandhaka Goksheera Gandhaka Placed in kurmaputa Ignition

Fig: 14



Fig: 15



Fig: 16

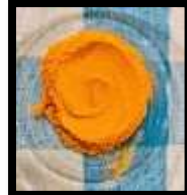


Fig: 17



Shuddha Gandhaka Hingulottha Parada Haridra Churna Mardana with Haridra Churna

Fig: 18



Fig: 19



Fig: 20



Fig: 21



Shuddha Parada Shuddha Gandhaka Kajjali – 2 hrs Kajjali – 190 hrs

Fig: 22



Nischandratva test

Fig: 23



Ashuddha kasisa

Fig: 24



Bhringaraja swarasa

Fig:25



*Bhavana of Kasisa
with Bhringaraja Swarasa*

Fig:26



Shuddha Kasisa

Fig: 27



Vatankura Swarasa

Fig:28



*Bhavana with
Vatankura Swarasa*

Fig:29



Bhavita Kajjali

Fig:30



Mritkapata Kupa

Fig:31



Filling of Kupa

Fig:32



Placing in Valukayantra

Fig:33



Mridwagni

Fig:34



12 hours of Paka

Fig:35



24 hours of paka

Fig:36



*Tapta shalaka
Insertion*

Fig:37



*Sheeta shalaka
Insertion*

Fig:38



Copper coin test

Fig:39



Suryodaya lakshana

Fig:40



Mukha Mudrana

Fig:41



After Swanga Sheeta

Fig: 42



Breaking of Kupi

Fig:43



Sublimated Product

Fig:44



Rasa Sindoor

Fig:45



Arjun Twak Kashaya

Fig:46



**Bhavana of Rasasindoor
+ Shudhha Kasisa**

Fig:47



**Chakrikas of Rasa sindoor
+ Shudhha Kasisa**

Fig:48



**Sharava samputa placed
in Varahaputa**

Fig:49



Colour of Chakrikas after Puta

Fig:50



Final Product

XRD REPORTS

Fig:51 Kajjali

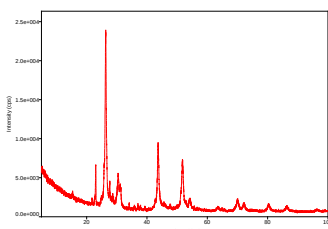


Fig:52 Rasa Sindoor

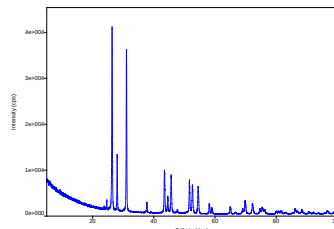
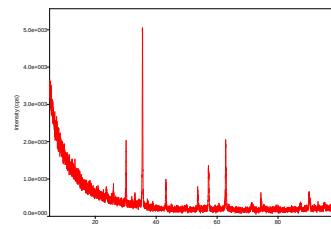


Fig:53 Kasisabaddha rasa





FTIR REPORTS

Fig:54 Kajjali

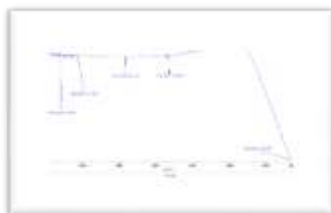


Fig:55 Rasa Sindoor

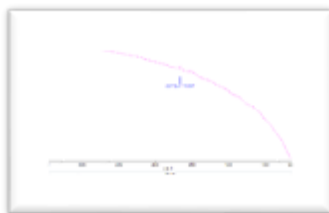
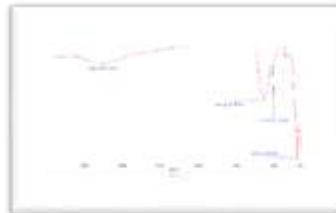


Fig:56 Kasisabaddha rasa



SEM EDS REPORTS

Fig:58 Kajjali

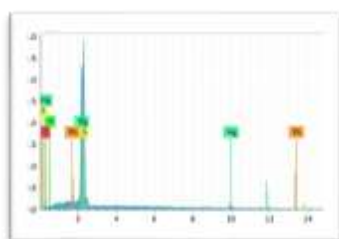


Fig:59 Rasa Sindoor

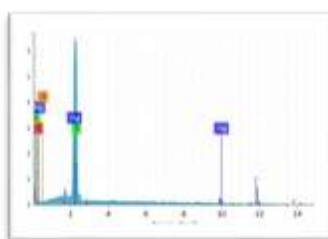
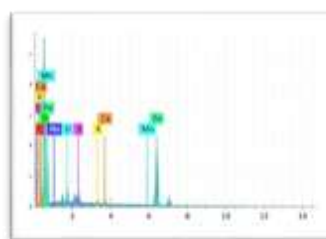


Fig:60 Kasisabaddha Rasa



ZETA PALS REPORT

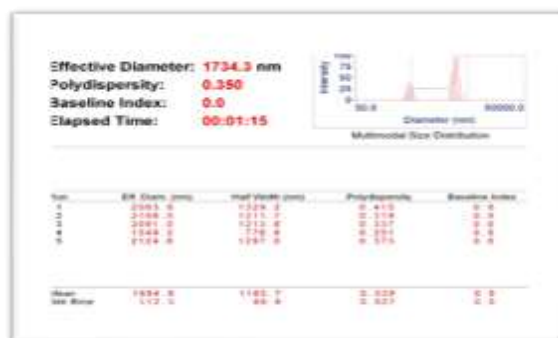
Fig:62 Kajjali



Fig:63 Rasa Sindoor



Fig:64 Kasisabaddha Rasa



IV. REFERENCES

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