

A PHARMACEUTICAL STUDY OF RAJATA SINDHOORA PREPARED BY VERTICAL MUFFLE FURNACE**Dr. Tarika S. Bangera*¹, Dr. B. Vinaya Chandra Shetty² and Dr. Nayana Pai³**

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ABSTRACT

Rajata Sindhoora is one of the unique *Kupipakwa Rasayana yoga* by its methodology of preparation in the field of *Rasashastra*. The drug *Rajata Sindhoora* contains *Shoditha Rajata*, *Shodhita Parada*, *Shoditha Gandhaka* in a proportion of 1:4:4 ratio as per the reference of *Rasendra Sambhava* and prepared by conventional method by using Vertical Muffle Furnace. Unlike the traditional method of preparation, in the present study modified method has been adopted to ensure the added advantages of muffle furnace with respect to temperature control, less fuel consumption and minimum human effort.

KEYWORDS: *Rajata Sindhoora*, Vertical Muffle Furnace, *Kupipakwa Rasayana*.**INTRODUCTION**

Rasashastra being a pharmaceutical science aims at designing unique preparations of Rasoushadhies. Among them *Kupipakwa Rasayana Yogas* are one set of preparations which takes the prior role in terms of therapeutic utility. *Rajata Sindhoora*,^[1] is one of the *Kupipakwa Rasayana Yoga*,^[2] prepared in specialized glass bottle to form a therapeutically efficacious compound. As this preparation undergoes with excess human effort with large fuel consumption in traditional Bhatti method which was replaced by the Vertical muffle furnace. Hence present study was conducted to prepare *Rajata Sindhoora* in Vertical muffle furnace.

MATERIALS AND METHODS**Materials**

Raw materials used for the preparation of *Rajata Sindhoora* such as *Rajata Hingula* and *Gandhaka* were selected based on *grahya lakshnas* mentioned in *Rasa classics*. Extraction of *Parada* from *Hingula*,^[3] purification of Sulphur,^[4] purification of *Rajata*,^[5] and preparation of *Kajjali* were carried out as per the classical reference in laboratory of PG Department of Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College Moodbidri.

Methods

The preparation of *Rajata Sindhoora* was divided

into three stages, namely *Purvakarma* (Preoperative), *Pradhanakarma* (Operative), *Pashchatkarma* (Post operative).

Purvakarma

Shodhita Rajata Hingulotta Parada and *Shodhita Gandhaka* were taken in the ratio of 1:4:4 in a *khalva yantra*^[6] and triturated well till the whole mixture was converted into fine black, lusterless powder (*Kajjali*)^[7] Then this mixture was levigated with *Kumari swarasa*,^[8] for one day. After complete drying of the mixture, 250g of *Kajjali* was filled which was upto one third of the *kupi* and was placed in Vertical muffle furnace,^[9] embedded with heating element chamber measures, inner- 15inch height, 6 inch width, 6 inch length, outer – 15 inch height, 9 inch width, 9 inch length, mild steel body measures 25 inch height, 22 inch width, 22inch length. The insulation mould was kept inside the bottom of the heating element of the muffle, to adjust the height of the *kupi* before the procedure. The *Kupi* has been kept in the centre of the heating element chamber with the distance of 1/2 inch from the sides. The *Kajjali* filled *Kupi* was kept firmly with support of sand filled inside the insulation mould.

Pradhana karma

The 250g of *Kajjali* was filled in *Kacha kupi* and was placed at the Heating element chamber of the Vertical Muffle Furnace. *Kramagni paka*,^[10] was followed

throughout the procedure. The temperature was set at the temperature controller for 100°C. For the first 7 hours *Mrudvagni* was given i.e. temperature maintained between 125°C to 250°C. Next 15 hours *Agni* was gradually raised to *Madhyamagni* stage i.e. 250°C to 450°C, Last 10 hours *Teevragni* was given i.e. Temperature maintained between 450°C to 600°C. The

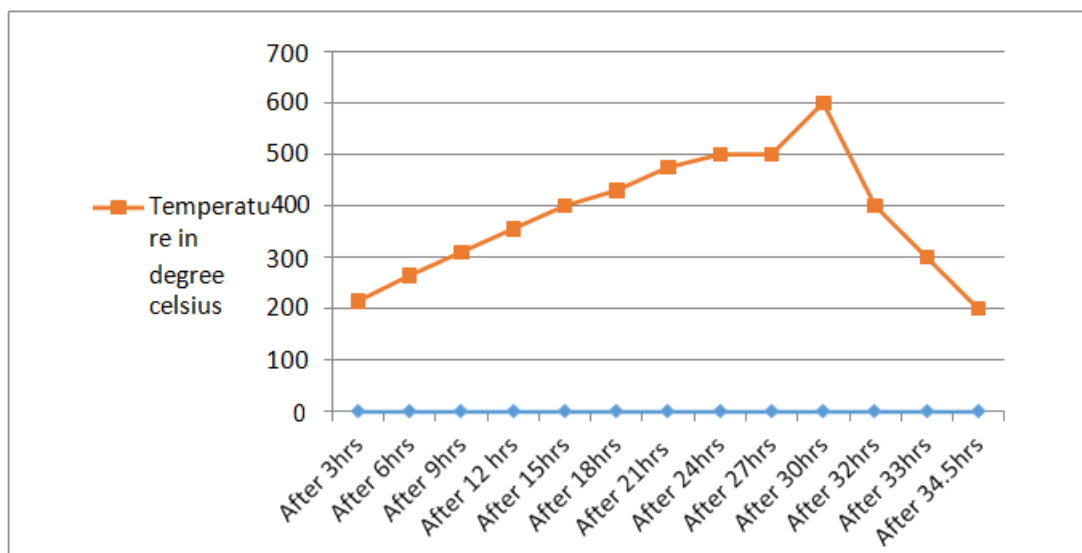
neck of *kupi* was cleared with the help of red hot iron rod to avoid choking at the neck of the bottle by sulphur. After the appearance of *Sindhoora Siddhi lakshana's* corking was done. The heating was maintained at high temperature. Later the temperature was gradually decreased to room temperature.

Table 1: Observation during the preparation of Rajata Sindhoora.

Time	Time in Hours	Set temp in furnace in °C	Reached temp in furnace in °C	Display temp in °C	Observations
9.24am	0 hr	100	100 at 9.28am	100	
9.43am	15min	150	150 at 9.47am	150	White fumes seen through torch light inside the <i>kupi</i> .
10.02am	15min	170	170 at 10.04am	170	Characteristic odour of sulphur was appreciated
11.04am	1hr	185	185 at 11.06am	185	Slight white fumes seen outside the <i>kupi</i> with increased odour
12.06pm	1hr	200	200 at 12.07pm	200	Slight yellow fumes inside the bottle, and odour of sulphur was appreciated.
1.07pm	1hr	215	215 at 1.08pm	215	
2.08pm	1 hr	230	230 at 2.08pm	230	Dense white fumes accumulated at the neck of <i>kupi</i>
3.08pm	1hr	250	250 at 3.17pm	250	Slight accumulation of yellowish particle at the neck of <i>kupi</i> with dense yellow fumes
4.17pm	1hr	265	265 at 4.19pm	265	<i>Kajjali</i> started to melt
5.19pm	1hr	280	280 at 5.27pm	280	Dense yellow fumes seen outside the <i>kupi</i>
6.27pm	1hr	295	295 at 6.29pm	295	Slowly cessation of yellow fumes observed
7.29pm	1hr	310	310 at 7.30pm	310	<i>Kajjali</i> melted completely
8.30pm	1hr	325	325 at 8.30pm	325	Strong sulphur odour appreciated. yellow particles deposited at the neck of <i>Kupi</i> .
9.30pm	1hr	340	340 at 9.30pm	340	<i>Sheeta shalaka</i> inserted. <i>Kajjali</i> was slight sticky.
10.30pm	1hr	355	355 at 10.31pm	355	Dense <i>Gandhaka</i> fumes found. Bottom could not seen with torch.
11.31pm	1hr	370	370 at 11.32pm	370	<i>Sheeta shalaka</i> inserted, melting of <i>kajjali</i> ascertained.
12.32am	1 hr	385	385 at 12.34am	385	Boiling of <i>Kajjali</i> started.
1.34am	1hr	400	400 at 1.37am	400	Neck of the <i>kupi</i> was blocked and cleared with hot <i>shalaka</i>
3.37am	2hr	415	415 at 3.39am	415	Hot <i>shalaka</i> inserted. Blue flame at the mouth of <i>kupi</i> was observed.
4.39am	1hr	430	430 at 4.40am	430	Density of yellow fumes reduced gradually
5.40am	1 hr	445	445 at 5.42am	445	<i>Sheeta shalaka</i> inserted, some adhered product taken from the neck of <i>kupi</i> .
6.42am	1hr	460	460 at 6.44am	460	Hot <i>shalaka</i> was inserted, block was cleared off.
7.44am	1 hr	475	475 at 7.45am	475	Hot <i>shalaka</i> was inserted. Increase in 1 inch flame was observed at the neck of <i>kupi</i>
1.45pm	6hr	500	500 at 1.45pm	500	Blue flame still persists
2.45pm	-	500	-	500	Blue flame gradually diminished

3.45pm	-	500	500 till 4.20pm	500	Slight <i>Suryodaya lakshana</i> could be seen at the base of the <i>kupi</i> , complete cessation of blue flame was observed
4.23pm	2hr 35min	525	525 at 4.24pm	525	Copper foil test was positive. <i>Suryadaya lakshana</i> was well appreciated, No flames observed. Corking done
4.25pm	1min	550	550 at 4.29pm	550	
4.31pm	2min	575	575 at 4.35pm	575	
4.35pm	1min	600	600 at 4.40pm	600	Peak temperature, maintained for 1hr
5.40pm	1hr	550	550 at 5.40pm	550	Reduction of temperature
5.45pm	5min	500	500 at 5.47pm	500	
5.57pm	10min	450	450 at 6.10pm	450	
6.20pm	10min	400	400 at 6.21pm	400
6.30pm	9min	350	350 at 7.05pm	350
7.15pm	10min	300	300 at 7.47pm	300
7.50pm	3min	250	250 at 7.55min	250
8.03pm	8min	200	200 at 8.07pm	200
8.16pm	9min	150	150 at 8.18pm	150	Furnace was switched off

Table 2: Temperature pattern of *Rajata sindhoora*.



Pashchat karma

After complete cooling of the Muffle furnace, sand was removed from the insulation mould and then *Kupi* was taken out from the E.M.F. The mud smeared cloth layers of the *Kupi* were scrapped out with a knife. A jute thread dipped in Kerosene was tied to the *Kupi* 2-3cm below the level of sublimated product and ignited. When the whole

thread was burnt off, wet cloth was wrapped around that burning thread where it was tied. The bottle was broken into 2 equal halves with a breaking sound. From the neck region product was collected as a single block with a central hole by a gentle tapping and was stored in a clean sterile container.

Table 3: Result: Showing Loss and Weight of *Rajata Sindhoora*.

Total Wt of <i>Kajjali</i> (g)	Wt of <i>R.S.Kantastha</i> (g)	Wt of <i>R.S.Talastha</i> (g)	Loss(g)
250g	79g	15g	156g

PHOTOS



Fig. 1: *Shodhita Rajata*



Fig. 2: *Hingulotta Parada*



Fig. 3: *Shodhita Gandhaka.*



Fig. 4: *Rajata pishti*



Fig. 5: *Kajjali* preparation.



Fig. 6: *Bhavana* with *Kumariswarasa.*



Fig. 7: *Bhavana* to *Kajjali*



Fig. 8: Filling *Kajjali* to *Kupi.*



Fig. 9: Placing of *Kupi* in V.M.F.



Fig. 10: V.M.F.



Fig. 11: Stage of yellow fumes.



Fig. 12: *Shalaka sanchalana.*



Fig. 13: Stage of blue flames.

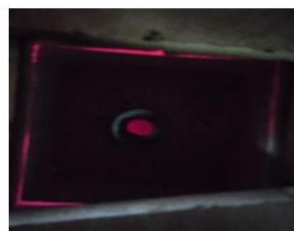


Fig. 14: *Suryodaya Lakshana.*



Fig. 15: *Rajata Sindhoora.*

OBSERVATION AND RESULT

In the present study desired characteristics were observed on different phases of processing such as sulphur fuming, melting and boiling of *kajjali*, blue flame appearance. Confirmative tests like *sheeta shalaka* test, copper coin test and *suryodaya lakshana* were also observed during the process. Here temperature maintained between 150⁰C to 600⁰C. Total Weight of *Rajata Sindhoora* obtained was 79g.

DISCUSSION

Rajata Sindhoora being one of the *Kantastha Kupi Pakwa* preparation requires *Kramagni paka* which was successfully achieved by modified Verticle Muffle Furnace method in the present study. Total duration of the *kramagni paka* was 34.5hours where duration of *Madhyamagni* was more and temperature ranges between 250⁰C to 450⁰C as it gives sufficient time for the desired product formation by the process of *Gandhaka jarana*.

CONCLUSION

In the present pharmaceutical study *Rajata Sindhoora* was prepared successfully by adopting *Kramagni Paka* in Verticle Muffle Furnace with 7 hours of *Mrudvagni* followed by 15hours of *Madhyamagni* and last 10hours of *Teevragni* which also resulted in reduced time duration, less fuel consumption and human effort as compared to the traditional method of preparation with standard quality.

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