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Analytical Study of *Samaguna balijarita Rasa Sindhur* prepared by using Traditional Method

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ABSTRACT

Rasa Shastra is indeed a fascinating and intricate aspect of *Ayurvedic* medicine. It focuses on the alchemical transformation and therapeutic application of metals and minerals, particularly Mercury. Ancient scholar knows various purification and processing techniques to enhance the medicinal properties of these substances. This branch of *Ayurveda* combines traditional herbal medicine with mineralogy, aiming to create potent formulations for treating various ailments. *Rasa Shastra* literature provides detailed methods for preparing these remedies, emphasizing the importance of dosage, preparation, and the synergistic effects of combining herbs with metals and minerals. This study involves extraction (*Nishkasan*) of *Parad* from *Hingul* (Cinnabar) by using traditional method i.e. *Nadh Yantra*. *Parad Nishkasan* from *Hingul* having same properties as like that of *Ashtasanskarita Parad* described in *rasa* texts.

Parad (Mercury), plays a significant role in *Ayurvedic* medicine, particularly in formulations like *Rasayoga*. In *Ayurveda*, it is often categorized based on its purity level *Shuddha* (pure) and *Ashudha* (impure). *Shuddha Parad* is considered beneficial, exhibiting properties that can alleviate ailments (*Rognashak*) without the toxic effects associated with *Ashudha Parad*. The toxicity typically linked to mercury arises when it is impure, which emphasizes the importance of purification processes in its preparation. When it used properly and in its purified form, *Parada* can be a valuable component in *Ayurvedic* treatments, demonstrating both medicinal and rejuvenating properties.

Key Words *Rasa Shastra, Parad, Nadh Yantra, Rejuvenating Properties*

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INTRODUCTION

Rasa Shastra is a significant branch of *Ayurveda* that involves the use of minerals, metals, and gemstones to create potent therapeutic compounds. It blends the concepts of alchemy with traditional healing practices to address a wide variety of diseases. The therapeutic use of metals and minerals in this system is thought to have a profound impact on health, with particular

attention paid to their purification, processing, and proper combination for medicinal purposes. The word *Rasa-sindhur* was first mentioned in *Rasendra Chintamani*¹. *Kupipakwa Rasayana* (a kind of metallic preparations) is one among *Parada murchana* (inducing disease curing properties). *Rasa-sindhur* is therapeutically very effective in *Kaphaja roga* (disease due to kapha), *Balakhasya* (loss of strength), *dhatukhasya*

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(tissue wasting), *Hrid-daurbalya* (weakness of heart), *prameha* (diabetes), and *Shula* (colicky pain)². The formulation is also indicated in various diseases, viz., *Rajyayakshma* (tuberculosis), *Rakta-pitta* (bleeding disorders), *Pandu* (anemia), and also for *Vrishya* (Aphrodisiac), *Rasayna* (rejuvenation), etc.

Rasa Sindhur has various synonyms such as *Udaya Bhaskar Rasa*³, *Nayananand Sindura*⁴, *Kamdeo Rasa*⁵. *Rasa Sindura*, a kind of *Kupipakwa Rasayana*, where *Kajjali* (black lustreless powder) is prepared by levigating Mercury and Sulfur with prescribed herbal juices, and then subjected for processing in traditional *Bhati* for prescribed time duration. According to the proportion of sulfur used in the process *Rasa Sindhur*, there are different references available in classics i.e. *Chturamsha* (1/4 part) to *Shadguna Balijarita* (6 parts) *Rasa Sindhur*. It has been claimed in the text that mercury treated with the process of *Gandhaka Jarana*, becomes highly potentiated i.e. it acquires many pharmaco-therapeutic properties. Amount of *Gandhaka jarana* and *Agni* are also responsible for enhancing therapeutic properties of Mercurials.

AIMS AND OBJECTIVES

➤ To prepare *Samaguna Balijarita Rasa Sindhur* per classical reference through Traditional Method.

➤ Physico-chemical analysis of *Samaguna Balijarita Rasa Sindura*.

MATERIALS AND METHODS

Preparation of *Rasa Sindhur*

Raw materials *Hingul* and *Gandhak* were procured from authentic source and both raw drug (*Hingul* & *Gandhak*) was authenticate from P.G. Department of *Dravy Guna* of Shri Krishna AYUSH University Kurukshetra.

Four steps are involved in the preparation of *Rasa-Sindhur*

Preparation of *Samaguna Balijarita Rasa Sindhur*

1. *Parad* extraction from *Hingul*⁶
2. *Gandhaka Shodhana*⁷
3. *Samaguna Kajjali* Preparation⁸
4. *Samaguna Rasa Sindura* Preparation⁹

Parad extraction from *Hingul*:

The extraction of *Parad* from *Hingul* was carried out by three methods i.e. *Adhah Patana*, *Urdhva Patana*, *Tiryanka Patana*. Yantra (Instruments) used in the extraction of *Parad* like *Damaruyantra*, *Vidhayadharayantra* and *Patana yantra* etc are mentioned in texts. In the present study *Damaruyantra* was used because it is assumed that *parad* extraction from *hingul* by using *Damaruyantra* was more convenient as compared to others yantra and also average yield of *Parad* is also more in *Damaruyantra* as compared to others.

Table 1 Amount of *Parad* extracted from *Hingul*

Batch .no	Weight of <i>Sudh Hingul</i>	Weight of <i>Parad</i> obtained from <i>Hingul</i>	Loss of <i>Parad</i>
1	150 gm	80 gm	70 gm
2	150 gm	90 gm	60 gm

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3	100 gm	64 gm	34 gm
4	100 gm	60 gm	40 gm

Gandhaka Shodhana:

For purification of the *Gandhak*, the traditional method using cow's milk and cow's ghee was used. In this method, sulfur in powder form mixed with ghee was heated up to its melting temperature and the resulting liquid is poured

through a filter into a vessel containing cow's milk. After pouring into cow's milk vessels *gandhak* was settled on the bottom of vessel in granules form. This process was repeated three times and the final deposited product was taken out, washed with hot water and dried.

Table 2 Observations during *Gandhaka Shodhana*

Sr.no	Weight of initial <i>Gandhak</i>	Shodhan Type	Wt. after <i>shodana</i> of <i>gandhak</i>	Weight after Dry
1.	150 gm	1 st	146gm	146 gm
2.	146 gm	2 nd	144 gm	144 gm
3.	144 gm	3 rd	141 gm	140 gm

Samaguna Kajjali Preparation:

Shodita Parad and *Shodita Gandhaka* were taken in equal quantity (100 gm *Sudh Parad* & *Sudh Gandhak* 100 gm) and triturated in *Khalva Yantra*. Gradually the white color of *Parad* and greenish yellow color of *Gandhaka* disappear and a black powder is formed. Trituration was continued till the powder became Dark black in color and very fine like *Kajjala* and also fulfilled all the criteria of *Kajjali* i.e. *Nishchandrika*. After this, *Kajjali* was given *Bhavana* with *Vatankur Swarasa* for three times and after completing three *Bhavana* of *Vatankur Swarasa* it filled in 7 layered *Kachkupi*.

Samaguna Rasa Sindhur Preparation:

Procedure

A clean and dry *Kachakupi* with narrow mouth having capacity around 700ml was taken (Brown colour beer bottle). A clean cotton cloth was taken that was smeared with *Multhanimitti* and is wrapped around the *Kupi* from all the sides to cover it uniformly. After drying, the same

procedure was repeated for 7 times, each wrapping was done after complete drying of previous layer. It will take maximum 2-4 hours for drying one layer of wrapped *Multhanimitti* cloth.

***Kupipoorna*¹⁰**

A clean glass funnel was placed over the mouth of the *Kachakupi* and mixture was slowly added into it. After complete filling of *Kajjali* into *Kachkupi*, Mouth of the *Kupi* was temporary covered by using cork.

***Kupisthapana*¹¹**

Procedure

A big, thick cast iron *Valakuyantra* was placed over *Bhatti*. Four *Angulas* of *Valuka* was filled initially at the bottom of iron vessel. The *Kachkupi* filled with *kajjali* was then placed on it at the center of iron vessel. Later *Valuka* was filled in the *Valakuyantra*, which covered around the neck of *Kupi* and then cork was removed.

Pradhana Karma

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In the Pradhana Karma the following temperature pattern of heating was followed;

Mrudu Agni: Room temp. to 200°C (3-4hrs).

Madhyam Agni: 200- 450°C (3 hrs.).

Tivra Agni: 450-550°C (2 hrs.).

The *Kachakupi* was placed in the *Valuka yantra* at room temperature i.e. 30⁰ C temperature. After this temperature was gradually increased for 1 hour 40 minutes upto 220⁰ C, *Kajjali* start Melting at 220⁰ C and white fumes emerge out from *Kachakupi* and Yellowish white fumes started to emerge out from the mouth of *Kachakupi*, the temperature at

this 240⁰ C. During the course of heating the red hot *Shalaka* (iron rod) was repeatedly inserted into the mouth of *Kachakupi* to clear accumulated *Gandhaka* at the neck of the bottle to prevent blocking. The Blue flame started to come out at the neck of *Kachakupi* temperature recorded at that time 420⁰ C.

After the disappearance of blue flame, the bottom of *Kachakupi* becomes red hot. *Tivra agni* was started at this stage and was maintained up to 480⁰ C to 550⁰ C.

Table 3 Temperature recorded along with observation

Time in hours	Temperature Reading	Specific Observation
11.30 am	30 ⁰ C	Kupi-sthapana
12.05 pm	100 C	<i>Kajjali</i> was dried
12.25 pm	150 ⁰ C	Sand start heating
12.40 pm	200 ⁰ C	<i>Kajjali</i> was dried
12.47 pm	220 ⁰ C	<i>Kajjali</i> start melting
12.55 pm	240 ⁰ C	White fumes appear
01.10 pm	240 ⁰ C	Yellowish white fumes start
01.30 pm	280 ⁰ C	Dark yellow color fumes
04.25 pm	360 ⁰ C	Yellow Fumes disappeared blue flame start appear
04.40 pm	420 ⁰ C	Flame increased about 2-3inches
05.54 pm	440 ⁰ C	Flame disappeared
05.56 pm	440 ⁰ C	Bottom of <i>kupi</i> become red hot <i>Shita shalaka</i> and copper coin test shows presence of <i>parad</i> particles
05.58 pm	420 ⁰ C	Cork was applied on <i>kupi</i> immediately
6.10 -6.45 pm	420-550 ⁰ C	Temperature was increased from 440-550 ⁰ C.
06.50pm-8.45pm	550 ⁰ C	Heat was given for 2 hours.

RESULTS

Total time taken for preparation: 9 Hours 30 minutes.

Time required for *Swanga-Shita*: 10-12 hrs.

Total Weight of *Kajjali* taken: 120 gm

Total Weight of *Samaguna Rasa Sindhur* obtained: 48 gm

Total Weight of residue obtained: 1- 2 gm

Classical Parameters

Table 4 Classical Parameters for analysis of *Samaguna Rasa Sindhur*

Test	Observation
<i>Varna</i>	<i>Sindhur</i>
<i>Sparsh</i>	<i>Slakshnamrdu</i>
<i>Gandha</i>	Slight sulphur smell
<i>Rekhapurnatva</i>	When fine powder of <i>Rasa Sindhur</i> was rubbed in between thumb and index finger it entered the furrows of the fingers.
<i>Varitarnatav</i>	When fine powder <i>Rasa sindhur</i> was sprinkled over water it was floating were observed.
<i>Nischdrlica</i>	No shining particles were observed.

Organoleptic Parametrs:

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Samaguna Balijarita Rasa Sindhur

Physio-Chemical

Analysis:

Colour: Reddish Brown , Odour:

Odourless , Touch: Fine powder ,

Taste : Tasteless.

Table 5 Physio-Chemical Analysis of *Rasa Sindhur*

Sr.no.	Parameters	Test method	Unit	Result
1	Ph	API Part 1, Vol.-VI, 2009	-	3.28
2	Loss on drying	API Part 1, Vol.-VI, 2009	% w/w	6.43
3	Total ash	API Part 1, Vol.-VI, 2009	% w/w	4.23
4	Acid insoluble ash	API Part 1, Vol.-VI, 2009	% w/w	1.15
5	Water soluble extractive	API Part 1, Vol.-VI, 2009	% w/w	29.53
6	Particle size -Zeta potential	By particle size Analyzer	Nm	930.8
7	XRD	By XRD Assay of Element		Data Attached
8	Mercury	SRL/CHEM/SOP-ICP-MS/13	% w/w	95.31
9	Sulphur	By Gravimetric Analysis	% w/w	12.96

X-Ray Diffraction Study Materials

Bruker's D-8 Advance X-ray diffract meter and is equipped with Cu K-alpha (Lambda-1.5 406) radiation and graphite monochromator operated at 40KV/30mA. SamagunaRasa Sindur each 1 gm. Method: Sample was well grounded to 200mesh and air dried. The X-ray diffractometer scans were made on randomly oriented samples from 3-650 2-theta (d=29.42 to 1.43angstrom) with a step size of 0.020 and one second time per step. The 2-theta value and intensity of the peak (counts) are represented on X and Y-axis respectively. Higher the value of counts represents higher the crystallinity of the phase. For identification of each phase, minimum 6 strong peaks were chosen and compared with standard X ray Powder Diffraction file (XPDF).

Table 6 XRD of *Samagunabalijarita Rasa Sindur*

Sample Name	Obs. Max 2-Theta °	d (Obs. Max) Angstrom	Net Height Cps	Net Area Cps x 2-Theta °	Intensity %
HgS	26.8737	3.31766	432.74	0.1378	88.06
HgS	28.5996	3.12126	124.69	0.1181	25.37
HgS	31.6244	2.82928	491.44	0.1574	100.00

Sharp peaks observed that major compounds as Mercuric sulphate of majorly at 100% intensity on 31.6244, 2 theta value with crystalline shape and structure.

XRD of Samaguna Balijarita Rasasindhur

Powder XRD analysis of *Rasa-sindhur* was carried out using Rigaku Ultima-IV X-ray diffractometer with CuK α radiation ($\lambda = 1.54 \text{ \AA}$) operating at 30 kV and 30 mA. Pattern was recorded for angle (2 θ) ranging from 10 to 100° at a scanning rate of 0.03 degree and a dwell time of 0.5 second. Higher the value of counts represents higher the crystallinity of the phase. For identification of each phase, minimum 3 strong peaks were chosen and compared with standard X ray Powder Diffraction file (XPDF). Sharp peaks observed that major compounds as mercuric sulphate of majorly at 100 % intensity on 31.62, 2 theta value with crystalline shape and structure.

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Sharp peak at $2\theta = 31.6244$ with 100% intensity indicates presence of crystalline Mercuric sulphate.

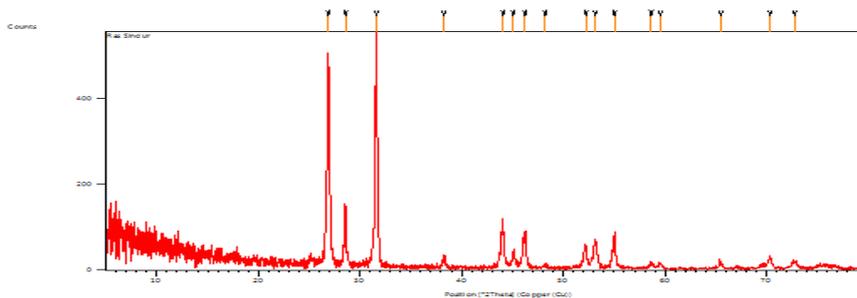


Figure 1 XRD of Samaguna Balijarita Rasasindur

Particle size by Laser Diffraction:

Particle size analysis is a technique for determining the particle size distribution in a material.

Principle: It works on the principle that when a beam of light (a laser) is scattered by a group of particles, the angle of light scattering is inversely proportional to particle size (i.e. the smaller the particle size, the larger the angle of light scattering).

Particle sizing by laser diffraction: Laser diffraction has become one of the most used particle size techniques, particularly for particles in the 0.5 to 1000 μ range. It is based on the idea that when a laser beam is scattered by a group of particles, the angle of light scattering is inversely proportional to particle size (i.e., the smaller the particle size, the larger the angle of light scattering).

Graphic (Particle Size Rasa Sindhur)

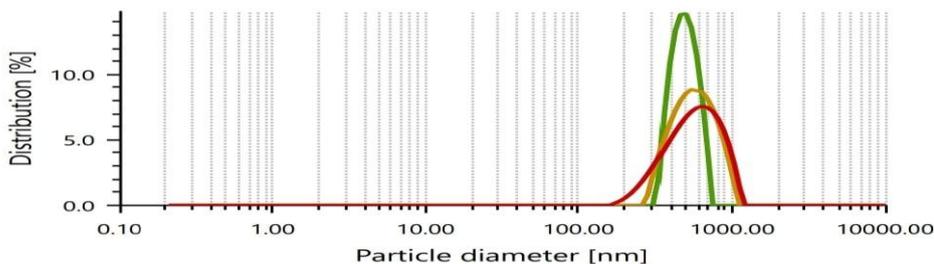


Figure 2 Graphic (Particle Size Rasa Sindhur)

Table 7 Particle Size Analysis (Result)

Name	Hydrodynamic diameter	Polydispersity index (%)	Peak 1	Peak 2	Peak3	Transmittance	Diff. Coef.
Mean value	587.3 nm	14.9	556.5nm	- [nm] (Intensity)	- [nm] (Intensity)	31.4 [%]	0.8 [$\mu\text{m}^2/\text{s}$]
St. Devi	13.17 nm	10.8	54.36nm	- [nm] (Intensity)	- [nm] (Intensity)	1.9 [%]	0.0 [$\mu\text{m}^2/\text{s}$]
Rel. St. Devi.	2.24 %	72.2	9.77%	- [%] (Intensity)	- [%] (Intensity)	5.95 [%]	2.25 [%]

Table 8 Measurements (intensity)

Name	Col our	Hydrodynamic diameter	Polydispersity index (%)	Peak 1	Peak 2	Peak3	Transmittance	Diff. Coef.
R.S 1	-----	600.1 nm	5.8	493.9 nm	(Intensity)	(Intensity)	29.9 [%]	0.8 [$\mu\text{m}^2/\text{s}$]

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R.S 2	-----	573.8 nm	12.1	584.2 nm	(Intensity)	(Intensity)	30.9 [%]	0.9 [µm ² /s]
R.S 3	-----	588.0 nm	26.9	591.5 nm	(Intensity)	(Intensity)	33.5 [%]	0.8 [%]

DISCUSSION

Discussion on Analytical Parametrs according to Ayurveda

Kajjali: The obtained *Kajjali* was black fine powder and possessed *Slakshnatva* and *Sukshmatva and Nishchandratva*.

Rasa Sindura: *Samaguna balijarita Rasa Sindhur* were obtained as brick red in colour.

Discussion on Ayurvedic Parametres

Discussion on Kajjali Parikshan: By day 3, *Kajjali* became *Varitar* and *Rekhapurna*; by day 25, it turned *Nishchadrika*—black, soft (*Mridu*), tasteless, and odorless. *Rekhapurnatva* denotes the fineness in particle size i.e., size has been reduce so as to enhance bio availability. *Nishchandratva* denote the absence of free mercury state in *Kajjali*.

Discussion on Rasa Sindhur Parikshan: Copper coin test and red-hot base confirm *Rasa Sindhur* preparation. *Nishchandratva* indicate absence of Mercury in elemental form. *Varitaratva* confirmed the fineness of the product.

Red hot appearance- Red hot appearance of the bottom of *Kachkupi* indicative of complete product formation.

Discussion on Modern Parametres

Physical-Chemical Analysis

Discussion on pH: pH of *Samaguna Kajjali* and *Samaguna balijarita Rasa sindhur* was 5.87 indicating mild acidic nature of the sample and

absorption of *Samaguna balijarita Rasa sindhur* may be easy.

Discussion on Ash value : Ash value of *Samaguna balijarita Rasa sindhur* were 0.27%.

Discussion on Acid insoluble ash: Acid insoluble ash value of *Samaguna balijarita Rasa sindhura* is 0.15%.

Discussion on Loss on drying at 110 °C: The test is used to detect the moisture and volatile content in the sample. Loss on drying value of *Samaguna balijarita Rasa Sindhur* was 0.02% respectively.

Discussion on Water insoluble Ash: Water insoluble ash analysis of *Samaguna Balijarita Rasa Sindhur* was 0.12%.

Discussion on Essay of Elements: ICP-MS and Gravimetric analysis of *Rasa Sindhur* show free Hg: 95.31%, S: 12.96% present in sample.

Discussion on Particle size Determination of Rasa Sindhur:

Importance: A precise PSD ensures consistent drug performance, influencing dissolution rates, absorption, and therapeutic effectiveness. Optimal PSD enhances drug stability, ensuring uniformity in dosage delivery and shelf-life.

Particle size distribution of *Rasa Sindhur* mean average size of particles found 587.3nm and distribution of particles are in between 573.8 to 600.1 nm.

Discussion on XRD Of Rasa Sindhur: -

- The *Rasa sindhur* was identified as

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Mercuric sulphate with crystalline shape and structure.

- Sharp peaks observed that major compounds as mercuric sulphate of majorly at 100 % intensity on 31.62, 2 theta value.

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