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Pharmaceutico- Analytical Profile of Sardha Sama Guna and Dwi Guna Madanodaya Rasa - A Kupipakwa Rasayana

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ABSTRACT:

Introduction: Madanodaya Rasa (MDR) is a Sagandha, Bahirdhuma Kupi Pakwa Rasayana (~ Mercury and Sulphur containing Herbo-mineral formulation) which is prepared out of Sardha Sama Guna Kajjali (S.S.G.K:- 1:1½ ratio of Mercury and Sulphur) as per Rasa Manjari and Dwi Guna Kajjali (D.G.K :-1:2 ratio of Mercury and Sulphur) as per Rasa Yoga Sagara. Both the preparations have the same bhavana dravya (~triturating media) as Rakta Kamala Pushpa Swarasa (~ Red lotus flower) and utility is vrishya(~aphrodisiac). Both are unavailable in the market and its comparative study and standardization is not carried out yet, hence the present study was carried out to standardize the temperature pattern and to do instrumental analysis.

Materials and Methods: S.S.G and D.G.MDR were prepared as per classical reference and the samples were subjected to XRD, FTIR and SEM-EDS.

Results:-The duration of trituration of S.S.G and D.G.MDR Kajjali was 236 hr and 260 hr respectively. The duration of heating was 22 hrs., and 19 hrs and total yield was 28 % and 14.5 % respectively. XRD showed Cubic crystalline structure with the presence of HgS in both the Kajjali and Hexagonal crystalline structure with HgS in both MDR. SEM shows the S.S.G.MDR has smallest particle size of 18.46 nm and D.G.MDR has 27.53nm. EDS shows Hg and S as the major elements. FTIR report confirms that both the batches of MDR K and MDR contain organic functional groups. **Conclusion**: XRD, FTIR and SEM-EDS showed not much difference in the crystalline structure.

Keywords: Madanodaya Rasa, Kupipakwa Rasayana, Instrumental analysis.

INTRODUCTION

Madanodaya Rasa is one of the unique Herbo-mineral compounds mentioned in Rasa Manjari [1]and Rasa Yoga Sagara prepared by Kupi Pakwa Rasayana method having vrishya property. As per Rasa Manjari, it is a Sardha Sama Guna and as per Rasa Yoga Sagara[2] it is a Dwi Guna , Saagni Kandastha Bahirdhuma Kupi Pakwa Rasayana prepared under Kramagni tapa for a specific period. Madanodaya is prepared by Parada(~Mercury) and Gandhaka (~ Sulphur) as the main ingredient with a unique bhavana dravya Rakta

Kamala Pushpa Swarasa. Sardha Sama Guna Kupi Pakwa Rasayana is a rare Kupi pakwa preparation and the specific bhavana dravya, Rakta kamala pushpa swarasa, mainly indicated in Male infertility .

Kupi Pakwa Rasayana is a unique Herbo- mineral preparation , prepared in Kacha Kupi (~ glass bottle) by maintaining Kramagni Paka for a specific time in either Valuka Yantra or in Vertical Muffle Furnace[3]. Among Chaturvidha Kalpana's, Kupi Pakwa Rasayana is considered as most potent mercurial preparation than Kharaliya Rasayana and Parpati Kalpana which is quicker in action even in a smaller dosage and having strong chemical bond compared to another Kalpana's.

Madanodaya Rasa is a variety of Rasa Sindura and similar preparation with different ratio of Parada and Gandhaka with same bhavana dravya are mentioned by different acharyas which is mainly described as a Vajikarana dravya(~Aphrodisiac drug). Rasa Sindura is a very popular drug which is available in the market , but Madanodaya Rasa is an uncommon drug, and no comparative research works of different ratios has been carried out yet regarding its pharmaceutical preparation and its aphrodisiac activity.

Hence the present study was carried out to standardize the temperature pattern and to provide scientific analytical evidence by conducting Physico-chemical and instrumental analysis regarding the preparation.

AIMS AND OBJECTIVES

This study mainly focuses on preparing Madanodaya Rasa as per Rasa Manjari and Rasa Yoga Sagara and to compare the difference in the temperature pattern and the analytical parameters.

1. To prepare Sardha Sama Guna Madanodaya Rasa and Dwi Guna Madanodaya Rasa.
2. To carry out Physico- chemical analysis and Instrumental analysis like X-ray Diffraction (XRD), Scanning electron microscope and energy-dispersive X-ray spectrometry (SEM-EDS) and Fourier Transform Infrared Spectrometry (FTIR) of the samples.

MATERIALS AND METHODS

Collection of raw drugs:

Main raw drugs used in the preparation of Madanodaya Rasa were purchased from an authenticated source ensuring Grahya Lakshanas mentioned in ancient texts and SEM-EDS and XRD were done before the study. Raw drug identification of Herbal drugs like Rakta Kamala Pushpa was done in Pg & PhD studies of Department of Dravya Guna Vijnana, G. A. M.C, Bangalore. 1.5 Kg Hingula was procured from All India Kirana Stores, Mumbai. Parada was extracted from purified Hingula in the Dept. of Pg and PhD studies of Rasa Shastra and Bhaishajya Kalpana, G.A.M.C, Bangalore.1.5 Kg Gandhaka was procured from Kajarekar Ayurvedic raw drug depot , Belgaum and purified. Rakta Kamala Pushpa was collected from K. R. Market ,Bangalore. Associated drugs for purification of raw drugs like Ksheera, ghee, nimbu and haridra churna were collected from local market, Bangalore.

Figure . 1 Hingula

Figure 2 . Raw Gandhaka

Figure 3 . Raktakamala Puspa

METHODS (~ Preparatory phase)

This includes selection of genuine raw drugs, its purification , Kacha Kupi nirmana, Sardha Sama Guna and Dwi Guna MDR Kajjali preparation.

PURVA KARMA (~ PRE-PREPARATORY PHASE)

a) Hingula Shodhana and Hingulotha Parada Nirmana

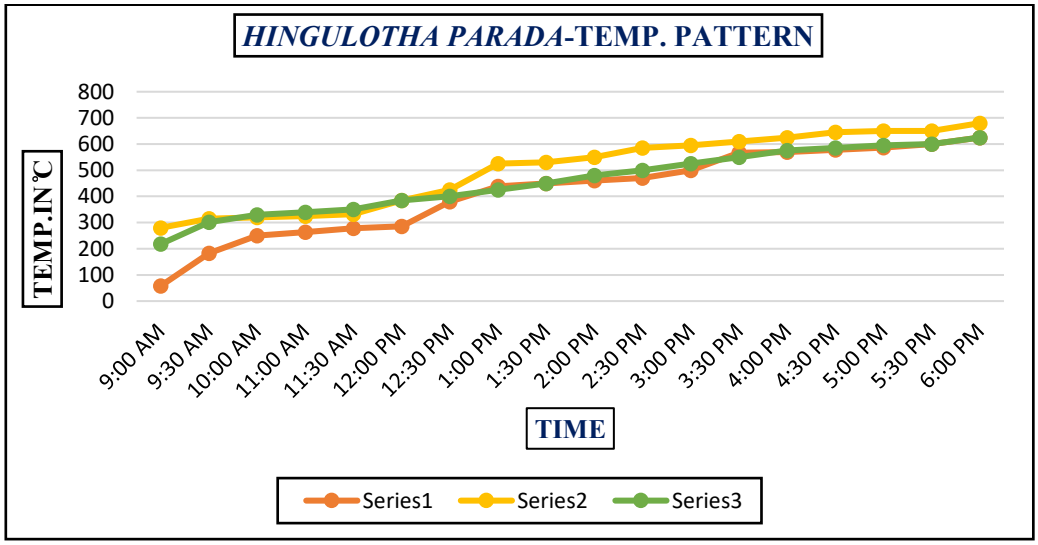
780 gm Hingula(~Cinnabar) was purified by levigating with Nimbu Swarasa(~lemon juice) for 7 times and allowed to dry[4]. Hingulotha Parada was prepared by Urdhwa Patana method(~sublimation process) in 3 batches[5].303 gm Parada was extracted from 475 gm Shudha Hingula. Parada was purified by doing mardana with Haridra Churna (~Curcuma longa. Linn) for 24hrs and then washed thoroughly with hot water, filtered through cloth, dried, and stored in an airtight glass container[6]. Images of Hingula Shodhana and Hingulotha Parada nirmana are illustrated in figures 1 and 2.

Temp. graph of Hingulotha Parada Nirmana is shown in Graph No 1.

Figure 4. Hingula Shodhana

Figure 5. H.P Nirmana

Graph No.1 shows Temp. pattern of Hingulotha Parada nirmana.



b) Gandhaka Shodhana

650gm Gandhaka was purified by Galana method with cow's milk 7 times and 525 gm pure Gandhaka was obtained[7] . Gandhaka was finely powdered and melted with equal quantity of ghee and filtered through a cloth tied around the mud pot filled with milk. After each Galana process Gandhaka was washed thoroughly with hot water to remove the content of milk and ghee, dried and powdered. After purification it was powdered and stored in an inert glass container. This purified Hingulotha Parada and Shudha Gandhaka were used for the preparations of two batches of Madanodaya Rasa.[Figure6]

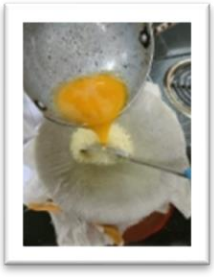


Figure 6. Gandhaka Shodhana

c) Kacha Kupi Nirmana

Two 650 ml beer bottles were taken, washed with hot water thoroughly and dried under sunlight. At the base of the bottle ,paste of Multani mitti was applied to make it an even surface and a cloth smeared with Multani Mitti was covered and dried completely. Similarly, a cloth smeared with Multani mitti was used to cover neck and body of the bottle. Totally 3 pieces of cloth were used, one for the bottom, one for body and one for the neck and upper portion of the bottle. The next day after complete drying, another cloth smeared with Multani Mitti, was applied over the formal layers. In this way,7 layers are covered over the surface of the bottle and dried properly. [Figure no.7]

Figure 7. Kacha Kupi Nirmana

d) Kajjali Nirmana

Sardha Samaguna Madanodaya Rasa Kajjali Nirmana

Sama guna Kajjali was prepared first by adding equal quantity Parada and Gandhaka (300gm :300gm) and grinded till it attains Kajjali siddha lakshanas and then bhavana was done with Rakta Kamala Pushpa Swarasa (3 bhavana was done). After complete drying half part of Shudha Gandhaka (150 gm) was added and triturated till whole Gandhaka was completely mixed with Kajjali .Again Rakta Kamala Pushpa Swarasa bhavana was done. Total Kajjali obtained was 735 gm. This Kajjali was used to prepare Sardha Sama Guna MDR. [Figure 8]

Figure 8. Kajjali mardana with Rakta Kamala Pushpa

Dwi guna Madanodaya Rasa Kajjali Nirmana

36 gm of Shudha Gandhaka was added to 180 gm Sardha Sama Guna MDR Kajjali and triturated well to get Dwi Guna MDR Kajjali and was used to prepare Dwi Guna MDR . Total Kajjali obtained was 207gm.

e) Kupi purana

200 gm of S. S. G. Kajjali and D.G. Kajjali was carefully filled into two already prepared Kachakupi with the help of a funnel and a glass rod.

PRADHAN KARMA (~MAIN PHARMACEUTICAL PREPARATION)

Placement of Kupi in VMF

One insulation brick (Komi bricks) with a length and width of 11 cm and a height of 6 cm were placed inside the bottom of heating element of the VMF, to adjust the height of the Kupi, so that the neck of the Kupi was to be at the same level to that of the upper part of the VMF. The depth of the heating element was 30 cm, and the diameter is 15 cm**.** The Kacha Kupi, which was earlier filled with Madanodaya Rasa Kajjali, was properly placed in the heating element of the VMF .The Kajjali-filled Kupi had been kept at the centre of the heating element chamber at ½ an inch from the sides and small pieces of bricks were holding the Kupi firmly without any movement. A hole was made in the centre of the ceramic wool and placed over the neck of the Kupi so that to allow the passage of the Kupi and used to cover the furnace opening to avoid escaping heat from the furnace. K- type Thermocouple and Tapta Shalaka were placed inside the furnace nearer to the wall of the furnace by making two holes in the wool without disturbing the Kupi.

Sardha Sama Guna MDR was prepared with 200 gm Kajjali by Vertical Muffle Furnace method. Kramagni paka was maintained throughout the procedure. Total time taken was 22 hours and yield were 56gm. Dwi Guna MDR was prepared with 200 gm Kajjali and time taken was 19 hours and yield were 26 gm by VMF method. In S.S.G.MDR corking was done after 18 hours and in D.G.MDR it was done after 12½ hours. After corking 4 hours heat was given to S.S.G MDR and 6 hours heat was given for D.G.MDR. After complete self-cooling Kupi was removed from VMF.

Observations during the preparation of S.S.G.MDR , and D.G.MDR have been tabulated in Table 1 and Table 2 respectively. Images of Kupi pakwa preparations are shown in Figures 9-15. Temp. pattern of S.S.G.MDR and D.G.MDR are shown in **Graph no 2 & 3** respectively.

Figure 9. VMF

Figure 10. Flame

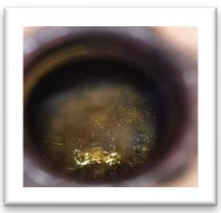


Figure 11. Golden globules

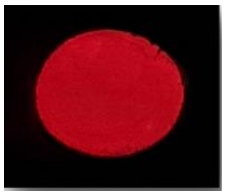


Figure 12. Suryodaya

Figure 13. Copper foil test + ve

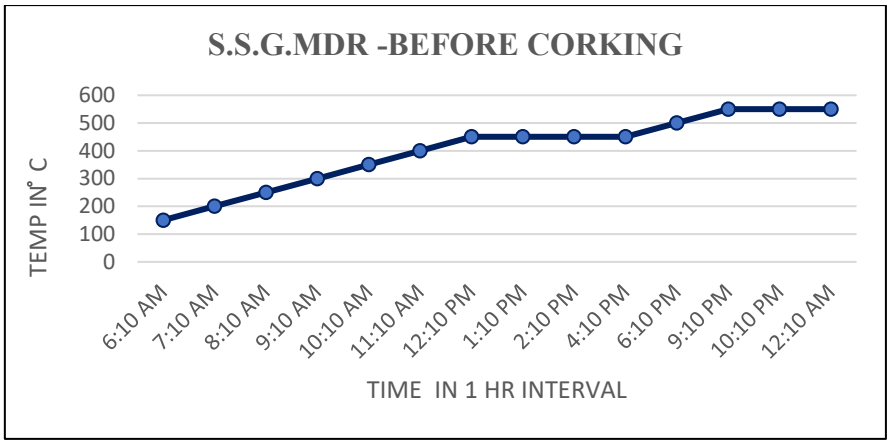
Figure14 . Kupi after corking

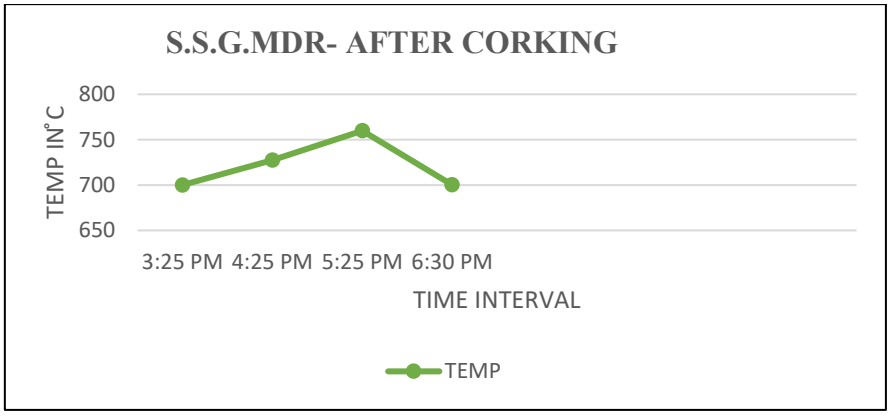
Figure 15. Tivragni after corking

Table No.1 shows observations during S. S. G .MDR

Time duration	**Time**	**Set Temp.**	**Display Temp.**	**Thermo-Couple Temp**	**Observations**
	6.10 am	150˚C	24.8℃	46℃	Intensity 55
1 hr	7.10 am	200˚C	154˚C	131.7˚C	Intensity 60
	7.40 am		200˚C	180.5˚C	**Gandhaka smell started**
2 hr	8.10 am	250˚C	202℃	190.1˚C	Intensity 65
	8.40 am		254˚C	237.9˚C	**White fumes started**
3 hr	9.10 am	300˚C	253˚C	243.8˚C	While inserting Tapta Shalaka **blue flame started** .
4 hr	10.10 am	350˚C	305	291.5	Tapta Shalaka was inserted, and blue flame started coming out of the neck **-6-7 cm Golden globules present at the bottom**.

5 hr	11.10 am	400℃	351℃	341.2˚C	After inserting Tapta Shalaka flame increased up to 7 cm
	11.40 am		401℃	390.4˚C	After inserting Tapta Shalaka flame increased up to **10-12 cm**. **Golden deposits seen at the neck**
6 hr	12.10 pm	450˚C	400˚C	396.4℃	Blue flames ++
7 hr	1.10 pm		451˚C	449.3˚C	Flame ++ 3 cm hight
8 hr	2.10 pm		449℃	457.6℃	Intensity 70
9 hr	3.10 pm		451˚C	459.4℃	Fumes reduced
10 hr	4.10 pm		451℃	459.3℃	Flame & fumes reduced; neck is clear
11 hr	5.10 pm		450℃	460.1℃	No change
	6.30 pm	500℃	462.3℃	461.2℃	No change
13 hr	7.10 pm		500˚C	502℃	After inserting Tapta Shalaka , flame ++
	7.40 pm		501℃	509.3˚C	Sheeta Shalaka inserted. **Kajjali was melted**.
14 hr	8.10 pm		500˚C	512.6˚C	Golden globules seen at the bottom
15 hr	9.10 pm	550	500˚C	501˚C	Same observation
16 hr	10.10 pm		549℃	560.1℃	No change, Flame +
17 hr	11.10 pm		550˚C	578.5˚C	**Suryodaya lakshana**, Hg **particles started moving inside Kupi.**
18 hr	12.10 am		551˚C	580.3˚C	**Copper coin test was positive.** VMF was switched off. Corking was done. Thermocouple was removed.
	12.15 am		475℃		VMF switched on.
	12.45 am	600˚C	523˚C		No change
19hr.35 min	1.45 am	650˚C	567˚C		No change
	2.00 am	700˚C	587˚C		No change
20hr.20min	2.30 am	750˚C	592˚C		No change
22 hr	4.15 am		615˚C		VMF switched off.





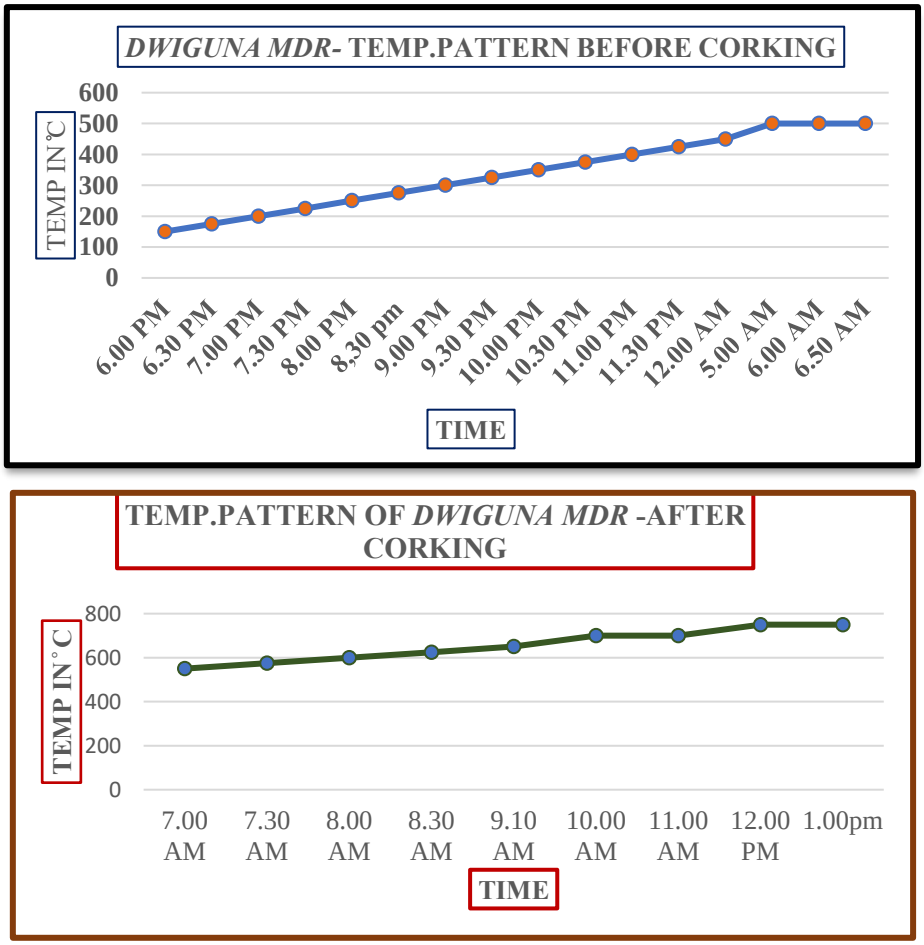
Graph No 2 shows temperature pattern of S.S.G.MDR.

Table No .2 shows observations during D.G.MDR.

Duration	**Time**	**Set Temp.**	**Display Temp**	**Thermo-Couple Temp**	**Observations**
	6.00 pm	150°C	39°C	29.9°C	Intensity 55
	6.30 pm	175°C	154°C	86°C	**White fumes started**. Slight **sulphur odour** started.
After1 hour	7.00 pm	200°C	179°C	129.3°C	Fumes started coming out of the Kupi. Small mercury globules seen at the bottom of the Kupi.
	7.30 pm	225°C	203°C	142.6°C	**Dense yellow fumes** started. The bottom of the Kupi was not visible. Gandhaka smell ++
After 2 hours	8.00 pm	250°C	226°C	202.2°C	Pungent sulphur smell noted. **Yellow deposits** seen around the neck of the Kupi.
After 3 hours	9.00 pm	300°C	277°C	245.6°C	Dense yellow fumes found. Bottom was not visible with torch light.

	9.30 pm	325˚C	318˚C	280.3˚C	While inserting Tapta Shalaka, **blue flames stared** appearing.
After 4 hours	10.00 pm	350˚C	326˚C	293.4˚C	Tapta Shalaka was inserted, and blue flame started coming out of the neck **6-7 cm**
	10.30 pm	375˚C	351˚C	314.9˚C	Irritating order of sulphur ++, Blue flame increased by 5-6 cm. Bottom appeared as **dark orange coloured with golden globules.**
After 5 hours	11.00 pm	400˚C	376˚C	338.3˚C	Blue flames present, and Golden globules present at the bottom
After 6 hours	12.00 am	450℃	351℃	341.2˚C	Sheeta Shalaka was inserted; **Kajjali became semi solid.** In white paper it showed yellow lines.
	12.40 am		451℃	418.1˚C	After inserting Tapta Shalaka flame increased up to 3-4 cm. Golden deposits seen at the neck. **Kajjali started melting.**
After 7 hours	1.00 am		450˚C	421℃	Blue flames ++.Tapta Shalaka catches fire while removing Tapta Shalaka.
After 8 hours	2.10 am		451˚C	420.9℃	**Sheeta Shalaka catches fire** during insertion. Fumes and flames were reduced, and bottom was clear.
After 9 hours	3.00 am		451℃	428.5℃	Intensity 55. Flame and fumes were reduced. **Mercury particles moving inside the bottle**.
After 10 hours	4.00 am	475˚C	451℃	433.7℃	Flame & fumes reduced; neck was clear. **Golden colour seen at the bottom**.
After 11 hours	5.00 am	500˚C	480℃	460.5℃	While inserting Tapta Shalaka & Sheeta Shalaka there was no fumes and flame. Sulphur smell also was absent.
After 12.30 hours	6.30 am		502℃	481.6℃	**Copper coin test** done. Small mercury globules present.
	6.50 am		502˚C	486℃	**Copper coin test:- Positive.** **Preparation for corking:-** VMF switched off. The Ceramic wool was carefully removed. Kupi was taken out from VMF with the help of an oven gloves.

					Corking was done with the help of cork and cloth smeared with Multani Mitti. It took 10 min. to complete corking. Kupi was again replaced in the VMF.
13 hours	7.00 am	550˚C	435℃		**VMF was Switched on**. Temperature was increased.
	7.30 am	575˚C	435˚ C		Intensity increased to 70
14 hours	8.00 am	600˚C	500˚ C		Intensity 75
15 hours	9.10 am	650˚C	550˚ C		No change
16 hours	10.00 am	700˚C	568˚ C		Intensity 90
17 hours	11.00 am		638˚ C		No change
18 hours	12.00 pm	750˚C	650℃		No change
19 hours	1.00 pm		680˚ C		**VMF switched off**.



Graph No. 3 Shows Temp. pattern of D.G.MDR before and after corking

PASCHAT KARMA(~POST PHARMACEUTICAL PREPARATION)

The layers of mud smeared cloth were scrapped, and external surface was cleaned. Thread soaked in Kerosene was tied 1 inch below to the level of the product and was ignited. After complete burning of the thread, a wet cloth was wrapped around the bottle and pressed to break the Kupi exactly at the level of thread. MDR was collected carefully from the neck of the Kupi and residue from the bottom of the Kupi, weighed and packed. [Figure no.16-18]

Figure 16. Scrapping the Kupi

Figure 17. Kupi breaking.

Figure 18. *MDR*

OBSERVATIONS

- **Hingula Shodhana:** During purification it was noted that quantity of Nimbu swarasa used and the time taken for each bhavana was reduced subsequently. [Figures 4]
- **Hingulotha Parada Nirmana :** Urdwapatana was done for 9 hrs in Kramagni Paka and 303gm Parada was extracted from 525gm Shudha Hingula. [Figures 5]
- **Gandhaka Shodhana:** Gandhaka was completely purified after 7 times Galana in milk and slight temperature variation may leads to colour change. [Figures 6]
- During **Sardha Sama Guna Kajjali Nirmana** it was found to be more difficult to carryout bhavana with Swarasa and to get rid of moisture content.[Figure 8]
- **Dwi Guna MDR Kajjali Nirmana:** Time taken for Kajjali nirmana was less compared to S.S.G.MDRK. Kajjali Pareeksha is shown in the Figure 19-21.
- **SSG MDR Preparation and D.G.MDR preparation** was done by VMF method and Kramagni paka was maintained throughout the procedure. Time taken for the preparation was less in D.G.MDR compared to S.S.G.MDR. Images showing important stages of the procedure are highlighted in Figures 9-18.

ANALYTICAL STUDY

Organoleptic study was carried out in the P.G & PhD studies of Department of Rasa Shastra and Bhaishajya Kalpana, G.A.M.C, Bangalore. Physico-Chemical analysis was carried out at Govt. Drug Testing Lab, Jayanagar, Bangalore. Instrumental analysis like XRD, SEM-EDS & FT-IR of S.S.G MDRK, D.G.MDRK, S.S.G.MDR and D.G.MDR were conducted at IISC, Bangalore .

RESULTS

Organoleptic characters:-

Table No. 3 shows ancient parameters for analysis of SSG MDR K & D.G MDR K

TEST	OBSERVATION	
	S.S.G.MDR.KAJJALI	D.G.MDR. KAJJALI
Swarupa	Powder	Powder
Varna	Greyish black.	Greyish black
Sparsha	Smooth and soft.	Smooth and soft
Gandha	Slight Sulphur smell	Slight sulphur smell
Rasa	Tasteless	Tastelessness
Rekha Purnatva	When fine powder of Kajjali was rubbed between the thumb and index finger it entered the furrows of the fingers.	-Same-
Varitaratva	When finely powdered Kajjali was carefully sprinkled into a test tube containing water, Kajjali was floating over the water.	-Same-
Nischandratva	Lustreless i.e., No shining particles were observed.	-Same-

Figure 19. Rekhapurnatva

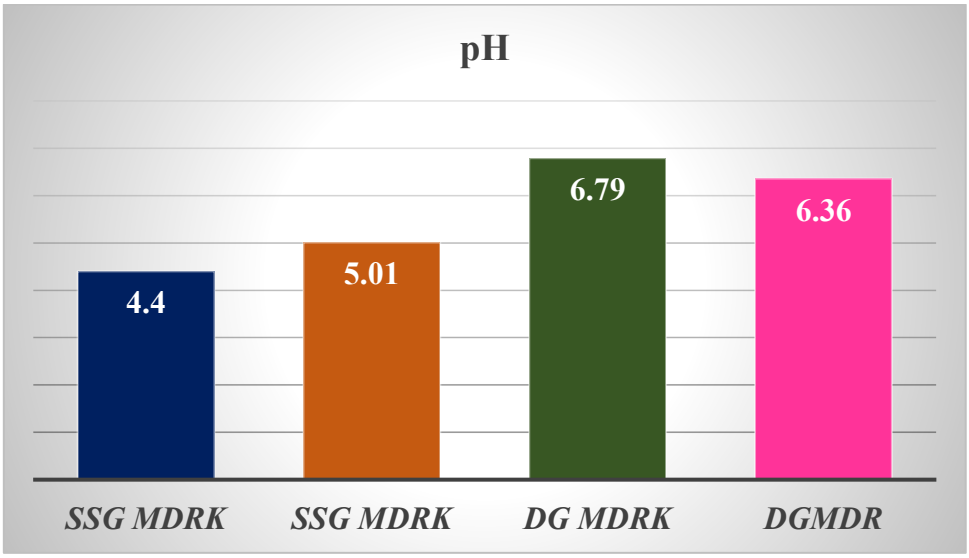
Figure 20. Varitara

Figure 21. Nischandratva

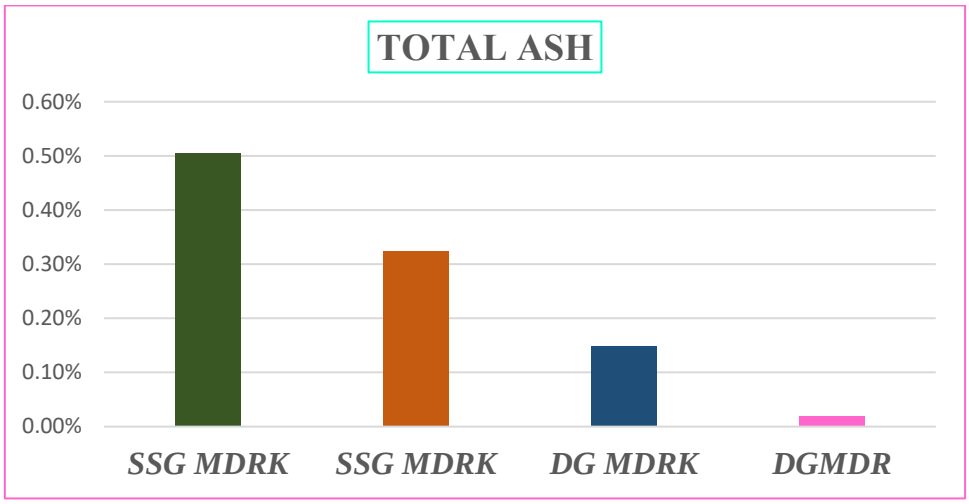
Table No. 4 shows ancient parameters of S. S. G. MDR and D.G.MDR

TEST	OBSERVATION
Swarupa	Powder
Varna	Like tender leaves of Mango tree.
Sparsa	Slakshna and Mridu
Gandha	Odourless
Rasa	Tasteless
Rekha Purnatva	When finely powdered MDR was rubbed between the thumb and index finger it enters the furrows of the fingers.
Varitaratva	When finely powdered MDR was carefully sprinkled into a glass vessel containing water, MDR floats on the surface of the water.
Nischandratva	There were no shiny particles in the finely powdered MDR even when it was rubbed between wet thumb and index finger observed in the bright sunlight.
Nirdhoomatva	The MDR didn't emit any smoke when sprinkled over red-hot coal.

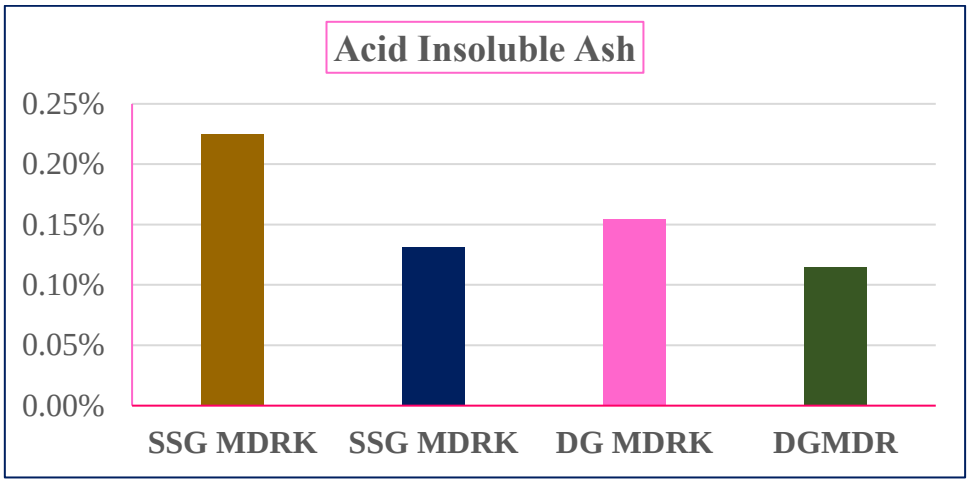
Graph No. 4 shows Physico-chemical analysis- pH



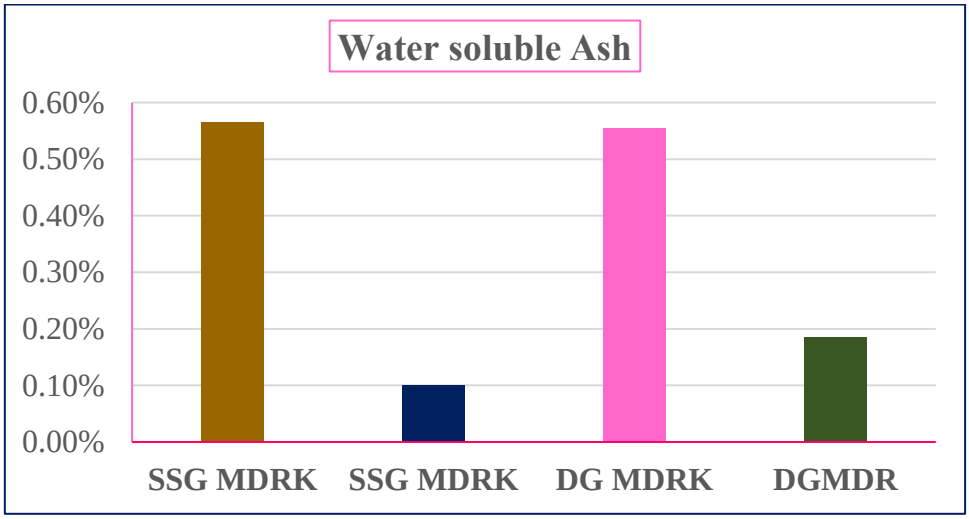
Graph No. 5 shows Total Ash



Graph No . 6 shows Acid Insoluble Ash



Graph No. 7 shows Water Soluble Ash



Graph No. 8 shows Loss on drying.

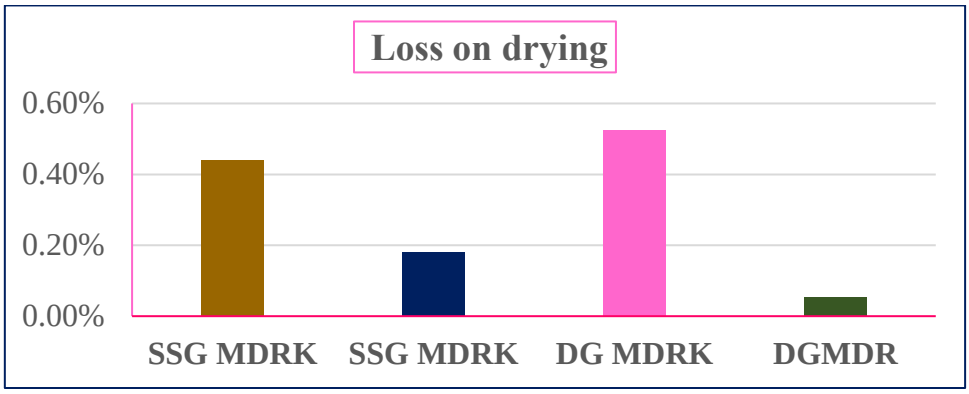


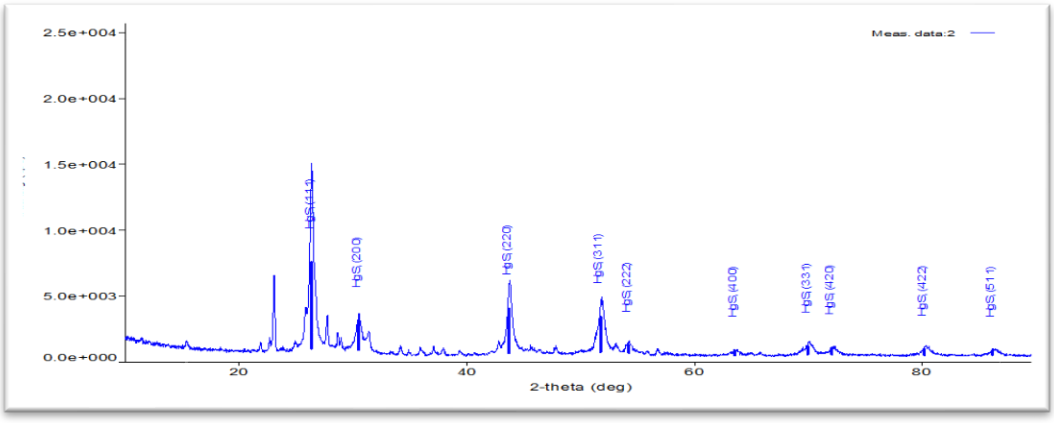
Table No. 5 shows Physico- chemical analysis

PARAMETER	S.S.G. MDR K	S.S.G. MDR	D.G. MDR K	D.G.MDR
pH	4.4	5.01	6.79	6.36
Total ash	0.5045 % w/w	0.3243 % w/w	0.149 % w/w	0.019 % w/w
Acid insoluble Ash	0.2249 %	0.1314 %	0.1542 %	0.1146%
Water soluble ash	0.5644%	0.0999%	0.5547%	0.1843%
LOD	0.4392 %	0.1794%	0.523%	0.053%

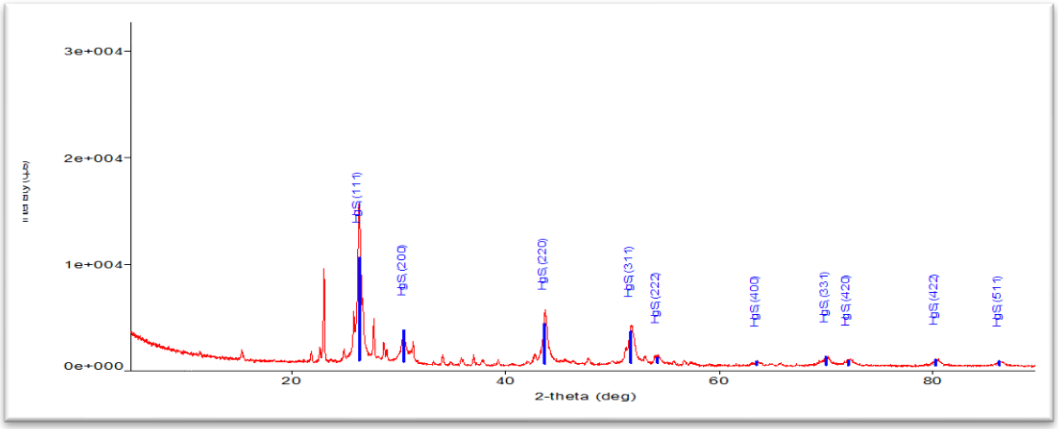
XRD ANALYSIS[8]

Samples S.S.G.MDR Kajjali, D.G.MDR Kajjali, S.S.G.MDR, D.G.MDR were subjected to X-Ray diffraction study.[Figures 24-27] XRD values of Hingula were compared with Standard Joint Committee Powder Diffraction File (JCPDS) and confirmed that the drug contains HgS in hexagonal crystalline structure. XRD values of S.S.G.MDR K and D.G.MDR K were compared with standard value and confirmed that both contains Mercury sulphide (HgS) with Cubic crystalline structure, whereas S.S.G.MDR and D.G.MDR are having Hexagonal crystalline structure and it contains HgS. [Graph no 9-12]

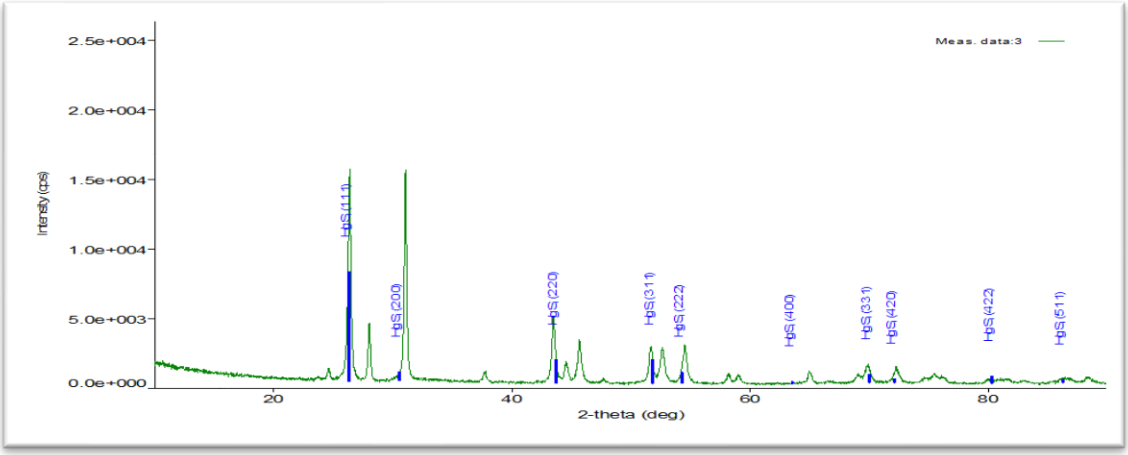
Graph No .9 shows XRD Analysis of Sardha Sama Guna MDR Kajjali



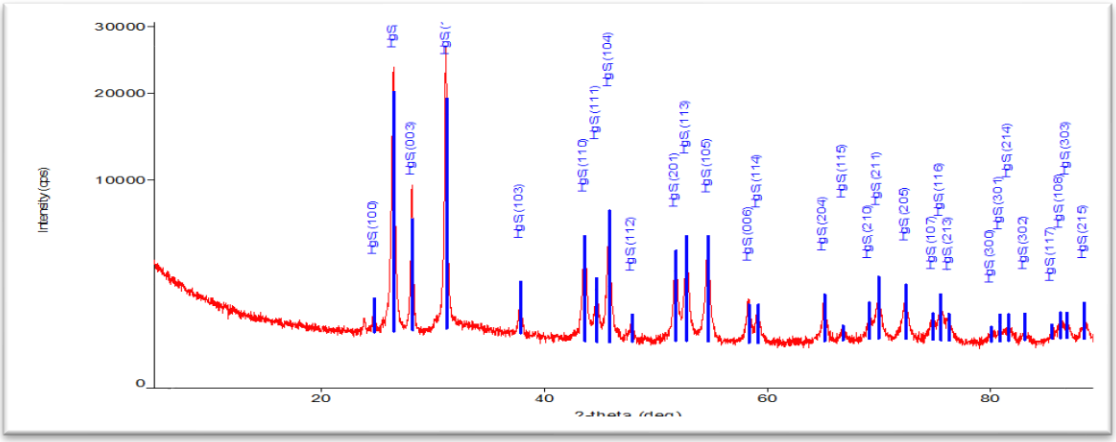
Graph No 10 shows XRD Reports of Dwi Guna MDR Kajjali



Graph No 11 shows XRD reports of S.S.G. MDR



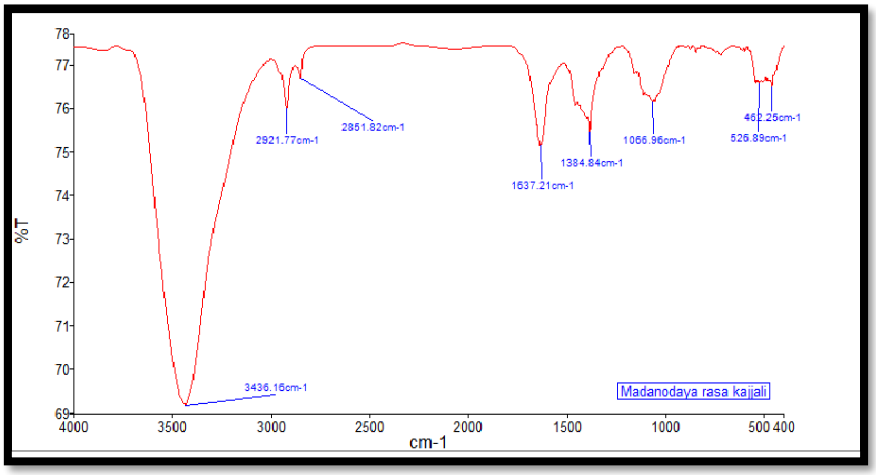
Graph No 12 shows XRD analysis of DWI GUNA MDR



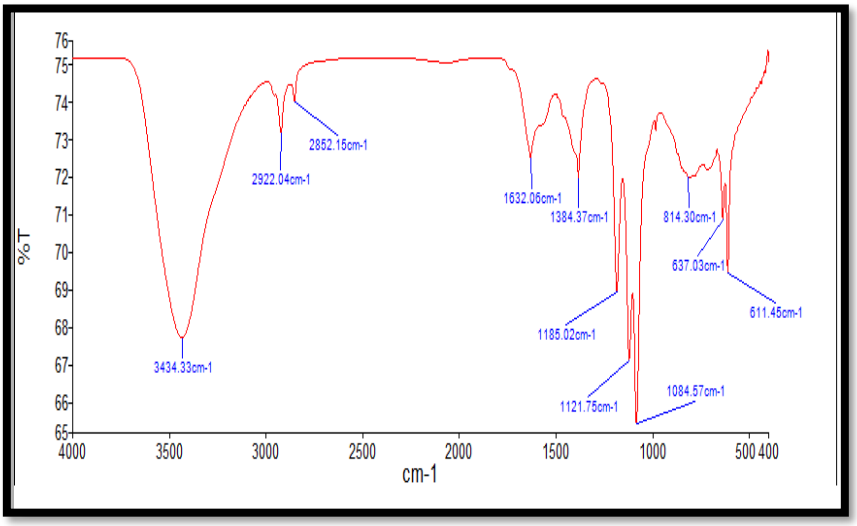
FTIR ANALYSIS[9]

FTIR report confirms that both the batches of MDR K and MDR contain organic functional groups like Fluro compound, alkane, amine, alcohol, aldehyde ether, amine salt, carboxylic acid etc which are added during bhavana.[Graph no. 13-16]

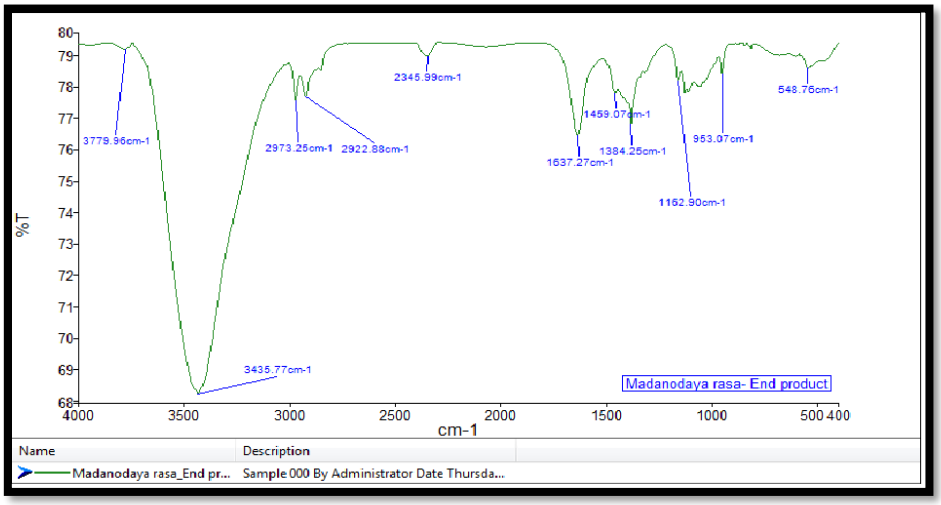
Graph No.13 shows FTIR reports of S.S.G.MDR Kajjali



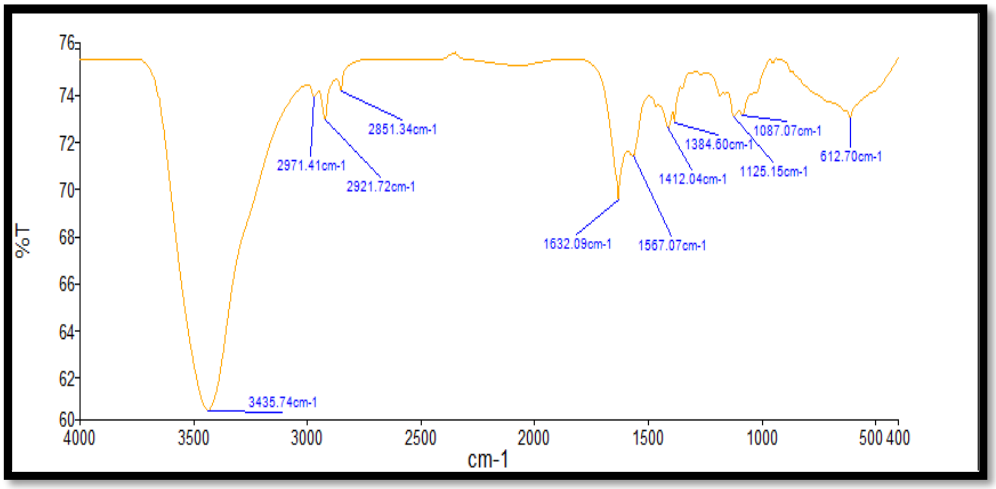
Graph No 14 shows FT- IR reports of Dwi Guna MDR Kajjali



Graph No 15 shows FTIR reports of Sardha Sama Guna MDR



Graph No.16 shows FTIR reports of D.G.MDR.



SEM ANALYSIS[9]

SEM reports show that the smallest particle size of S.S.G.MDR.K and S.S.G.MDR are 36.57nm and 18.46 nm respectively. The smallest particle size of D.G.MDR K and D.G.MDR are 36.91nm and 27.53 nm respectively. Thus, this report confirms that particle size is reduced, and it helps in easy absorption and increased bioavailability. [Table 6]

Table No 6 shows the SEM result .

NO	SAMPLE	SMALLEST PARTICLE SIZE (in nm)	LARGEST PARTICLE SIZE (in nm)
1.	**Hingula -I**	64.00 nm	254.7 nm
2.	**Hingula -II**	83.47 nm	227.6 nm
3.	**Gandhaka**	61.35 nm	455.3 nm
4.	**S.S.G.MDR K**	36.57 nm	206.0 nm
5.	**S.S.G.MDR**	18.46 nm	322.2 nm
6.	**D.G.MDR K**	36.91 nm	452.6nm
7.	**D.G.MDR**	27.53 nm	253.8nm

EDS ANALYSIS

The EDS report shows that the WT. % of Mercury and Sulphur in Hingula is 85.35% and 14.65% ; in S.S.G.MDR K is 63.29% and 36.71% ; in D.G.MDR K is 71.73% and 28.27% ; in S.G.G.MDR is 84.64% and 15.36% ; in D.G.MDR is 85.27% and 14.73% respectively. Wt. % of Mercury was reduced, and wt.% of Sulphur was increased in both the Kajjali whereas Mercury wt. percentage increased in both the product due to the evaporation of extra Sulphur during Kramagni paka.[Table 7-8]

Table no 7 shows the EDX result of Sardha Sama Guna MDR K and D.G. MDR

ELEMENT	MDR KAJJALI		MDR- Batch II	
	Weight%	Atomic %	Weight %	Atomic %
S K	36.71%	78.39 %	15.36 %	53.18 %
Hg M	63.29 %	21.61 %	84.64 %	46.82 %

CK	Traces	Traces	Traces	Traces

Table no 8 shows the EDX result of D.G. MDR Kajjali and D.G. MDR

ELEMENT	D.G. MDR KAJJALI		D.G. MDR	
	Weight %	Atomic %	Weight %	Atomic%
S K	28.27	71.14	14.73	51.95
Hg M	71.73	28.86	85.27	48.05

DISCUSSION

Kupipakwa Rasayana is a unique Herbo-mineral formulation prepared in specifically prepared glass bottle by gradual heating in Valuka yantra or EMF. In general, Kupi Pakwa Rasayanas have disease curing property, Rasayana and Vajikarana properties, are mainly prepared by Sagandha Murchana or Nir Gandha Murchana. Madanodaya Rasa is a Sagandha Bahirdhuma, Kandastha Kupi Pakwa Rasayana, described by Rasa Manjari and Rasa Yoga Sagara as a Vrishya yoga. Similar preparations are mentioned by Rasa Ratna Samucchaya, Bhaishajya Ratnavali, Rasa Ratnakara etc. The name itself suggests that it is suitable for increasing desire of love and affection, and it is suitable to treat male infertility.

Mercury has great affinity towards Sulphur molecules and during the preparation of Kajjali it binds easily with Sulphur molecules and molecules of Mercury easily disintegrate. It is believed that Mercury is Siva Virya and Sulphur is menstrual blood of Goddess Parvathy which represents the easy assimilation and strong bondage between the two drugs. Sulphur has the tendency to reduce toxicity of Mercury and therefor if the quantity of Sulphur increases provides a good therapeutic effect.

During the preparation of Madanodaya Rasa by two different ratios, it was noted that the time taken was reduced in D.G.MDR compared to S.S.G.MDR. It was found to be difficult to assess all the siddha lakshanas in both the preparations and after getting Copper coin test positive along with grey colour discoloration in the foil associated with mercury particles corking was done to avoid the escape of Mercury.

In XRD analysis of S.S.G.MDRK a total of 36 peaks were identified at different angles from 15.361 to 86.292. 10 strong peaks were chosen as strong with their relative intensity and compared to Standard X-Ray Powder diffraction file.(XPDF) and confirmed that it contains Mercury sulphide with Cubic crystalline structure. Total 25 peaks were identified in Madanodaya Rasa (22 Hours preparation) at different angles (2Ɵ) from 23.75 to 88.32 and 10 strong peaks were compared to Standard X-ray powder diffraction file.(XPDF) and it has Hexagonal crystalline structure which contains HgS .Total 41 peaks were identified in Dwi Guna Madanodaya Rasa Kajjali at different angles(2Ɵ) from 26.35 to 86.28 and identified as Mercury sulphide with Cubic crystalline structure. Totally 24 peaks were identified in Dwi Guna Madanodaya Rasa (19 Hours) preparation) at different angles (2Ɵ) from 23.829 to 88.41 and identified as Cinnabar with Hexagonal crystalline structure. Thus, the black sulphide of Mercury converted into red Sulphide of Mercury by gradual increase of heat.

FTIR reports shows the presence of organic compounds which may added during purificatory processes, and this will reduce the toxicity and increases the bioavailability of the product. SEM reports shows the reduced particle size. EDS shows that the Mercury percentage of MDR is like Hingula and at the end there is no change in the chemical composition.

CONCLUSION

The duration of heating in S.S.G.MDR was 22 hr and in D.G.MDR was 19 hrs and total yield was 28 % and 14.5 % respectively.It has been found very difficult to assess various lakshanas during both the Kupi preparations. It may be due to the unique bhavana dravya. Madanodaya rasa prepared by two different ratios doesn't shows much difference in the organoleptic characters as well as in instrumental analysis and showed slight difference in the Physico-chemical analysis. Various analytical tests carried out revealed that both the batches of MDR contains Mercury Sulphide which are in nano particle size and having the presence of organic functional groups in a Hexagonal crystalline system .The importance of the increased Sulphur content in the product should be proved clinically.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

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