



Analytical Assessment of *Rajata Sindura*

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ABSTRACT

Though, the classical reference is not found for the preparation of *Rajata Sindura*, it was collected as a byproduct during the preparation of *Rajata Bhasma* by adopting the *Kupipakwa* method instead of *Putapaka* method. *Rajata* (Silver) *Sindura* is prepared and analyzed on various parameters. For the preparation of *Rajata Sindura* 99.56% pure Silver was obtained and subjected to *Vishesha shodhana* with lemon juice then was converted into tiny pieces and triturated along with equal quantity of *Hingulottha Parada* and lemon juice for 6 hrs followed by trituration with *Shuddha Gandhaka* and *Kumari Swarasa* (Aloe Vera Juice) to obtain *Kajjali*. *Rajata Kajjali* was subjected to *Kupipaka* in Electric Muffle Furnace and *Valukayantra* in the quantity of 250 g each. Total four batches of *Rajata Sindura* were prepared, two in Electric Muffle Furnace and two in *Valukayantra*. *Rajata Sindura* was obtained as a byproduct at the neck part (*Galastha*) of *Kupi* and the material collected at the bottom part of *Kupi* (*Talastha*), was further used to make *Rajata Bhasma*. During the preparation of *Rajata Sindura* in E.M.F., the maximum temperature was given in each batch i.e. 600°C and 601°C whereas in *Valukayantra* maximum temperature was observed in each batch i.e. 708°C and 748°C. Namburi Phased spot test was done in all four samples of *Rajata Sindura*, two from each – E.M.F. and *Valukayantra* method whereas one sample of *Rajata Sindura* (prepared by *Valukayantra* method and collected in a most intact form) was analyzed on different parameters; physicochemical parameters like Carbon Disulphide Soluble Extract, Estimation of Silver and Mercury content and for advanced modern parameters AESICP (Atomic Emission Spectroscopy with Inductively Coupled Plasma) method was selected. In AESICP study, the Silver was present in 0.020481% whereas Mercury and Sulphur was found with 91.995% and 11.685% respectively. In addition to that quantity of Iron, Cadmium and Platinum was found 0.0072570%, 0.0000616% and 0.00044666% respectively.

Key Words: *Rajata Sindura*, *Kupipakwa*, *Rajata*, *Kajjali*, AESICP

INTRODUCTION

Kupipakwa Rasayan is one of the most significant *Kalpana* of *Rasashastra* with regards to not only its unique method of preparation but also the smaller dose and highly effectiveness. Therefore, when *Rajata Bhasma* was prepared by using the *Parada* and *Gandhaka* -as a media- a try was given to prepare it by adopting *Kupipakwa* method

instead of *Putapaka* method as prescribed in *Rasa Tarangini*, so that a specific *Sindura Kalpana* can be obtained as a byproduct. Though, there is no any classical reference of *Rajata Sindura*, *Makardhwaja* method (only and ratio of *Parada* and *Gandhaka* was selected as prescribed in *Rasa Tarangini* for *Putapaka*¹ Method) was followed to procure *Sindura* at the *Galastha* part of *Kupi* and



it was named as '*Rajata Sindura*' as it was collected as the by-product while preparing the *Rajata Bhasma*. The obtained *Rajata Sindura* passed all the tests of *Kupipakwa Rasayan* during the preparation of it and hence it was also important to know if it contains any amount of Silver into it. Total four samples of *Rajata Sindura* were prepared; two by using *Valukayantra* as well as two by using Electrical Muffle Furnace (E.M.F.). The most appropriate sample of *Rajata Sindura* was collected, which was obtained from *Valukayantra* method (and was observed in intact form while breaking the *Kupi*) and analyzed on different parameters such as physicochemical parameters like Carbon Disulphide Soluble Extract, Estimation of Silver and Mercury content and to analyze on modern parameters Atomic Emission Spectroscopy and Inductively Coupled Plasma (AESICP) method was selected whereas Namburi Phased Spot (NPS) Test was done in all the four samples of *Rajata Sindura*.

MATERIALS AND METHODS

Preparation of *Rajata Sindura*:

Samanya Shodhana of *Rajata* was escaped because 99.56% Silver was obtained from market and it was in the form of Rode.

Vishesha Shodhana: For *Vishesha shodhana*² of *Rajata*, thick Silver rode was converted into folia (*Kantakvedhipatra*) of 32 Gauze. It was cut into the size of 2" X 4" pieces and subjected to *Nirvapa* in Lemon Juice for 7 times.

Pishti Formation: *Shodhit Rajata* was converted into tiny pieces and triturated along with equal

quantity of *Hingulottha Parada* and lemon juice for 6 hrs. Due to the minimum quantity of *Parada* it was converted to a lustrous steel gray colored coarse powder instead of *Pishti*.

Kajjali Formation²: The above obtained coarse powder was then triturated with *Shuddha Gandhaka* (equal quantity to *Rajata*) for 6 hrs. Then *Kumari Swarasa* was added as per requirement and trituration was done for another 12 hrs.

Kupipaka: Prepared *RajataKajjali* was subjected for *Kupi Paka*. Total four samples were prepared where two samples were prepared in *Valukayantra* and two samples were prepared in Electric Muffle Furnace (E.M.F.). *RajataKajjali* was taken in the quantity of 250 gm in each *Kupi*. After *Kupipaka* and self – cooling of *kupi*, material obtained at the neck of the bottle (*Galastha*) was collected as *Rajata Sindura* while bottom material of the *Kupi* (*Talastha*) was used to prepare *Rajata Bhasma* for further procedures.

Analytical study of *Rajata Sindura*:

Namburi Phased Spot Test³ was done for all the four samples of *Rajata Sindura*; out of which, two samples were prepared by using E.M.F. i.e. R.S. (a) and R.S. (b) and two samples were prepared in *Valukayantra* i.e. R.S. (c) and R.S. (d). One sample was selected (which was obtained from the *Valukayantra method*) i.e. R.S. (d) for other analytical parameters such as Carbon disulphide soluble Extract, Estimation of Silver Content, Estimation of Mercury Content and Atomic Emission Spectroscopy with Inductively Coupled Plasma (AESICP).



RESULTS

NPS (Namburi Phased Spot) test of *Rajata Sindura* has been carried out in all the samples of *Sindura* i.e. R.S. (a), R.S. (b), R.S. (c), R.S. (d) and observations are presented in a tabular form as well as images of different stages are also been given i.e. Table (1) and Image (1). This method was developed by Dr. Namburi Hnumantha Rao in 1970 which was accepted and propagated by C.C.R.A.S.

The findings of Carbon Disulphide Soluble Extract (Table 2), Estimation of Silver content (Table 3) and Estimation of Mercury content of *Rajata Sindura* sample i.e. R.S. (d) are presented in a tabular form (Table 4).

Rajata Sindura sample R.S. (d) was analyzed with advanced modern parameter i.e. Atomic Emission Spectroscopy with Inductively Coupled Plasma (AESICP) and the result of the analysis has been presented in Table 5.

DISCUSSION

Table 1 Namburi phased spot test for *Rajata Sindura* Spotting on 10% potassium iodide paper after 48 hours of reagent con. HNO₃ treatment

Sample – R.S. (a)

Phase I (0 – 5 min.)	Central	Dark brown segment with little cream spot.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow color at outer side.
Phase II (5 – 20 min.)	Central	Dark brown segment with little cream spot.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow color at outer side.
Phase III (after 24 hrs.)	Central	Small brick red solid spot with white segment.
	Middle	Orange ring covered with dark brown ring.
	Peripheral	Brown color started to convert into light brown color at outer side.

Sample – R.S. (b)

Phase I (0 – 5 min.)	Central	Dark brown segment with little cream spot.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow color at outer side.
Phase II (5 – 20 min.)	Central	Dark brown segment with little cream spot.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow color at outer side.

In modern chemistry the technique of spot test or chromatography is widely used. Unlike the conventional method of Spot test, with Namburi Phased Spot test, with NPS technique the spot is not rejected immediately after reading and so the chemical reaction. This is a method to study or to detect continual chemical reactions that takes place gradually between two chemical substances on static media at every second or at a fraction of a second. In that, trial and error method, the author has come up with certain reagents and some chemical papers that produced specific pattern of spots with specific *Bhasma* and *Sindura*. NPS was conducted for all the four samples of *Rajata Sindura* and observations (Table 1 and Image 1) given by *Valukayantra* sample is differed than the E.M.F. samples and there is remarkable changes found between the *Valukayantra* samples, which also indicates there may be some changes regarding the final compound as well as the process of preparation and the quantity of elements present in it.



Phase III (after 24 hrs.)	Central	Small brick red solid spot with white segment.
	Middle	Orange ring covered with dark brown ring.
	Peripheral	Brown color started to convert into light brown color at outer side.
Sample – R.S. (c)		
Phase I (0 – 5 min.)	Central	Dark brown segment with little cream spot.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow color at outer side.
Phase II (5 – 20 min.)	Central	Light blackish brown shade.
	Middle	Brownish black ring.
	Peripheral	Brown color converted to light brown to yellow colour at outer side.
Phase III (after 24 hrs.)	Central	Small brick red solid spot with white segment.
	Middle	Orange ring covered with dark brown ring.
	Peripheral	Brown color decreased with outer periphery.
Sample - R. S. (d)		
Phase I (0 – 5 min.)	Central	Creamy segment with slight orange spot.
	Middle	Denatured orange colored ring with covered with blackish ring.
	Peripheral	Brown periphery converted to light brown to yellow color at outer side.
Phase II (5 – 20 min.)	Central	White colored segment with orange spot.
	Middle	Denatured orange colored ring with covered with blackish ring.
	Peripheral	Brown periphery converted to light brown to yellow color at outer side.
Phase III (after 24 hrs.)	Central	Small orange colored solid spot with light orange shade.
	Middle	Orange colored denatured ring covered with dark brown ring.
	Peripheral	Brown color converted to light brown at outer side.

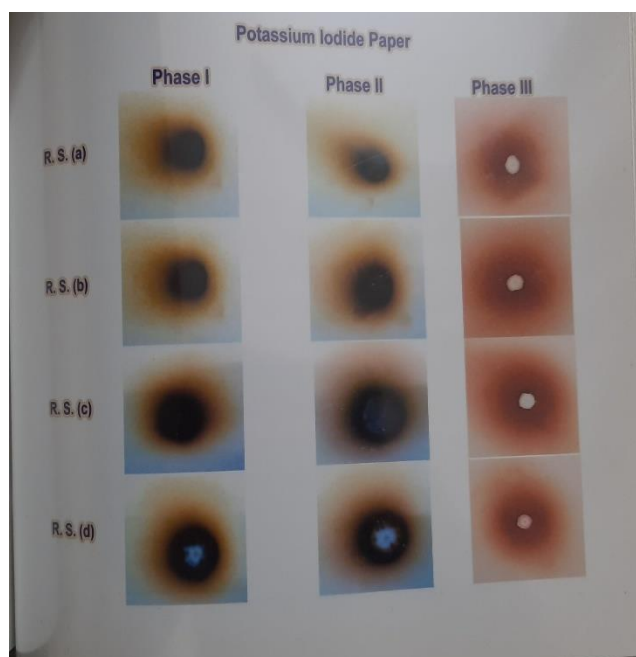


Image 1 Namburi phased spot test for Rajata Sindura R.S. (a), R.S. (b), R.S. (c) and R.S. (d)

As per the findings of the Carbon disulphide soluble extract (Table 2), it was found 0.65% in R.S. (d) which indicates 0.65% free Sulphur in sample R.S. (d). Estimation of Silver content (Table 3) in R.S. (d) was nil, which indicates there is no free silver in the sample and estimation of

Mercury content (Table 4) of R.S. (d) was found 87.19% which indicates the percentage of mercury suggests the higher chances of availability of HgS Compound in the *Rajata Sindura*.

Table 2 Carbon disulphide Soluble Extract in R.S. (d)

Test	R.S. (d)
Carbon disulphide soluble extract	0.65%

Table 3 Silver content in Rajata Sindura R.S. (d)

Sample	% of silver
R. S. (d)	Nil

Table 4 Percentage of Hg in RajataSindura R.S. (d)

Sample	% of silver
R. S. (d)	87.19

Table 5 AESICP analysis of R. S. (d)

Element	Samples (%w/w) R.S.(d)
Silver (Ag)	0.020481
Mercury (Hg)	91.995
Sulphur (S)	11.685
Iron (Fe)	0.0072570
Copper (Cu)	BDL
Cadmium (Cd)	0.0000616
Lead (Pb)	0.0044666
Platinum (Pt)	BDL#
Zinc (Zn)	BDL#

#BDL = Below Detectable Limit



Atomic Emission Spectroscopy with Inductively Coupled Plasma (Table5) (AESICP): Elemental analysis was conducted with AESICP of R.S. (d) sample (Table 5). In this study quantity of Mercury (Hg) was found 91.96% along with 11.67% of Sulphur(S). The study also shows the presence of Silver (Ag) 0.02% w/w and some other elements like Iron (Fe) 0.0072570%, Lead 0.0044666%, Cadmium (Cd) 0.0000616%. The quantity of Mercury indicates that Hg could be present in other forms additionally to HgS for eg. an amalgamation and/or compound with Silver, Iron and other elements too.

CONCLUSION

In present study, the percentage of Silver (Ag 0.02w/w) shows the presence of Silver in *Rajata Sindura*. Mercury with 91.96% w/w and Sulphur with 11.67% w/w indicates the major compound in this sample could be in HgS form. The various trace elements found in *Rajata Sindura* were Fe 0.0073% w/w, Lead 0.04%, Cadmium 0.000062%.



REFERENCES

1. Kulkarni D A, 1998, Rasaratnasamucchaya of Vagbhata, Reprint ed., New Delhi, Meharchand Lachmandas Publications; p 231.
2. Sharma S 2000, Rasatangini translated by K Shastri, 11th ed., New Delhi, Motilas Banarasidas; p 388, p 391.
3. Rao N M, 1991, Applications of NPS test in Identification of Bhasma & Sindura preparation in Ayurveda, New Delhi, CCRAS; p 53.