



Research Article

PHARMACEUTICAL ANALYTICAL STUDY OF *KAMPAVATARI RASA* - AN AYURVEDIC HERBO MINERAL FORMULATION

Patil Rohan¹, Yaranal Reshma Prakash^{2*}, Dindore Pallavi³

¹Lecturer, Department of Rasashastra and Bhaishajya kalpana, Late Kedari Redekar Ayurvedic Mahavidyalaya, Shendri Mal Gadhinglaj, Kolhapur, Maharashtra, India.

^{2*}Lecturer Department of Rasashastra and Bhaishajya kalpana, Gomantak Ayurvedic Mahavidhyalaya and Research Centre, Shiroda, Goa, India.

³Ex Professor P.G.Dept of Rasashastra, K.L.E.University's Shri BMK Ayurveda Mahavidyalaya, Shahapur, Belgaum, Karnataka, India.

ABSTRACT

Kampavatari Rasa (KVR) is a unique Ayurvedic herbo- mineral formulation mentioned in the classics *Rasa Raj Sundar* in *Vata vyadhi* and indicated mainly in *Kampavata* which resembles Parkinson's disease. The line of treatment in *Ayurveda* is to combat *Vata dosha* and to sustain neuronutrition by *Rasayana* remedies, which can be achieved by *Kampavatari Rasa* with its properties like *Tridosha shamaka* and *Rasayana*. The present study was executed to establish a finger print for this unique formulation which can be used further for drug standardization. *Kampavatari rasa* is prepared by triturating *Tamra bhasma* and *Rasa Sindura* in equal quantity with *Katuki swaras* (*Picrohiza kurroa*) for 21 times. Each ingredient was prepared according to the norms of *Ayurvedic* classical texts. Raw drugs were selected on bases of *Grahya lakshana* and its percentage. To ensure the proper preparation of *Tamra bhasma*, standard tests (*Bhasma Pariksha*), XRD, NPST and SEM were carried and for *Rasa sindura* NPST test and XRD were employed. After been complied these tests KVR was prepared and subjected for physico chemical analysis and quantitative analysis of Mercury, Sulphur and Copper by ICPAES. The study of *Kampavatari Rasa* revealed that its Loss on Drying - 3.4%, Total Ash - 48 %, Acid insoluble ash -13%, water soluble ash - 9.5%, Hardness test was 7kg/cm² and Tablet disintegration test 14/min which are within the normal limits and ICP - AES shows the percentage of Copper 20.51, Sulphur 8.9, and Mercury 20.43. This is the first study to establish the characterization of *Kampavatari rasa*.

KEYWORDS: *Kampavatari Rasa*, *Tamra Bhasma*, *Rasa Sindura*, *Katuki*, ICPAES.

INTRODUCTION

Ayurveda (knowledge of life), the science of longevity, is one of the most ancient forms of medicine that is said to have originated from *Lord Dhanvantri*, the physician of Gods. In this science, preparations involving heavy metals called *Bhasmas* (ash) are very common. These metals in combination with the constituents of herbs are said to form an effective combination in disease management and treatment¹, they are called as *Rasaushadhis* which are well known for their rapid action, small drug dose and having great efficacy.² This *Rasa kalpas* are prepared into different dosage forms like *Khalvi Rasayana*, *Parpati*, *Pottali* & *Kupipakwa Rasayana*, among this *Khalvi Rasayana* are used more above 80%.³ *Kampavatari Rasa* is a such formulation which include this type of dosage form mentioned in classics *Rasa Raj Sundar* mainly indicated in the *Kampavata*⁴. *Kampavata* is one of the *Nanatmaja vata vyadhi* termed as *Vepathu* mentioned by *Acharya Charaka*⁵, having main symptom like *Kampa*. *Kampavata* resembles PD and because of its crippling nature and non availability of curative treatment this disease has remained a great problem in the society⁶. The line of treatment mentioned in *Ayurveda* is to combat *Vata dosha* and sustain neuronutrition by *Rasayana* remedies, which can be achieved by this formulation having the main

ingredient *Tamra bhasma* which is *Tridosha shamaka*, and *Rasa sindura* as a best *Rasayana*. Since these preparations are sustaining themselves since centuries in clinical use, therefore one cannot exclude its use as it contains heavy metals which are considered toxic by contemporary science. Proper documentation is the demand of time to validate the claims about this metallic preparations⁷. The technological development and apprehensions of modern science obligated the patients and physicians to be watchful about the quality assurance, safety and efficacy of the medicine. Hence it is the need of the hour to produce fingerprints for quality medicines⁸. Many researchers have analyzed the metal and mineral-based individual *Bhasmas* and required to develop fingerprints for the compound formulations also. But till date no scientific work has been carried out on selected formulation *Kampavatari Rasa* with respect to physicochemical characterization, which is essential for drug standardization so study has been selected.

MATERIALS AND METHODS

Material

Raw material *Tamra patra*, *Parada*, *Gandhaka*, and *Navasadar* and other associated drugs are collected on

bases of their *Grahya lakshnas* form market and authenticated from the CRF KLE University BMK Ayurvedic Mahavidyalaya. And send for elemental assay in % at BTH Bangalore.

Pharmaceutical study carried out at Department of *Rasa shastra* KLE B.M.K. Ayurveda Mahavidhyalaya Research centre, analytical study were carried out at CRF K.L.E. University B.M.K. Ayurvedic Mahavidyalaya Research centre, IIT POWAI Mumbai, and Shivaji University Kolhapur.

Methods

Kampavatari rasa contain mainly *Tamra Bhasma*, *Rasa Sindura* and *Katuki (Picrohiza kurroa)*. The pharmaceutical study is carried out under following steps.

Rasa sindura

- A. *Shodhan* of *Parada*⁹
- B. *Shodhana* of *Gandhaka*¹⁰
- C. *Samaguna Kajjali* preparation¹¹
- D. *Shodhana* of *Navasadar*¹²
- E. Preparation of *Rasa Sindura*¹³ in Electric Muffle Furnance

For the preparation of *Rasa Sindura*, *Nimbu swaras Bhavita Kajjali* (black sulfide of mercury, wet-triturated with fresh juice of *Citrus Limon*) added *Navasadar* triturated well and was filled in a beer bottle wrapped by seven layers of clay and cloth. It was subjected to mild (250°C) moderate (250-450°C) and severe (650°C) heat through vertical electric muffle furnace. Total duration of heating was 24 hours. *Rasa Sindura* thus obtained was collected in the form of sublimate at the neck of the bottle and analyses were done.

- 1. *Tamra Bhasma*
 - A. *Samanya shodhana* of *Tamra*¹⁴
 - B. *Vishesh shodhana* of *Samnya shodhita Tamra*¹⁵
 - C. *Marana* of *Tamra*¹⁶

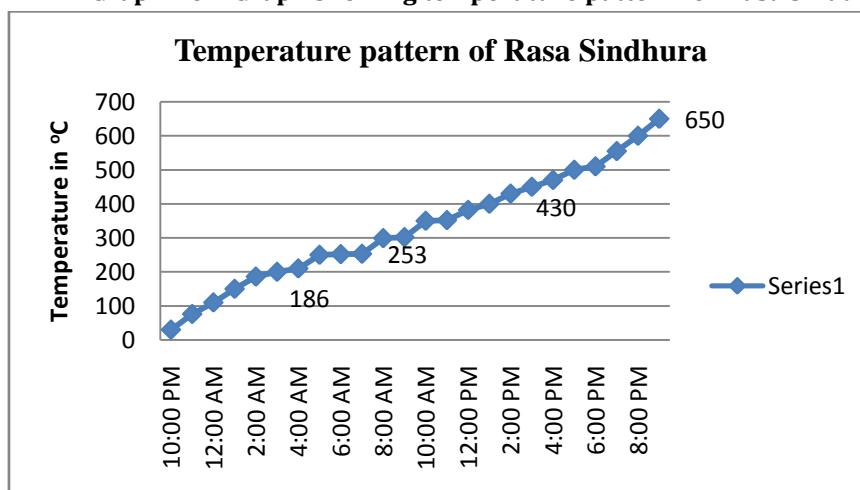
RESULTS

Pharmaceutical results

Table 1: Showing the results of *Rasasindura*

Batch	<i>Kajjali</i>	<i>Shodhita Navasadar</i>	<i>Nimbu Swaras</i>	Weight of <i>Rasa Sindura</i> obtained
1	100g	12.5 g	25 ml	38.4 g
2	100g	12.5 g	20 ml	36.8 g

Graph No1. Graph showing temperature pattern for *Rasa Sindura*



D. *Amritikarana* of *tamra Bhasma*¹⁷

For *Samanya shodhan Kantaka vedhi Tamra patra* was taken and heating and quenching done in media *Tail, Takra, Gomutra, Kanji* and *Kulatha kwath* each for 7 times. Then its *Dola yantra swedan* for 6 hrs had done in the *Gomutra* with *Saindhava* for its *Vishesh shodhana*. For *Marana* process it is subjected for *Gajaputa* by adding *Kajjali* and *Bhavana* of *Nimbu swaras*. Total 8 *Putra* have been given till the *Bhasma siddhi lakshana* are achieved. After the tests complies it processed for *Amritikarana* by giving *Panchamruta bhavana* to the *Tamra bhasma* and *Shudha Gandhaka* and subjecting *Gaja puta*, same procedure repeated for 3 times as per reference.

- 2. Preparation of *Katuki swaras* according to *Sharangadhara Samhita*¹⁸

Dry *Katuki* made into coarse powder and 8part water added and reduced to 1/4th quantity by heating. Then it is filtered and used for *Bhavana*.

- 3. Preparation of *Kampavatari rasa* according to the *Rasa Raj Sundhara*¹⁹

Equal quantity of *Tamra bhasma* and *Rasa sindura* taken in the *Khalva yantra* and triturated by adding *Katuki swaras* and dried so procedure of triturating by adding *Katuki swaras* done for 21 times and finally rolled into *Vati* form dried under shed and packed in the air tight container.

Analysis of *Tamra bhasma*, *Rasa Sindura* and *Katuki* were carried out at CRF KLE University B.M.K. Ayurvedic Mahavidhyalaya, Belguem. XRD of *Tamra Bhasma* and *Rasa Sindura* at Shivaji University. Particle size estimation of *Tamra Bhasma* by SEM at IIT Powai Mumbai.

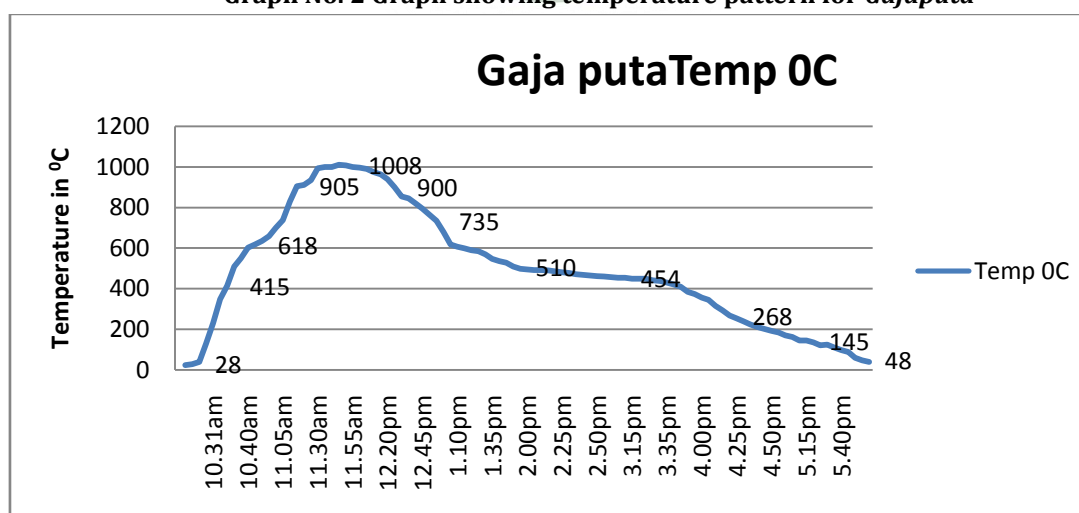
The physico chemical analysis of *Kampavatari Rasa* is carried out at CRF KLE University BMK Ayurvedic Mahavidhyalaya and quantitative analysis of Hg, S and Cu by ICPAES is carried out at IIT Powai Mumbai.

Table 2: Showing the weight variations during the procedures *Shodhana*, *Marana* and *Amritikarana* of *Tamra*

Sr. No.	Observations	Tamra Patra (in gm)
1	Wt before <i>Samanya shodhan</i>	200
2	Wt after <i>Samanya shodhan</i>	129
3	Loss	71
4	Wt. after <i>Vishesh shodhan</i>	115
5	Loss	14
6	Wt of sh. <i>Tamra</i> before <i>Marana</i>	110
7	Wt of <i>Tamra bhasma</i> after 8 th <i>puta</i>	101
8	Loss after <i>Marana</i>	9
9	Wt of <i>Tamra bhasma</i> taken for <i>Amritikarana</i>	60
10	Wt of <i>Tamra bhasma</i> after <i>Amritikarana</i>	58
11	Loss after <i>Amritikarana</i>	2

Table 3: Relation of *Putra*, weight and consistency during *Tamra Marana*

No. of <i>puta</i>	Wt. of <i>Tamra</i> in gms	Wt. of <i>Kajjali</i> in gms	Total wt. in gms	Wt after <i>Putra</i> in gms	Color	Consistency
1 st <i>puta</i>	110	220	330	129	Black with tinge of Red	Foils were brittle to powder
2 nd <i>puta</i>	120	30	154	123.2	Black	Hard
3 rd <i>puta</i>	118	29.5	153.4	110.2	Black	Hard
4 th <i>puta</i>	110.2	27.5	156.2	108.4	Greyish black	Soft
5 th <i>puta</i>	108.4	25	142.6	108.8	Greyish black	Soft
6 th <i>puta</i>	108.8	27	134.6	104.4	Greyish black	Soft
7 th <i>puta</i>	104.4	26	137	107	Black	Soft
8 th <i>puta</i>	107	26.2	135	101	Black	Soft

Graph No. 2 Graph showing temperature pattern for *Gajaputa***Table 4: Showing the results of *Amritikarana* of *Tamra Bhasma***

No of Putas	Tamra Bhasma	Shodhita Gandhaka	Panchamruta	Total Wt.	Wt after <i>Putra</i>
1 st	60 g	30 g	QS	101g	60g
2 nd	60 g	30 g	QS	115g	60g
3 rd	60 g	30 g	QS	105g	58g

Graph No. 3 Graph showing temperature pattern for Amritikarana

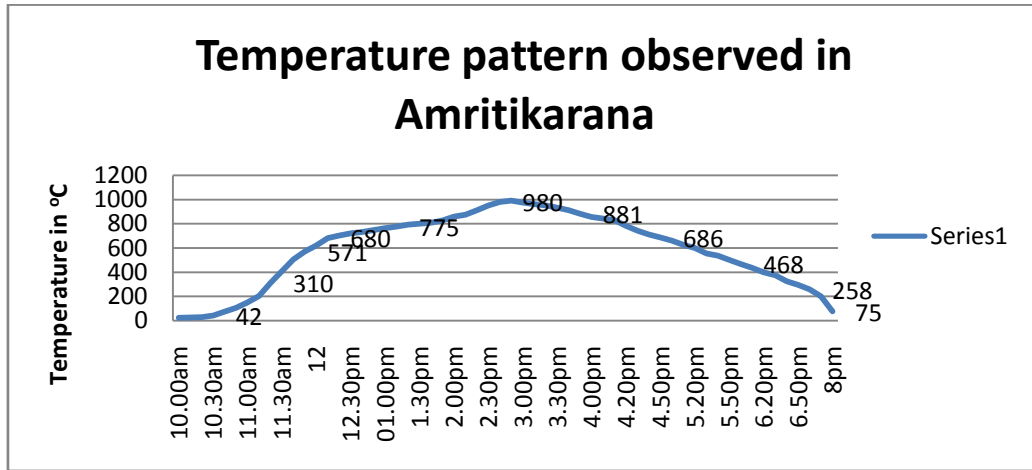


Table 5: Showing the results of Preparation *Kampavatari Rasa*

Tamra Bhasma	Rasasindura	Katuki Swaras	Weight Before	Weight After 21 Bhavana
43 g	43 g	25ml (appr. each Time)	86 g	110 g

Table 6: Showing the Relation of weight and *Bhavana Dravya* in Preparation of *Kampavatari Rasa*

No. of bhavana	Quantity of drug in gm		Quantity of Kwath in ml	Duration in hrs
	Before	After		
1 st	86	89.2	25	4
2 nd	89.2	90.5	24	4
3 rd	90.5	91.3	24	3
4 th	91.3	92.8	22	3
5 th	92.8	93	25	4
6 th	93	93.4	20	3
7 th	93.4	93.9	18	3
8 th	93.9	94.2	20	4
9 th	94.2	94.6	21	3
10 th	94.6	95.4	21	4
11 th	95.4	96.5	20	3
12 th	96.5	98	20	4
13 th	105.7	106.2	18	4
14 th	106.2	106.5	18	3
15 th	106.5	107	16	4
16 th	107	107.4	18	4
17 th	107.4	107.6	16	3
18 th	107.6	108	15	4
19 th	108	108.6	15	3
20 th	109	109.4	15	3
21 st	109.4	110	15	4

Analytical result

Table 7: Quantitative analysis of *Parada*, *Gandhaka* and *Tamra* by AAS (Instrumental) method²⁰

S.No	Raw material	Parameters	Percentage
1	<i>Parada</i>	% of Hg	87.08%
2	<i>Gandhaka</i>	% of S	97.23%
3	<i>Tamra</i>	% of Cu	88.64%

Table 8: Physicochemical features of Prepared *Rasasindura*²¹

Name of test	Results
Ash Value	Nil
Loss on drying	0.295%

Table 9: X-Ray Diffraction (XRD) results of *Rasasindura*²²

Sample	Major Phase-form
<i>Rasasindura</i>	Mercury Sulfide

Table 10: Showing Results of NPST of *Rasasindura*²³

Sample	Solution	Paper	Observation
<i>Rasasindura</i>	Aqua Regia	10% KI	Brick red solid spot with dark brown periphery observed

Table 11: Showing the results of *Bhasma Pariksha* of *Tamra Bhasma*²⁴

Name of test	Results
<i>Rekhapurnatwa</i>	Passes
<i>Varitara</i>	Passes
<i>Unnama</i>	Passes
<i>Nirdhumatwa</i>	Passes
<i>Jiwva Pariksha</i>	Passes
<i>Apunrbhavatwa</i>	Passes
<i>Dadhi Pariksha</i>	Passes

Table 12: X-Ray Diffraction (XRD) results of *Tamra Bhasma*²⁵

Sample	Major Phase-form
<i>Tamra Bhasma</i>	Copper sulfide

Table 13: Showing Results of NPST of *Tamra Bhasma*²⁶

Sample	Solution	Paper	Observation
<i>Tamra Bhasma</i>	5 N HNO ₃	10% KI	Solid chocolate color spot.

Scanning Electron Microscopic (SEM) result:²⁷*Tamra bhasma* (after 8th *puta*): Particle size 40 nm - 140 nm.**Analysis of *Katuki***²⁸**Table 14: Showing Physicochemical Analysis of *Katuki***

Name of test	Results
Loss on drying	8.4%
Total ash	2.463%
Acid insoluble ash	0.492
Water insoluble ash	2.487

Table 15: Organic test of *Katuki* shown positive for following test

Sr. No.	Name of Test	Water extract	Alcohol extract
1	Carbohydrate	Positive	Negative
2	Non reducing sugar	Positive	Positive
3	Steroids-Salkowski reaction	Positive	Positive
4	Test for Glycosides		
a.	Cardiac Glycosides (Deoxysugar)	Positive	Positive
b.	Saponin Glycosides	Positive	Positive
c.	Coumarin Glycosides	-	Positive
d.	Flavonoids	-	Positive
5	Alkaloids	Positive	Positive

Table 16: Qualitative Test for Inorganic Elements in *Katuki* shown positive for following test

Name of test	Results
Test for Iron	Positive
Test for Carbonate	Positive
Test for Sulphate	Positive
Test for Chloride	Positive

Table 17: Showing organoleptic characters of *Kampavatari Rasa*

Size /weight	Approximately 160-250 mg
Odour	Aromatic
Colour	Brownish black
Shape	Round
Taste	Tikta, Katu
Touch	Smooth

Table 18: Showing Physicochemical Analysis of *Kampavatari Rasa*²⁹

Name of test	Results
Hardness test	7kg/cm ²
Disintegration time	14 min
Loss on drying	3.4%
Total ash	48%
Acid insoluble ash	13%
Water soluble ash	9.5%
Microbiology Test	Within Normal Limit

Table 19: Qualitative Test for Inorganic Elements in *Kampavatari Rasa*³⁰

Name of test	Results
Test for Calcium	Present
Test for Magnesium	Absent
Test for Sodium	Absent
Test for Potassium	Absent
Test for Iron	Absent
Test for Carbonate	Absent

Table 20: Elemental study by ICP-AES of *Kampavatari Rasa*³¹

Sr No.	Elements	Percentage
1	% of Hg	20.43%
2	% of S	8.9%
3	% of Cu	20.51%

DISCUSSION

Kampavatari rasa is a unique metal base formulation mentioned in the *Rasa raj Sundhara* containing *Rasa sindura*, *Tamra Bhasma* in equal quantity and 21 *Bhavana* of *Katuki Swaras*.

The formulation is in use clinically but still there is no data available regarding its pharmaceutical and analytical study so present study is taken into consideration to fill this gap of knowledge.

Rasasindura and *Tamra Bhasma* have been taken equal in quantity in *Khalva yantra* and 21 *Bhavana* of *Katuki* has been given. Fresh *Katuki* for *Swaras* was not available so dry whole *Katuki* rhizome were purchased and identified by expert and *Paryayi swaras* method

mentioned in *Sharandhara Samhita* was adopted. Initial weight was 86 g after completion of 21 *Bhavana*'s it is raised upto 110 g so 24gms i.e. 27.9% of weight gain was observed. It may be due to *Bhavana dravya*. When *Katuki swaras (Kwath)* is prepared it contains *Ghana Satva* of *Katuki kandha* and water so increase in the weight may be due to *Ghana satva*.

Bhavana process increases the therapeutic efficacy of material and with its active chemical constituents organic components of liquid media are transferred to the material to make it organo- metallic compounds with main drug, which are favourable to the

body, thus increasing bioassimilation power and therapeutic effect.

As we proceed for the *Bhavanas* it was becoming stickier and the quantity of *Katuki swaras* required for the each *Bhavana* was decreased as we proceed. The *Katuki* smell appeared to the final product and the final product became stickier which can be easily rolled into pills.

The colour of *Tamra Bhasma* was black in colour. Touch is smooth and soft, odourless and tasteless. All samples fulfilled *Rekhapurnatwa*, *Varitaratwa*, *Unama*, *Avami*, *Apunrbhavatwa* and *Dadhi pariksha* after 8 *Gaja* puta.

XRD was carried out for *Tamra Bhasma*, the 2 θ value at maximum intensity of *Tamra Bhasma* showed almost similar peaks which match with Cu₂S (Copper sulfite). SEM shows most of the particles in nanoparticles ranges from 40 nm to 140 nm. Reduction in particle size facilitates absorption of the *Bhasma* in the system.

The colour of *Rasasindura* was reddish brown. Touch is smooth and fine, odorless and tasteless.

Total ash value found to be Nil and Loss on drying was 0.295 % which were similar to the standards which are mentioned in the Pharmaceutical Standards of Ayurvedic Formulation for *Rasa Sindhura*.

XRD was carried out for *Rasasindura*, the 2 θ value at maximum intensity of *Rasasindura* showed similar peaks which match with HgS (Mercury sulfite).

The role pills were subjected to tablet Hardness test and Disintegration test. Hardness was 7 kg/cm² which are within the normal limits and Disintegration time was 14 min which is within the limits.

Acid insoluble Ash is that ash which is not soluble in 5% HCl. If the amount of Ash insoluble in HCl is 13% in case of *Kampavatari Rasa*, this otherwise means that, rest of the part of the ash is soluble in 5% HCl. This gives us hint that all most 87% of the *Kampavatari Rasa* is being absorbed in the stomach where in the pH similes the environment created in the procedure of Acid insoluble Ash.

Loss on drying suggests the presence of moisture, organic matter or volatile substances present in the Yoga. In case of *Kampavatari Rasa* it is 3.4%, which can be explained by presence of *Katuki bhavana dravya*, and its volatile substances.

Total ash of *Kampavatari Rasa* found to be 48 % which may be due to presence of *Tamra bhasma* which must have total ash more than 90 % and where as *Rasa Sindura* has total ash nil.

The result of ICP-AES shows the percentage of Copper is 20.51, Sulphur is 8.9 and Mercury is 20.43 in *Kampavatari rasa*.

CONCLUSION

Kampavatari Rasa is a black colored compound formulation in form of *Vati* used in the intervention of *Kampavata*. Physico chemical analysis of KVR revealed Loss on Drying - 3.4%, Total Ash - 48 %, Acid insoluble ash -13%, water soluble ash - 9.5%, Hardness test 7 kg/cm², Tablet disintegration time -14 min. Quantitative analysis of KVR by ICPAES reveals Mercury - 20.43%, Copper - 20.51%, and Sulphur - 8.9%. This study can serve the need

for the characterization of KVR. This study can be a direction for establishing the fingerprint of *Kampavatari rasa* herbomineral compound formulation.

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***Address for correspondence
Dr Reshma Prakash Yaranal**

Lecturer

Department of Rasashastra and

Bhaishajya kalpana

Gomantak Ayurvedic

Mahavidyalaya and Research

Centre, Shiroda, Goa.

drreshmayaranal@yahoo.com

Contact : 09763690872

KAJALI PREPARATION



Sh. Parada



Sh. Gandhaka



Trituration



Kajjali

RASA SINDHURA PREPARATION



Kupi bharana



Kupi heating in EMF



Kanthastha
collected Rasa



Rasa sindhura

TAMRA BHASMA PREPARATION



Chakrikas for Puta



Gaja puta



Tamra bhasma

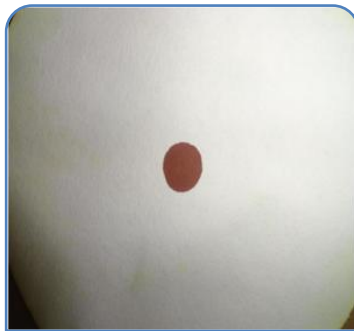


Final product Kampavatari Rasa in tablet
form after 21 bhavanas of Katuki

Analytical tests



Disintegration test of KVR

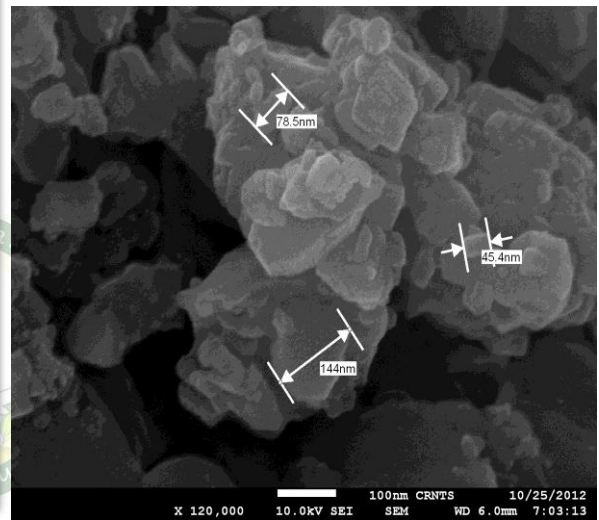
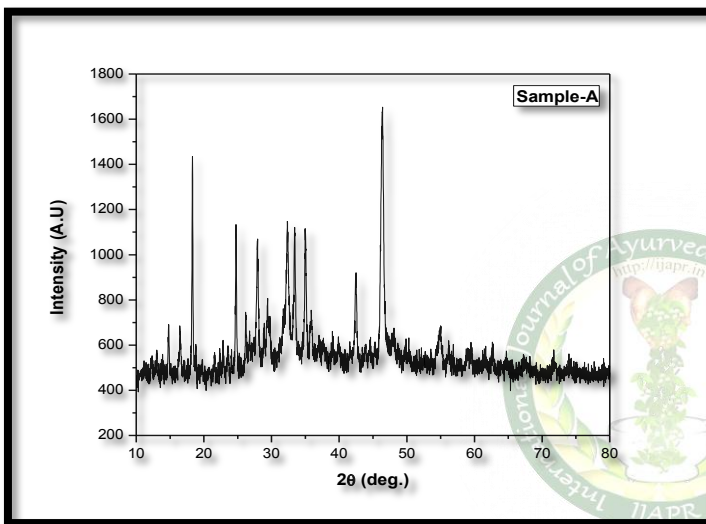


NPST of Tamra bhasma



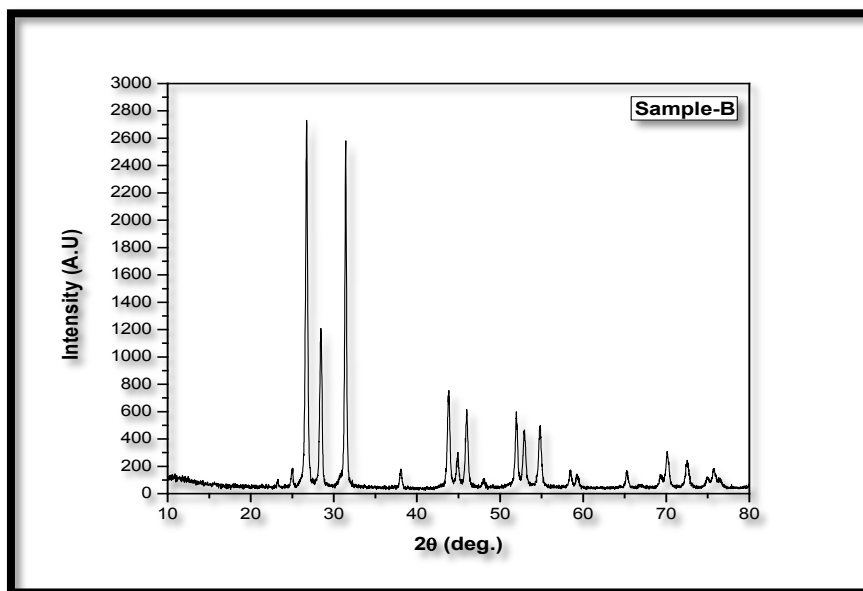
NPST of Rasa Sindura

Graph No.1 Graph showing XRD result of Tamra Bhasma



SEM of Tamra Bhasma after 8th Puta

Graph 1: Graph showing XRD result of Tamra Bhasma



Graph 2: Graph showing XRD result *Rasa Sindura*