

Pharmaceutico-Analytical Study of Chandrasahasa Rasa - A Unique Formulation

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ABSTRACT

Ayurveda is one of the oldest systems of medicine, is momentous in audience of worldwide on virtue of its holistic approach of life.

Rasaushadhis in *Ayurveda* have a wide range of therapeutic utility due to their prolonged shelf life, finer particles size, being tasteless, odourless, minimum dose, quick action, makes them more effective and unique. With proper *anupana*, herbo-mineral formulations act effectively in a variety of pathological conditions.

Jwara is considered as *Rogadhipati* i.e., most serious and king of all diseases in which the mind, sense organs and the body all are affected (*Dehendriya mana santapakara*).

Chandrasahasa Rasa (CR) is an unique herbo mineral *Kharaliya Rasayana* mentioned in *Vaidya Chintamani* of 16thAD constituting 14 ingredients with 5 *bhavana dravyas* which is solely indicated in *Ashta vidha Jwara* and 13 *Sannipataja Jwara*.

Physical test shows CR is Greenish Brown in colour with pH 4.56±0.10 and Mean particle size of CR is 639.8 nm. XRD study compared with 2θ angle and JCPDF standards and confirms that CR is a compound of Metacinnabar in cubic crystal system, Sulphur in Orthorhombic crystal system, Arsenic di sulphide and Sodium hydroxide borate hydrate are Monoclinic crystal system. Elements present in CR as confirmed by the EDS study are C, O, Na, S, Cl, K, As, and Hg in the Weight percentage of 49.95, 26.45, 0.76, 10.38, 0.29, 4.38, 2.64 and 5.15 respectively.

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KEYWORDS: *Chandrasahasa Rasa, Kharaliya Rasayana, Sannipataja Jwara, Triguna Kajjali, Vaidya Chintamani*

INTRODUCTION

Ayurveda is not merely a science of diseases and drugs, where it has every aspect of life in its sphere. *Ayurveda* has used metals and minerals in abundance for a long time. These herbo-mineral combinations are given paramount importance in treatment, where metals and minerals are used in the form of *Rasaushadhis*. *Jwara* is considered as dreadful disease or associated symptom in many diseases. No person ever lived without getting affected from *Jwara* once in a lifetime. Hence it is considered as *Rogadhipati* i.e., most serious and King of all diseases.

Chandrasahasa Rasa^[1] is a unique herbo mineral *Kharaliya Rasayana* mentioned in *Vaidya Chintamani* of 16th AD constituting 14 ingredients such as *Triguna Kajjali*, 2 *Kshara dravyas* (*Tankana*,

Surya Kshara), 2 *Visha dravyas* (*Vatsanabha, Jayapala*), *Manahshila* and other herbal drugs such as *Trikatu* (*Shunti, Maricha, Pippali*), *Ela, Lavanga, Jatiphala* with 5 *bhavana dravyas* (*Jambhira Swarasa, Bhringaraja Swarasa, Nirgundi Swarasa, Nagavalli swarasa and Triphala Kashaya*) is solely indicated in *Ashta vidha jwara* and 13 *Sannipataja jwara*. Though there are 'n' number of formulations for fever, in present scenario it has been seen many new diseases are arising along with association of fever, some are even fatal, so it needs a special attention. Before subjecting to invitro or in vivo study, we require in detail Pharmaceutico- analytical study of the formulation. So, it was thought worthwhile to undertake such study.

AIMS AND OBJECTIVES**Aim:**

Preparation of *Chandrasahasa Rasa* and to carry out their Pharmaceutico-analytical study.

Objectives:

- Preparation of *Chandrasahasa Rasa* according to classical method mentioned in *Vaidya chintamani* with due importance to SOP.
- To carry out Physico-chemical analysis of *Chandrasahasa Rasa*.

MATERIALS AND METHODS

- Raw materials were collected after authoritative identification through *grahya-agrahya lakshanas* from Bharat Trading Company, Mumbai and Kalva acchaiah, Ballari.
- Preparation of *Chandrasahasa Rasa* were done in Dept of PG Studies in RS&BK, Taranath Government Ayurvedic Medical college, Ballari
- Physico- Chemical analysis were done at Quality Control Laboratories, ALN Rao Ayurvedic Medical College, Koppa and Micro and Nano Characterization Facility (MNCF), Centre for Nano Science & Engineering (CeNSE) Indian Institute of Science, Bengaluru-560012, Karnataka, India

Preparation of Chandrasahasa Rasa

- Raw materials were collected after authoritative identification through *grahya-agrahya lakshanas*.

- *Hingulottha Parada* was collected form *Hingula* through *urdhwapatana method*^[2].
- *Hingula Shodhana* was carried out by *bhavana* with *ardraka swarasa* as media for 7 times^[3].
- *Gandhaka Shodhana* was carried out in *kurmaputa* by *Bhudhara yantra* method with *godugdha* as media^[4].
- *Nirmanana* of *Triguna Kajjali*^[5] was prepared by *mardana* for 124 hours.
- *Vatsanabha Shodhana* was carried out by *sthapana* in *Gomutra* under *atapa* for 3 days^[6].
- *Tankana Shodhana* was carried out by *Bharjana* in *loha paatra*^[7].
- *Manahshila Shodhana* was carried out by *Bhavana* with *Ardraka swarasa* for 7 times^[8].
- *Suryakshara Shodhana* was carried out by *Bhavana* with *Ela toya* for 3 times^[9].
- *Jayapala Shodhana* was carried out by *Swedana* with *Godugdha* in *dolayantra* for 3 hours.^[10]
- Homogenous mixture of all the ingredients with *Triguna Kajjali* was done and *bhavana* with *Jambhira swarasa*, *Bhringaraja Swarasa*, *Nirgundi Swarasa*, *Nagavalli Swarasa* and *Triphala Kashaya* was done and 3 samples – *Triguna Kajjali*, BCR (Before Bhavana of *Chandrasahasa Rasa*) and CR (*Chandrasahasa Rasa*) was sent for analytical test.

RESULTS**1. Pharmaceutical Results:****Table no. 1: Showing results from *Hingulottha Parada***

Batch	Wt of <i>Hingula</i> taken for <i>urdhwapatana</i>	Wt of <i>Parada</i> obtained	Yield %
Batch I	250gm	160gm	77.80
Batch II	250gm	173gm	

Table no. 2: Showing results from *Hingulottha Parada Shodhana*

Wt of <i>Ashoditha Parada</i> taken	Wt of <i>Shoditha Parada</i>	Yield %
333g	315g	94.59

Table no. 3: Showing results from *Gandhaka Shodhana*

Wt of <i>Gandhaka</i> taken	Wt of <i>Shoditha Gandhaka</i> obtained	Loss	Yield %
500 g	476 g	24gm	81
476g	428g	48gm	
428g	405g	23gm	

Table no. 4: Showing results from *Vatsanabha Shodhana*

Wt of <i>Ashodita Vatsanabha</i> taken	Wt of <i>Shodhita Vatsanabha</i> obtained after drying & peeling	Loss	Yield %
100gm	52gm	48gm	52

Table no. 5: Showing results from Hingula Shodhana

No of bhavana	Quantity of Hingula taken	Quantity obtained	Gain/Loss	Yield %
1	315g	317g	2g Gain	110.47
2	317g	340g	23g Gain	
3	340g	317g	23g Loss	
4	317g	326g	9g Gain	
5	326g	334g	8g Gain	
6	334g	332g	2g Loss	
7	332g	348g	16g Gain	

Table no. 6: Showing results from Suryakshara Shodhana

Wt of Suryakshara taken	Wt of Shodhita Suryakshara obtained	Gain/Loss	Yield %
518 g	537 g	19gm Gain	104.6
537g	557g	20gm Gain	
557g	542g	15gm Loss	

Table no. 7: Showing results from Jayapala Shodhana

Wt of Jayapala taken	Wt of Shodhita Jayapala obtained	Loss	Yield %
100 g	50 g	50gm	45
50g	47.5g	2.5gm	
47.5g	45g	2.5gm	

Table no. 8: Showing results from Manahshila Shodhana

No of bhavana	Quantity of Manahshila taken	Quantity obtained	Gain/Loss	Yield %
1	495g	522g	27g Gain	114.14
2	522g	548g	26g Gain	
3	548g	565g	17g Gain	
4	565g	585g	20g Gain	
5	585g	557g	28g Loss	
6	557g	594g	37g Gain	
7	594g	565g	29g Loss	

Table no. 9: Showing results from Tankana Shodhana

Wt of Ashodita Tankana taken	Wt of Shodita Tankana obtained	Loss	Yield %
254gm	151gm	103gm	59.44

Table no. 10: Showing results from preparation of Triguna Kajjali

Wt of Parada	Wt of Gandhaka	Wt of Kajjali obtained	Yield %
125gm	375gm	406gm	81.2

Table no. 11: Showing results from Churnikarana of Chandrasasa Rasa Drugs

Name of Drug	Initial weight	Weight after Churnikarana	Loss	% of Yeld
<i>Shoditha Vatsanabha</i>	52gm	40gm	12gm	76.92
<i>Maricha</i>	70gm	54gm	16gm	77.14
<i>Pippali</i>	70gm	53 gm	17 gm	75.71
<i>Shunti</i>	70gm	56.5 gm	13.5 gm	80.71
<i>Lavanga</i>	30gm	20 gm	10 gm	66.66
<i>Ela</i>	60gm	32 gm	28 gm	53.33
<i>Jatiphala</i>	30gm	22 gm	8 gm	73.33
<i>Shoditha Jayapala</i>	45gm	37 gm	8 gm	82.22

Table no. 12: Showing results from Bhavana of ingredients of Chandrasasa Rasa

Bhavana Dravya	Quantity of Homogenous mixture of ingredients taken	Quantity obtained	Gain/Loss	Yield %
<i>Nimbu Swarasa</i>	310g	401g	91g Gain	123.22
<i>Bhringaraja Swarasa</i>	401g	365g	36g Loss	
<i>Nirgundi Swarasa</i>	365g	390g	25g Gain	
<i>Nagavalli swarasa</i>	390g	395g	5g Loss	
<i>Triphala Kashaya</i>	395g	382g	13g Loss	

2. Analytical Results

Table no. 13: Showing Results of Organoleptic characters of *Triguna Kajjali*, BCR and CR

Physical test	<i>Triguna Kajjali</i>	BCR	CR
Colour	Black	Greyish Brown	Greenish Brown
Odour	Odourless	Characteristic	Characteristic
Taste	Tasteless	Pungent, Bitter	Bitter, Astringent
Touch	Fine	Fine	Fine

Table no. 14: Showing Results of Physical tests of *Triguna Kajjali*, BCR and CR

Parameter	<i>Triguna Kajjali</i>	BCR	CR
pH(10 % Aqueous Solution)	6.25±0.10	8.65±0.10	4.65±0.10
Total Ash value	0.04%	24.43%	23.40%
Acid insoluble ash	Nil	3.32%	2.42%
Water soluble ash	Nil	4.13%	4.29%
Loss on drying at 105°C	0.67%	1.32%	3.91%
Alcohol Soluble Extractive	0.33%	14.63%	21.43%
Water Soluble Extractive	0.01%	26.05%	35.32%

Table no. 15: Showing Total Microbial Count of *Triguna Kajjali*, BCR and CR

Parameters	<i>Triguna Kajjali</i>	BCR	CR
Total aerobic count	Nil	Nil	Nil
Total fungal count	Nil	Nil	Nil

Table no. 16: Showing the Results of Chemical tests of *Triguna Kajjali*, BCR and CR

Elements	<i>Triguna Kajjali</i>	BCR	CR
Total Mercury	60.50%	26.15%	19.34%
Mercurous Mercury	1.90%	0.30%	0.29%
Mercuric Mercury	58.25%	25.85%	19.05%
Free Mercury	0.35%	0.00%	0.00%
Total Sulphur	25.25%	22.18%	21.82%
Sulpide	22.50%	21.15%	21.24%
Sulphite	2.65%	1.03%	0.52%
Sulphate	0.10%	0.10%	0.06%
Free sulphur	0.02%	0.00%	0.00%
Arsenic	-	2.08%	1.55%
Boron	-	2.04%	1.85%

Table no. 17: Showing XRD results of *Triguna Kajjali*

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

Table no. 18: Showing XRD results of BCR

Sample	Compound Name	Chemical Formula	Crystal Structure
BCR	Metacinnabar	HgS	Cubic
	Sulphur	S	Orthorhombic
	Arsenic disulphide	As ₂ S ₂	Monoclinic
	Sodium hydroxide borate hydrate / Tincalconite	Na ₂ B ₄ O ₇ 5H ₂ O	Monoclinic

Table no. 19: Showing XRD results of CR

Sample	Compound Name	Chemical Formula	Crystal Structure
CR	Metacinnabar	HgS	Cubic
	Sulphur	S	Orthorhombic
	Arsenic disulphide	As ₂ S ₂	Monoclinic
	Sodium hydroxide borate hydrate / Tincalconite	Na ₂ B ₄ O ₇ 5H ₂ O	Monoclinic

Table no. 20: Showing SEM EDS result of *Triguna Kajjali* of two spectrum focused at two distinct areas from Low (10 μ m) to High (30 μ m) magnification

Triguna Kajjali					
Spectrum – 1 (Magnification - 30 μ m)			Spectrum – 2 (Magnification - 10 μ m)		
Element	Weight %	Atomic %	Element	Weight %	Atomic %
C	23.67	57.16	C	5.18	25.75
S	41.85	37.86	O	1.50	5.61
Hg	34.48	4.99	S	26.13	48.65
			Hg	67.19	20.00

Table no. 21: Showing SEM EDS result of BCR of two spectrum focused at two distinct areas from Low (10 μ m) to High (30 μ m) magnification

BCR					
Spectrum – 1 (Magnification - 30 μ m)			Spectrum – 2 (Magnification - 10 μ m)		
Element	Weight %	Atomic %	Element	Weight %	Atomic %
C	52.00	63.41	B	8.99	12.88
O	34.95	31.99	C	30.62	39.49
Na	2.04	1.30	N	2.63	2.91
Mg	0.46	0.28	O	37.44	36.25
P	0.47	0.22	Na	3.31	2.23
S	1.76	0.89	K	14.35	5.69
Cl	1.21	0.50	As	2.65	0.55
K	2.24	0.84	B	8.99	12.88
Ca	0.61	0.22			
As	0.96	0.19			
Hg	3.30	0.24			

Table no. 22: Showing SEM EDS result of CR of two spectrum focused at two distinct areas from Low (10 μ m) to High (30 μ m) magnification

CR					
Spectrum – 1 (Magnification - 30 μ m)			Spectrum – 2 (Magnification - 10 μ m)		
Element	Weight %	Atomic %	Element	Weight %	Atomic %
C	49.95	65.49	B	9.42	14.77
O	26.45	26.04	C	20.54	28.97
Na	0.76	0.52	O	39.58	41.92
S	10.38	5.10	Na	3.79	2.80
Cl	0.29	0.13	K	26.66	11.55
K	4.38	1.77			
As	2.64	0.56			
Hg	5.15	0.40			

Table no. 23: Showing Particle Size of *Triguna Kajjali*, BCR and CR

Sample	Mean diameter(nm)
<i>Triguna Kajjali</i>	2974.6
BCR	501.6
CR	639.8

Table no. 24: Showing FTIR Peaks of *Triguna Kajjali*

Sample peaks Cm ⁻¹	Bond	Functional groups
3670.81, 3335.93	O-H (free)	Alcohol
3335.93	N-H	Primary amine, Aliphatic Primary amine, Secondary amine
2922.10, 2852.09	O-H (weak) stretch	Alcohol
2922.10, 2852.09	O-H	Carboxylic Acid
	N-H	Amine Salt
	C-H	Alkane
1730.54, 1637.03	C-H	Aromatic compound

1730.54	C=O (strong)	Conjugated anhydride, Aldehyde
1637.03	C=C (medium)	Alkene, Conjugated alkene
1308.62	N-O	Nitro Compound
1308.62, 1144.69, 1016.39	C-F	Fluro Compound
1144.69	S=O	Sulfone
	C-O	Tertiary alcohol, aliphatic ether
818.82, 760.60, 688.43	C=C	Alkene
818.82	C-Cl	Halo Compound
	C-H	1,2,4- trisubstituted
	C-H	1,4 disubstituted or 1,2,3,4 - tetrasubstituted
760.60	C=H	1,3 - disubstituted
688.43	C-Br	Halo compound.
	C-H	1,2,3- trisubstituted

Table no. 25: Showing FTIR Peaks of BCR

Sample peaks Cm^{-1}	Bond	Functional groups
3343.19	O-H (strong) intermolecular bonded	Alcohol
	N-H (medium)	Aliphatic primary amine, Secondary amine
2918.68, 2851.78	C-H (medium)	Alkane
	N-H (strong)	Amine salt
	O-H (strong)	Carboxylic acid
	O-H (weak)	Alcohol
1736.65	C-H(weak), bending	Aromatic compound
	C=O (strong), stretching	Conjugated anhydride, Esters, δ - Lactone, Aldehyde
1638.06	N-H (medium), bending	Amine
	C=C (strong), stretching	Alkene (Monosubstituted)
	C=C (medium) stretching	Alkene (disubstituted), Conjugated alkene
1430.61	C-H(medium)bending	Alkane (methyl group)
	O-H(medium) bending	Carboxylic acid
1340.12	N-O(strong) Stretching,	Nitro compound
	O-H(medium)bending	Alcohol
1340.12, 1272.19, 1252.83, 1128.76, 1076.08	C-F(strong)Stretching	Fluro compound
1272.19, 1252.83	C-O(strong)Stretching	Aromatic ester, Alkyl aryl ether
1272.19	C-N(strong) Stretching	Aromatic amine
1128.76	C-O(strong) Stretching	Tertiary alcohol, Aliphatic ether
	S=O(strong)Stretching	Sulfone
1128.76, 1076.08	C-N(medium)stretching	Amine
1076.08	C-O(strong)stretch	Primary alcohol
994.52	C=C(strong), bending	Alkene (mono substituted)
822.07	C=C (medium) bending	Alkene(trisubstituted)
	C-H(strong) bending	1,4-disubstituted or 1,2,3,4-tetra substituted,
	C-Cl(strong)stretching	1,2,4 – trisubstituted Halo compound
771.00	C-H(strong) bending	1,2,3- trisubstituted,
		1,2- disubstituted
		1,3- disubstituted
706.37	C-H (strong)bending	Mono substituted benzene derivative, 1,3- disubstituted
1076.08	C-O(strong)stretch	Primary alcohol

Table no. 26: Showing FTIR Peaks of CR

Sample peaks Cm^{-1}	Bond	Functional groups
3284.78	O-H (strong) stretching N-H (medium) stretching C-H (strong) stretching	Alcohol, Carboxylic acid Aliphatic primary amine Alkyne
2917.49, 2851.16	O-H (strong) stretching O-H (weak) stretching N-H (strong) stretching C-H (medium) stretching	Carboxylic acid Alcohol Amine salt Alkane
1729.02	C-H (weak) bending C=O (strong) stretching	Aromatic compound Conjugated anhydride, Aldehyde, α , β -unsaturated ester
1632.82	N-H (medium) bending C=C (medium) stretching	Amine Cyclic alkene, Conjugated alkene, alkene (disubstituted)
1515.74	N-O (strong) stretching	Nitro compound
1379.98, 1252.65, 1016.74	C-F (strong) stretching	Fluro compound
1379.98	C-H (medium) bending O-H (medium) bending	Alkane (methyl group) Alcohol, Phenol
1252.65	C-O (strong) stretching	Aromatic ester, Alkyl aryl ether
824.39	C-Cl (strong) stretching C=C (medium) bending C-H (strong) bending	Halo compound Alkene (trisubstituted) 1,2,4 – trisubstituted, 1,4-disubstituted or 1,2,3,4-tetra substituted
768.02	C-H (strong) bending	1,2- disubstituted 1,2,3-trisubstituted Mono substituted benzene derivative 1,3- disubstituted

Table no. 27: Showing TLC results with Rf values

Rf Values	Kajjali	BCR	CR
0.02	----	Dark Green	----
0.03	----	Fluorescent Green	Bright Fluorescent Green
0.12	----	Fluorescent Green	----
0.17	----	----	Blue
0.23	----	----	Blue
0.26	----	Fluorescent Green	Blue
0.32	----	Fluorescent Green	Fluorescent Green
0.35	----	----	Fluorescent Green
0.41	----	Fluorescent Blue	Fluorescent Blue
0.44	----	Fluorescent Green	Fluorescent Green
0.53	----	----	Fluorescent Green
0.64	----	Fluorescent Blue	Fluorescent Blue
0.67	----	Fluorescent Green	Fluorescent Green
0.79	----	Bright Fluorescent Blue	Bright Fluorescent Blue
0.83	----	Fluorescent Blue	----

DISCUSSION

- *Hingulottha Parada* - Mechanical trituration along with acidic media converts *Hingula* into finer particles and helps in sublimation, Citric acid helps in disintegration of HgS , Organic acid is responsible to weaken the bond and hence facilitates dissociation of mercury.
- *Hingula* when triturated with *Ardraka swarasa*, the active constituents like Gingerdiols,
- gingerols, shogaols etc, may unite to form different co-ordinate complexes of ligands.

- *Gandhaka Shodhana* - The organic sulphur present in the protein of milk might have a role in increasing bioavailability of inorganic sulphur. Since raw milk is the commonly recommended antidote for poisoning, it might help in neutralizing the sulphur poisoning.
- *Tankana* when *bharjana* done in big iron pan, turns to bloomed, puffed form of *tankana*, this is may be due to the activated dehydration, evaporation of water molecules and may increase the concentration of Boron. Normally Borax is deca hydrate – $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ but if heated above 60°C , it gives pentahydrate $\text{Na}_2\text{B}_4\text{O}_7 \cdot 5\text{H}_2\text{O}$.
- By *Sthapana* of *Vatsanabha* in *Gomutra*, the total alkaloid content decreases, but the contents of less toxic substances such as aconine, hypoaconine, and benzyl hypoaconine increases possibly due to conversion of the toxic aconitine into aconine or hydrolysis of the alkaloids to their respective amino alcohols after *shodhana* process.
- *Manahshila Shodhana* when triturated with *Ardraka Swarasa*, the sulphur-based amino acids present in ginger juice such as cysteine and methionine act as phytochelatin, which are heavy metal-binding peptides and are suggested to detoxify heavy metals by chelation.
- By *Nirmalikarana* with Water, Potassium nitrate gets dissociates into K^+ and NO_3^- ions and by *Bhavana* with *Ela*, K^+ and Na^+ ions gets excreted due to diuretic activity and Hexane extract acts as metal chelating and as reducing agent.
- *Godugdha* was used as a detoxifying agent for *Jayapala Shodhana*. When the Croton seeds were steamed in milk, the calcium present in milk chelated with crotonic acid and Tigilic acid, active constituents of *Jayapala*. Thus, the active constituents of Croton will not be freely available in Plasma.
- *Chandrasasa Rasa* was prepared step by step, firstly 80gms of *Triguna kajjali* was taken, to it 20 gms of *Shuddha Hingula* was added and triturated for about 1hr.
- Same way other ingredients i.e 40gms of *Shuddha Tankana*, 20gms of *Shuddha Vatsanabha*, 20gms of *Shuddha Manahshila*, 40gms of *Shuddha Suryakshara*, 160gms of *Trikatu churna*, 20gms of *Lavanga churna*, 30gms of *Ela churna*, 20gms of *Jatiphala churna* and *Shuddha Jayapala churna* each was added and triturated for 1hr each respectively, until homogenous mixture was prepared.
- To the mixture of *Chandrasasa Rasa* of 415ml of *Nimbu Swarasa*, 400ml of *Bhringraja swarasa*, 400ml of *Nirgundi swarasa*, 420ml of *Nagavalli swarasa* and 410ml of *Triphala Kashaya* was added until the mixture is completely immersed in the liquid and *Bhavana* was carried out for 4 ghati (1ghati- 24min) and upto *subhavita laxanas* observed.
- **Organoleptic Characters: *Triguna Kajjali*:** The Colour of *Kajjali* was Black, fine powder and amorphous on touch, Tasteless and odourless.

BCR: The colour of BCR was Greyish brown, fine powder and amorphous on touch, Pungent, Bitter on taste with characteristic odour

CR: The colour of CR was Greenish brown, fine powder and amorphous on touch, Bitter, Astringent on taste with characteristic odour

- The pH value of *Triguna Kajjali*, BCR and CR were 6.25 ± 0.10 , 8.56 ± 0.10 and 4.65 ± 0.10 respectively. The pH of CR is around 4.65 which implies that drugs are better absorbed from stomach.
- *Triguna Kajjali*, BCR and CR were evaluated for ash value and it was found to be 0.04%, 24.43% and 23.40% respectively which indicates the presence of inorganic materials.
- Acid insoluble ash of the *Triguna Kajjali*, BCR and CR were Nil, 3.32% and 2.42% respectively. It signifies that lesser amount of silica material, dirt or sand in the sample.
- The water-soluble ash of *Triguna Kajjali*, BCR and CR were Nil, 4.13% and 4.29% respectively. It indicates that water soluble contents of the drug.
- In the present study *Triguna Kajjali*, BCR and CR are having 0.67%, 1.32% and 3.91% respectively loss on drying at 105°C . Hence it can be stated that all have very less amount of moisture content and very rare chance of bacterial and fungal growth.

- Alcohol soluble extractives of *Triguna Kajjali*, BCR and CR are 0.33%, 14.63% and 21.43% whereas, water soluble extractives are 0.01%, 26.05% and 35.32%. So, water can be preferably used as mode of administration of CR.
- Total Bacterial count and Total Fungal count are Nil; Shows no growth.
- Free mercury of *Triguna Kajjali* is 0.35%, shows proper formation of *Kajjali* and was also confirmed by *Nishchandravta*. Other 2 samples were nil, proving safety of the Product.
- *Triguna Kajjali* was in Cubic System with elemental formula HgS and Orthorhombic crystal system with elemental formula S.
- BCR was in Cubic System with elemental formula HgS, Orthorhombic crystal system with elemental formula S, Monoclinic crystal system with elemental formula As_2S_2 and $Na_2B_4O_7 \cdot 5H_2O$
- CR was in Cubic System with elemental formula HgS, Orthorhombic crystal system with elemental formula S, Monoclinic crystal system with elemental formula As_2S_2 and $Na_2B_4O_7 \cdot 5H_2O$
- In SEMEDS, Elements found in *Triguna Kajjali* are Hg, S, C, O in the percentage of 67.19%, 26.13%, 5.18% and 1.50% respectively.
- Elements found in BCR are C, O, Na, Mg, P, S, Cl, K, Ca, As, and Hg in the percentage of 52.00%, 34.95%, 2.04%, 0.46%, 0.47%, 2.76%, 1.21%, 2.24%, 0.61%, 0.96% and 3.30% respectively.
- Elements present in CR has confirmed by the EDS study are C, O, Na, S, Cl, K, As, and Hg in the Weight percentage of 49.95, 26.45, 0.76, 10.38, 0.29, 4.38, 2.64 and 5.15 respectively. Variation in the percentage of the element might have also occurred due to heterogeneous mixing of the sample.
- FTIR analysis of CR shows it contains organic functional group like Amine salt, Alkyne, Carboxylic Acid, Alcohol, Alkane, Aromatic compound, Aldehyde, Esters, Amine, Alkene, Nitro-Fluro-Halo compound, Phenol, Aromatic ester, Alkene.
- By Zeta- Pals method, Mean particle size of *Triguna Kajjali* is –2974.6 nm , BCR is – 501.6 nm and CR is 639.8 nm, lesser the particle size greater the bio availability of the drug.
- In present study TLC of the drug mixture is compared with the final product. The Rf values at 254nm, 11 peaks were identified in BCR sample and 12 peaks were identified in final product CR, which indicates that the drugs which were absent before bhavana are present in final product. As *Triguna Kajjali* is mineral products so no peaks were identified.

CONCLUSION

- *Chandrasahsa Rasa* is one such unique herbo mineral formulation mentioned in *Vaidya Chintamani* of 16thAD constituting 14 ingredients with 5 *bhavana dravyas* which is solely indicated in *Ashta vidha Jwara* and 13 *Sannipataja Jwara* by aama dosha nivarana.
- *Shodhana* of ingredients is an essential step before usage, which will modify the raw drugs into safe, bio-active, therapeutic form.
- Physical test shows CR is Greenish brown in colour with pH 4.65 ± 0.10 .
- XRD study compared with 2θ angle and JCPDF standards and confirms that CR is a compound of Metacinnabar in cubic crystal system, Sulphur in Orthorhombic crystal system, Arsenic di sulphide and Sodium hydroxide borate hydrate are Monoclinic crystal system.
- Elements present in CR has confirmed by the EDS study are C, O, Na, S, Cl, K, As, and Hg in the Weight percentage of 49.95, 26.45, 0.76, 10.38, 0.29, 4.38, 2.64 and 5.15 respectively.
- FTIR analysis of CR shows it contains organic functional group like Amine salt, Alkyne, Carboxylic Acid, Alcohol, Alkane, Aromatic compound, Aldehyde, Esters, Amine, Alkene, Nitro-Fluro-Halo compound, Phenol, Aromatic ester, Alkene.
- By Zeta- Pals method, Mean particle size of CR is 639.8 nm, lesser the particle size greater the bio availability of the drug.
- Further detailed study is required to bring out many more characteristics of this unique formulation.

FIGURES



Hingula mardana



Urdhwa Patana Yantra



Hingulottha Parada



Hingulottha Parada mardana with Haridra churna



Hingulottha Parada mardana with Haridra churna



Shodhita Gandhaka



Shodhita Vatsanabha



Shodhita Hingula



Nirmalikrita Suryakshara



Shodhita Suryakshara



Shodhita Jayapala



Shodhita Manahshila



Shodhita Tankana



Triguna Kajjali



Churnikruta Jatiphala



Churnikruta Ela



Churnikruta Lavanga



Churnikruta Trikatu



CR bhavana with Nimbuka Swarasa



CR bhavana with Bhringaraja Swarasa



CR bhavana with Nirgundi Swarasa



CR bhavana with Nagavalli Swarasa



CR bhavana with Triphala Kashaya



Final Product - Chandrasahasa Rasa

Physico-Chemical Analysis Reports

QUALITY CONTROL LABORATORIES
ALN RAU MEMORIAL AYURVEDIC MEDICAL COLLEGE
AND PG CENTRE
 KOPPA, DISTRICT: CHIKMAGALUR, KARNATAKA, 571102

Reference Number: QM/12/2023 Date: 09th August 2023

Purpose: Analysis for Kujjal, BCR and CR...

Result:

A. Organoleptic Characteristics

	Kujjal	BCR	CR
Colour	Black	Charcoal brown	Charcoal brown
Odour	Charcoal	Charcoalish	Charcoalish
Taste	Vanilla	Pragosa, bitter	Bitter, astringent
USP 2022	2022 (200802)	2022 (200802)	2022 (200802)

B. Physico-chemical parameters

	Kujjal	BCR	CR
Loss on Drying at 105°C	4.87%	1.12%	1.81%
Total ash	0.00%	26.43%	25.48%
Acid insoluble ash	NA	3.37%	2.47%
Water soluble ash	NA	4.23%	4.29%
Alcohol soluble extractive	4.13%	16.61%	21.43%
Water soluble extractive	4.81%	26.01%	19.77%
pH (10% aqueous solution)	4.25 ± 0.10	8.95 ± 0.10	4.93 ± 0.10

C. Elemental Analysis

	Kujjal	BCR	CR
Molarity	40.50%	36.17%	16.34%
Molecular Molarity	10.25%	20.80%	10.01%
Molecular Molarity	1.80%	8.80%	8.30%
Free Molarity	4.35%	4.60%	8.60%

Patron: Honourable Shri Anur Hamosh Rao
 Laboratory is not liable to bear any legal action or dispute based on this report.

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 KOPPA, DISTRICT: CHIKMAGALUR, KARNATAKA, 571102

Reference Number: QM/12/2023 Date: 09th August 2023

Purpose: Analysis for Kujjal, BCR and CR...

Result:

	Kujjal	BCR	CR
Sulphide	25.00%	22.04%	21.00%
Sulphide	22.00%	22.25%	21.24%
Sulphide	2.00%	1.00%	0.50%
Sulphide	0.00%	0.10%	0.00%
Free Sulphur	0.02%	0.00%	0.00%
Acetate	---	1.00%	1.50%
Bicarb	---	2.04%	1.81%

B. Thin Layer Chromatography
 Solvent System: Toluene: Ethyl Acetate: 7:3
 Spots were not clearly seen under visible light

Under Long UV

R _F Value	Kujjal	BCR	CR
0.02	---	Dark green	---
0.05	---	Fluorescent green	Bright fluorescent green
0.12	---	Fluorescent green	---
0.17	---	---	Blue
0.23	---	---	Blue
0.26	---	Fluorescent green	Blue
0.32	---	Fluorescent green	Fluorescent green
0.38	---	---	Fluorescent green
0.41	---	Fluorescent blue	Fluorescent blue
0.44	---	Fluorescent green	Fluorescent green
0.53	---	---	Fluorescent green
0.64	---	Fluorescent blue	Fluorescent blue
0.67	---	Fluorescent green	Fluorescent green
0.70	---	Bright Blue	B. Fluorescent blue
0.83	---	Fluorescent blue	---

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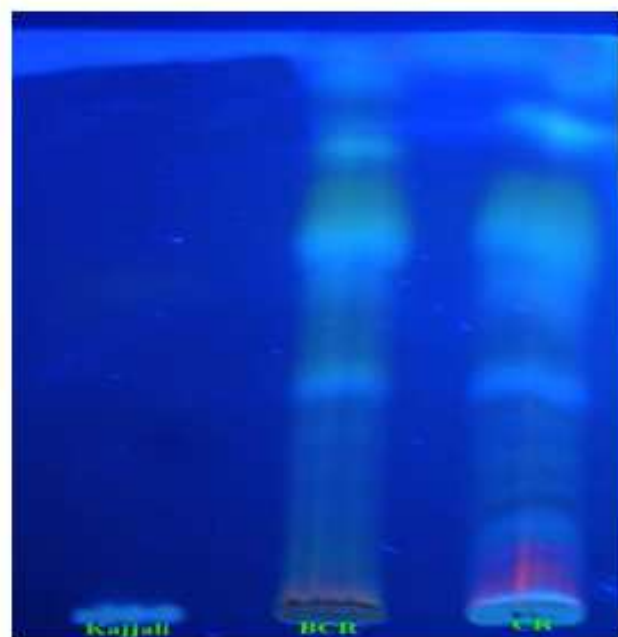
Purpose: Analysis for Kujjal, BCR and CR...

Result:

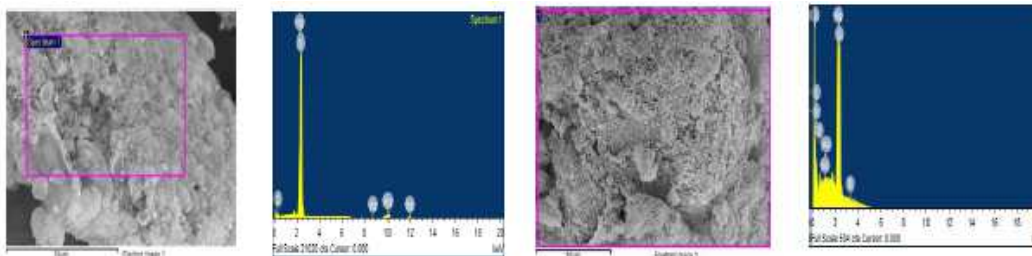
E. Microbial contamination

	Kujjal	BCR	CR
Total aerobic count	NA	NA	NA
Total fungal count	NA	NA	NA

Patron: Honourable Shri Anur Hamosh Rao
 Laboratory is not liable to bear any legal action or dispute based on this report.

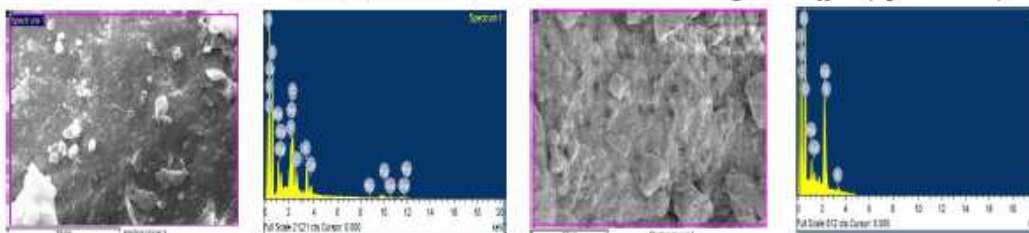


TLC findings of 3 Samples



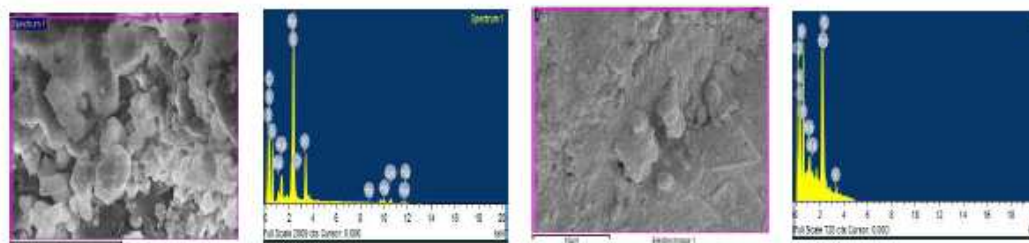
SEM-EDS of Triguna Kajjali (Spectrum -1)

SEM-EDS of Triguna Kajjali (Spectrum -2)



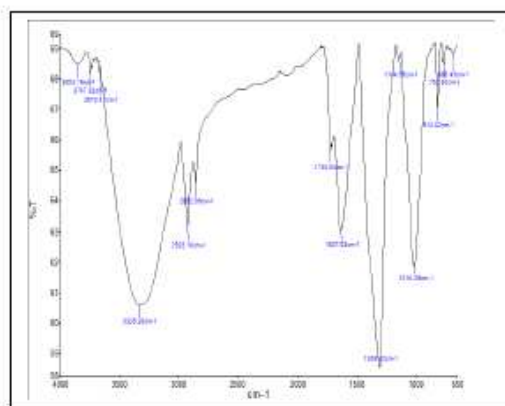
SEM-EDS of BCR (Spectrum -1)

SEM-EDS of BCR (Spectrum -2)

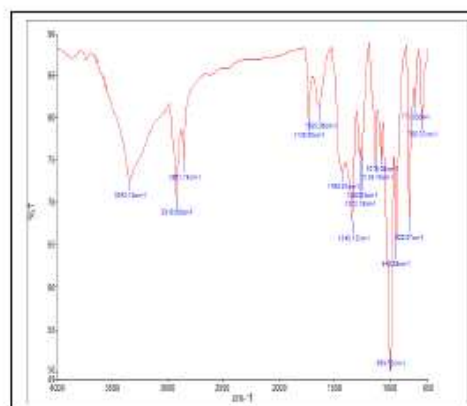


SEM-EDS of CR (Spectrum -1)

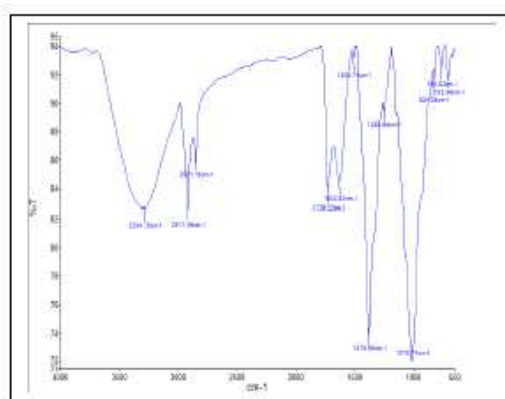
SEM-EDS of CR (Spectrum -2)



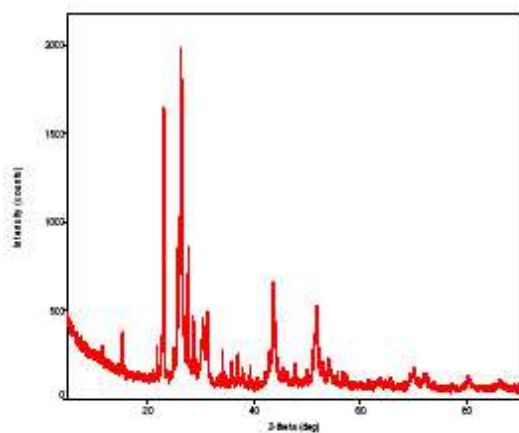
FTIR of Triguna Kajjali



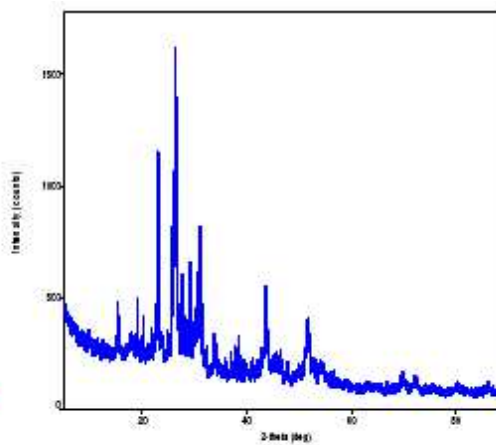
FTIR of BCR



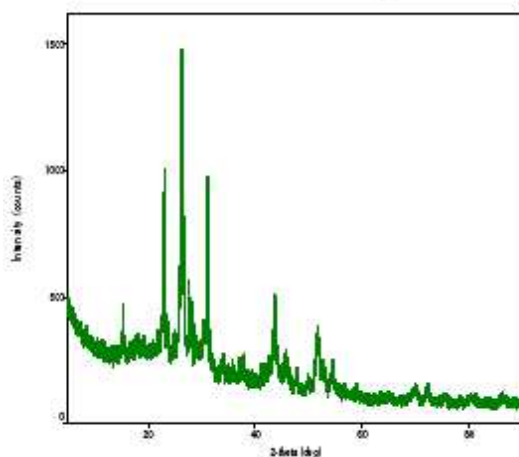
FTIR of CR



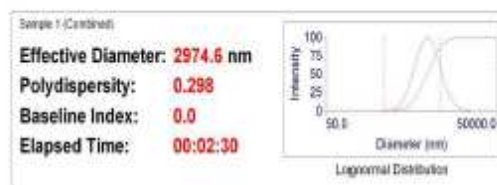
XRD Peaks of Kajjali



XRD Peaks of BCR

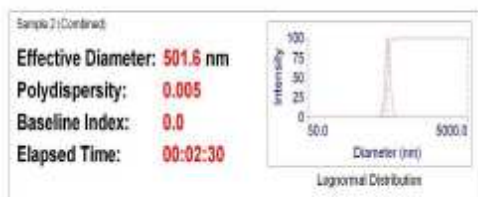


XRD Peaks of CR



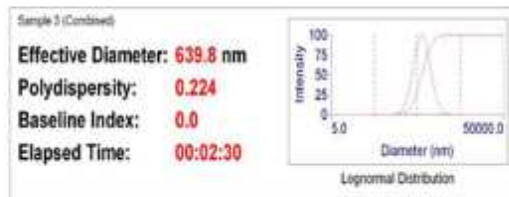
Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	3916.9	2323.1	0.352	0.0
2	3532.8	2099.8	0.383	0.0
3	3221.7	2095.2	0.423	0.0
4	2357.7	1385.5	0.297	0.0
5	2584.8	1378.8	0.319	0.0
Mean	3039.2	1828.7	0.368	0.0
Std. Error	106.8	288.8	0.021	0.0
Combined	2974.6	1822.9	0.298	0.0

Particle Size Analysis of Triguna Kajjali



Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	483.2	32.8	0.003	0.0
2	544.8	26.5	0.005	0.0
3	529.8	88.8	0.005	0.0
4	504.8	159.8	0.003	0.0
5	475.8	33.0	0.003	0.0
Mean	503.0	72.4	0.020	0.4
Std. Error	13.2	25.4	0.010	0.4
Combined	501.6	29.5	0.005	0.0

Particle Size Analysis of BCR



Run	Eff. Diam. (nm)	Half Width (nm)	Polydispersity	Baseline Index
1	854.7	307.1	0.224	0.7
2	814.3	247.8	0.183	0.5
3	823.1	332.5	0.288	0.5
4	872.8	375.4	0.311	0.5
5	812.7	293.8	0.230	0.5
Mean	831.0	312.4	0.247	0.8
Std. Error	11.2	21.5	0.027	0.8
Combined	639.8	303.0	0.224	0.0

Particle Size Analysis of CR

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