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Pharmaceutico-analytical evaluation of *Kapha Chintamani Rasa*: A Herbo-mineral formulation

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Abstract
Background: *Kapha Chintamani Rasa* is a *Khalveeya Rasaoushadi* (herbo-mineral formulation) mentioned in the classical text of *Rasendra Sara Sangraha*.
Objective: To carry out the pharmaceutical study of *Kapha Chintamani Rasa* and to evaluate the physicochemical properties of *Kapha Chintamani Rasa*.
Methods: *Kapha Chintamani Rasa* contains ingredients such as *Hingula* (Cinnabar), *Tankan* (Borax), *Rasa Sindoor* (sulphide of Mercury), *Marich* (Piper nigrum), *Indrayava seed* (Holarrhena antidysenterica), *Bhang Seed* (Cannabis sativa), *and Bhavana of Adhraka Swaras*. All the above ingredients were blended uniformly to obtain a homogeneous mixture, from which *Vatis* were prepared.
Results: Analytical results of *Kapha Chintamani Rasa* were as follows: friability-0.05%, disintegration-26 min, pH-8.21, loss on drying-8.93%, total ash-13.95%, acid insoluble ash-2.34%, XRD-confirmed the presence of Cinnabar, mercury sulfide, Sodium borate.
Conclusion: *Kapha Chintamani Rasa* was prepared according to the classical reference of *Rasendra Sara Sangraha*. To date, no research work has been conducted on *Kapha Chintamani Rasa*; therefore, the present study aimed to evaluate the pharmaceutical and analytical profile of this formulation.

Keywords: *Kapha Chintamani Rasa*, pharmaceutical study, analytical study

Introduction

Ayurveda, one of the world's oldest medical systems, has gained global recognition for its holistic perspective on health and life. *Ayurvedic* formulations are prepared using substances of herbal, mineral/metallic, and animal origin, which undergo specific pharmaceutical procedures to achieve therapeutic efficacy. Pharmaceutical studies deal with the collection, authentication, and processing of raw drugs and the preparation of *Kapha Chintamani rasa*. Analysis is important for every product, and is even more significant for a drug, as it involves life. Pharmaceutical analysis may be defined as the application of analytical procedures to determine the purity, safety, and quality of drugs and chemicals. The specialised methods of *Shodhana* (purification), *Bhavana* (trituration), and *Marana* (calcination) in *Rasashastra* transform toxic raw materials into potent and safe remedies, collectively known as herbomineral formulations (*Rasaushadhis*). Among these, *Kapha Chintamani Rasa* is a notable formulation. It is a *Kharaliya Rasayana* which contains *Hingula*, *Tankan*, *RasaSindoor*, *Marich*, *Indrayava seed*, *Bhang Seed*, and *Bhavana* of *Adhraka Swaras*. In this paper, the pharmaceutical aspects of *Kapha Chintamani Rasa* prepared by reference to *Rasendra Sara Sangraha* [1] are discussed, i.e. Pharmaceutical procedures adopted for the preparation of *Kapha Chintamani Rasa* have been discussed, such as *Hingula Shodhan*, *Gandhak Shodhan*, *Tankan Shodhan*, Extraction of *parada* from *hingula*, and preparation of *kajjali* and *Rasa Sindoor*, etc.

Objectives of the study

- To carry out the pharmaceutical study of *Kapha Chintamani Rasa*.
- To evaluate the physicochemical and Analytical properties of *Kapha Chintamani rasa*.

Materials and Methods

Procurement of raw drugs: Raw drugs were procured from the local markets of Jodhpur and authenticated by a committee comprising experts from the Departments of *Dravyaguna, Rasa Shastra, and Bhaishajya Kalpana*, PGIA, DSRRAU, Jodhpur.

Pharmaceutical procedures carried out during the study are as follows:

1. *Hingula Shodhan* [2]: *Bhavana* with *Nimbu swarasa* for seven times.
2. Mercury was extracted from *Shuddha Hingula* using the *Nada-Yantra* technique [3].
3. *Gandhak Shodhan* [4]: Performed through *Dhalana* (melting and filtration) and *Galana* (pouring) methods.
4. Preparation of *Kajjali* [5]: Method Employed-*Mardana* (Levigation)
5. Preparation of *Rasa Sindoor* [6]: *Kupipakva* method using *Valuka Yantra* (iron vessel filled with sand).
6. Purification of *Tankan* by the *Nirjalikaraṇa* method [7].
7. Preparation of *churna* [8] of *Marich*, *Bhang* seed, *Indrayava* seed.

Procedure

Ashuddha Hingula (785 g) was coarsely powdered and subjected to seven cycles of *Bhavana* with fresh *Nimbu Swarasa* (450 ml), 3-3.5 hours/day, gradually reducing the liquid. The colour changed from bright red to reddish orange, and after washing thrice and shade-drying, 791 g of *Shuddha Hingula* was obtained. *Shuddha Hingula* (200 g per batch) was then processed in a cotton cloth inside a *Nada Yantra* for mercury sublimation. Three consecutive extractions yielded 118.4 g, 143.3 g, and 145.5 g of Parada, with an average recovery of 67.81%. *Ashuddha Gandhaka* (500 g) was melted in ghee, filtered through cotton into milk, washed with hot water, and dried. This process was repeated three times, yielding 476 g of *Shuddha Gandhaka*. Equal parts of *Shuddha Parada* and *Gandhaka* (400 g each) were triturated in a *Khalva Yantra* to prepare *Kajjali*. The mixture changed from yellow to gray to jet black, passed classical tests by 42 hours, and gave 789 g of *Kajjali* (yield 98.62%). For *Rasasindoor*, *Bhavita Kajjali* (789 g) underwent three *Bhavana* cycles with Arial Roots *Swarasa*, then placed in 7-layer mud-coated bottles and heated in a *Valuka Yantra* from room temperature to 650 °C. Sublimation, flame, and *Shalaka* tests were monitored, and after cooling, the final *Rasasindoor* was collected and stored. *Ashuddha Tankaṇa* (200 g) was powdered and roasted with mild heat, producing 110 g of *Shuddha Tankaṇa* (yield 55%). Other raw materials were powdered for uniform distribution in *Vaṭi Kalpana*; for example, *Marich*, *Bhaṅga seed*, and *Kuṭtaj seed* yielded 88.46%, 79.16%, and 90.76%, respectively.

Method of preparation of *Kapha Chintamani rasa*: 1 part of *Hingula*(Cinnabar), 1 part of *Indrayava* (Holarrhena antidysentrica), 1 part of *Tankan* (Borax), 1 part of *Bhang seeds* (Cannabis sativa), 1 part of *Marich* (Piper nigrum), 3 parts of *Ras Sindoor*. All the above ingredients were taken in a *khalva yantra* one by one, triturated till a homogenous mixture was formed. This was then subjected to bhavana by adding *Adhraka Swaras*. *Vati's* were prepared and stored in an air-tight container.

Physico-chemical and Analytical Evaluation

Organoleptic characteristics, along with physicochemical parameters including pH [9], loss on drying [10], total ash [11], acid-insoluble ash [12], water-soluble extractive [13], and alcohol-soluble extractive [14], Hardness [15], Friability [16], and Disintegration test [17] were evaluated according to the standard methods outlined in the Ayurvedic Pharmacopoeia of India (API).

X-Ray Diffraction (XRD) analysis was performed using an Olympus XRD Terra-II Diffractometer. The instrument scanned over a range of 5°-80° (2θ) with a step size of 0.02° and a scanning speed of 1-2°/min. The diffraction patterns obtained were analysed using software and compared with the ICDD (PDF) database to identify crystalline phases. Peak positions (2θ), intensities, and full width at half maximum (FWHM) were assessed to determine phase composition and estimate crystallite size. Elemental composition was determined using a Vanta handheld X-Ray Fluorescence (XRF) Analyser, following the Geochem3-Beam Daily method. Particle size analysis was conducted with the BIOVIS PSA 2000 Particle Size Analysis System, which automatically measured thousands of individual particles and reported size distribution parameters, including D10, D50, and D90.

Result

The results obtained were categorized into:

- Pharmaceutical results
- Analytical results

Table 1: Results of the pharmaceutical procedure

SI. No.	Name of the practical	Quantity taken	Quantity obtained	Loss/Gain
1	*Hingula shodhana*	785 g	791 g	+6 g
2	*Hinguloth Parada Niṣkasana*	600 g	407.2 g	Yield 67.81%
3	*Gandhak Shodhana*	500 g	476 g	-24 g
4	*Kajjali Preparation*	Parada + Gandhaka (400 g each)	789 g	-11 g
5	*Rasa sindoor Preparation*	Kajjali (600 g)	314.6 g	-285 g
6	*Tankan Shodhana*	200 g	110 g	-90 g
7	*Marich beeja churnikarana*	130 g	115 g	-15 g
8	*Bhang beeja churnikarana*	120 g	95 g	-25 g
9	*Indrayava beeja churnikarana*	130 g	118 g	-12 g
10	*Kapha Chintamani Rasa*	240 g	259 g	+19 g

Result of Organoleptic Tests

The organoleptic characters of *Kapha Chintamani Rasa* were noted as follows:

- Appearance-*Vati*
- Colour-Brick Red
- Odour-Aromatic

Result of Physicochemical Analysis

Table 2: Showing Physicochemical Parameters of *Kapha Chintamani Rasa*

S. No.	Test Parameter	Result	Unit
1.	pH value	8.21	-
2.	Moisture Content	8.93	%
3.	Total Ash	13.95	%
4.	Acid-insoluble Ash	2.34	%
5.	Alcohol soluble extractive	6.73	%
6.	Water-soluble extractive	19.88	%
7.	Tablet hardness test	0.59	N
8.	Tablet friability test	0.05	%
9.	Disintegration test	26	Min.

Table 3: Result showing identified peaks in XRD of *Kapha Chintamani Rasa*

Compound	Composition	Crystal shape	2 theta	D spacing	Intensity%
Cinnabar, syn ·Mercury sulfide-$-alpha ·Mercury Sulfide	Hg S	Hexagonal axis	30.936 32.845 36.413	3.3539 3.1639 2.8629	98.5 34.7 97.7
· Sodium Borate	Na2 B6 O10	Monoclinic	12.569 26.234 30.909	8.1715 3.9415 3.3568	12.1 14.8 100

Table 4: Showing the result of XRF and the probable source of the elements detected

Element	PPM/%	±3σ	Probable Assignment
Si	3680 ppm	360	Silicates from earthen vessels or herbal media
P	4280 ppm	190	Phosphorus—likely from herbal juices or organophosphate residues
S	5.21%	0.12	Sulfur—originating from Gandhaka or sulfur-containing herbal media
Ca	5940 ppm	200	Calcium from herbs or contact with earthen materials
Fe	412 ppm	64	Iron as a trace mineral or vessel residue
Co	37 ppm	33	Cobalt trace—possibly from mineral content
Cu	210 ppm	34	Copper in trace amounts—may come from utensils or ores
As	201 ppm	32	Arsenic trace—environmental or ore origin
Rb	1325 ppm	47	Rubidium—soil or mineral origin
Zr	137 ppm	16	Zirconium—trace mineral origin
Nb	1102 ppm	37	Niobium—minor trace from natural minerals
Mo	2530 ppm	81	Molybdenum—possibly from mineral ores
Ag	34 ppm	31	Silver—trace contamination from metallic contact
Sn	121 ppm	82	Tin—possible vessel interaction
Ce	420 ppm	330	Cerium—a rare earth element from a mineral matrix
Nd	710 ppm	570	Neodymium—trace rare earth element
Hg	26.59%	0.47	Mercury—principal component, likely from Hingula (HgS)
Pb	156 ppm	67	Lead—trace, environmental or ore contamination
LE	65.99%	0.46	Light elements (C, H, O, N)—from Bhavana Dravyas and organic matter

Table 5: Result showing Particle Size of *Kapha Chintamani Rasa*

Sample name:		Sample code:
1.	Field Scanned	05
2.	Total particle count	49324
3.	Number of single particles	46760
4.	Number of agglomerates	2564
Single particle	d 10	10% particles are below 0.71 microns.
	d 50	50% particles are below 1.22 microns.
	d90	90% particles are below 2.06 microns.
Agglomerate	d 10	10% agglomerates are below 1.33 microns.
	d 50	50% agglomerates are below 2.56 microns.
	d90	90% agglomerates are below 4.10 microns.

Discussion

Pharmaceutical study: The study confirms the precision and reproducibility of classical *Rasa Shastra* techniques in preparing herbo-mineral formulations. *Ashuddha Hingula* (785 g), purified through seven *Bhavana* cycles with *Nimbu Swarasa*, exhibited a colour change from bright red to reddish orange, indicating detoxification. A slight gain in weight (791 g) was due to moisture absorption and retention of organic matter from the lemon juice. Extraction through the *Nada Yantra* yielded *Shuddha Parada* with an average recovery of 67.81%, with losses attributed to vapour retention and adherence to apparatus surfaces. Purified *Gandhaka* (476 g from 500 g) showed minor weight loss from impurity removal and slag formation during repeated

filtrations. *Kajjali* prepared from equal parts of *Shuddha Parada* and *Gandhaka* gave a 98.62% yield (789 g), with minor loss due to adherence to the mortar and volatilization during trituration. *Bhavita Kajjali* processed in *Valuka Yantra* yielded *Rasasindoor*, where weight loss corresponded to the sublimation of mercury and sulfur vapours. Roasting of *Ashuddha Tankaṇa* resulted in 110 g of *Shuddha Tankaṇa* (55%), primarily due to loss of crystalline water. Powdered herbal materials showed 79-91% yield, with minor reductions from essential oil volatilization. These outcomes validate classical processes as precise, reproducible, and scientifically rational.

Analytical Study: Physicochemical analysis showed a pH of 8.21, indicating a slightly alkaline nature that may support easy absorption and suitability for respiratory ailments. The *moisture content* (8.93%) was within acceptable limits, reflecting good stability and a lower chance of microbial growth. The *total ash* (13.95%) and *acid-insoluble ash* (*2.34%*) values suggest the presence of inorganic minerals in purified form, confirming proper incineration. The *alcohol-soluble extractive* (6.73%) and *water-soluble extractive* (19.88%) values indicate the presence of both polar and non-polar phytoconstituents, ensuring therapeutic potential. Tablet evaluation showed *hardness* (0.59 N) and *friability* (0.05%) within the normal range, signifying adequate compactness and mechanical strength. The *disintegration time* (*26 min*) demonstrates appropriate formulation characteristics for the gradual release of active principles, essential in herbo-mineral preparations. XRD analysis of *Kapha Chintamani Rasa* confirmed the presence of Cinnabar (HgS) and Sodium Borate ($Na_2B_6O_{10}$) as crystalline components. Cinnabar showed intense peaks at 2θ = 30.936°, 32.845°, and 36.413° (d = 3.3539-2.8629 Å), indicating a well-crystallised hexagonal structure. Sodium Borate peaks at 2θ = 12.569°, 26.234°, and 30.909° (d = 8.1715-3.3568 Å), confirming a monoclinic crystalline phase, supporting the formulation's stability and characteristic structure. XRF analysis showed mercury (26.59%) and sulfur (5.21%) as the major components, confirming *Hingula* (HgS) and *Gandhaka* as primary ingredients. Light elements (C, H, O, N, 65.99%) indicate the presence of organic matter from *Bhavana dravyas*. Calcium, phosphorus, and silicon likely originated from herbs or earthenware. At the same time, trace metals (Fe, Cu, Co, Pb, etc.) and rare elements (Ce, Nd, Rb, Zr, Nb, Mo) reflect minor contamination from minerals, soil, or processing utensils. Overall, the profile supports the herbo-mineral nature of the preparation with Hg and S as active constituents. The particle size distribution of the sample was evaluated, distinguishing between single particles and agglomerates. For single particles, 10% were below 0.71 µm, 50% below 1.22 µm (median size), and 90% below 2.06 µm, indicating a relatively fine particle population. Agglomerates exhibited larger sizes, with 10% below 1.33 µm, 50% below 2.56 µm, and 90% below 4.10 µm, reflecting the tendency of particles to cluster during processing. Overall, the data suggest that the sample consists predominantly of fine particles, with a minor fraction forming larger agglomerates. Such a size distribution is important as it can influence surface area, dissolution rate, and bioavailability in pharmaceutical applications.

Fig 1: Preparation of Kapha Chintamani Rasa

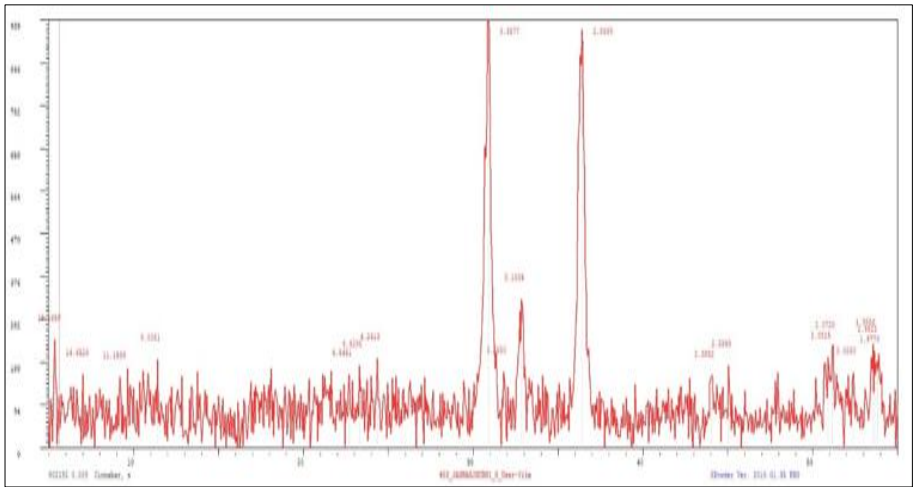

Fig 2: XRD data analysis graph of Kapha chintamani rasa

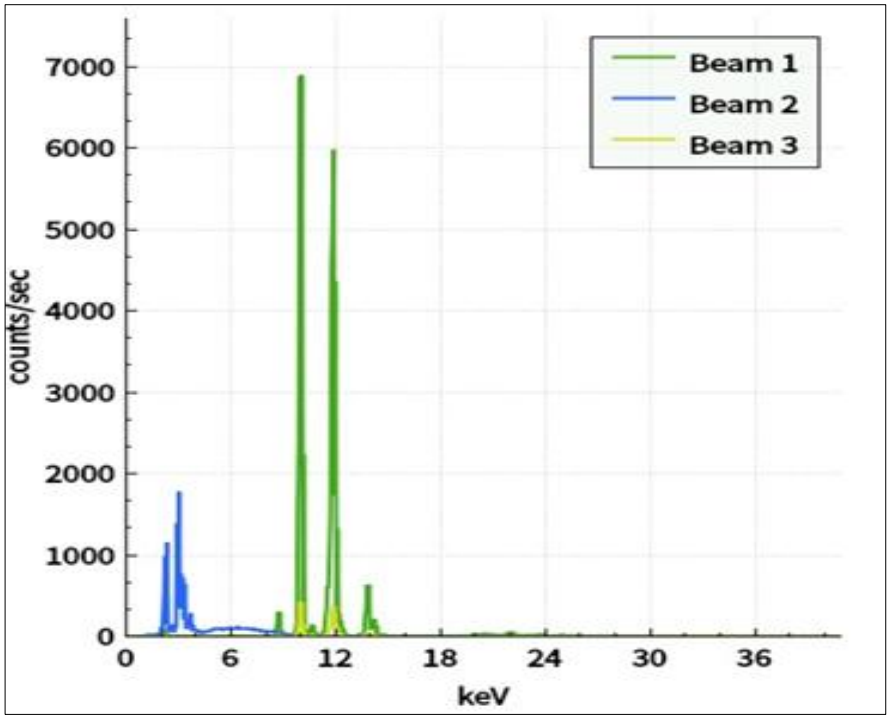

Fig 3: XRF analysis graph

Conclusion

The pharmaceutico-analytical study of *Kapha Chintamani Rasa* demonstrated that classical Rasashastra procedures such as *Shodhana*, *Bhavana*, and *Marana* effectively transform raw materials into a stable, fine, and therapeutically potent formulation. Physicochemical parameters confirmed the preparation's quality and stability, while XRD and XRF analyses verified the presence of crystalline *HgS* (Cinnabar) and other trace minerals essential to the formulation. Particle size analysis revealed fine particles in the micron range, indicating enhanced bioavailability and homogeneity. Overall, the formulation was found to be well-prepared, safe, and pharmaceutically standardized.

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