



**PHYSICO CHEMICAL EVALUATION OF RAJATA BHASMAS PREPARED WITH
TWO DIFFERENT INCINERATING AGENTS**

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ABSTRACT

Back ground: Rajata (Silver) is considered as śuddha loha, in the form of Bhasma, is indicated in various disorders like Smritinasha, Unmāda, Apasmāra, Vīryakshaya, Vata rogas and also having qualities like Agni-deepana, Vayasthāpana and Rasāyana. Rasa Vagbhata mentioned that Pārada is the best medium for making Bhasmas of metals. Thus, Pārada and Gandhaka were selected for incineration of Rajata. **Aims:** To Analyse the Physico-Chemical parameters of Rajata Bhasmas. **Methods and Material:** Rajata Bhasma was prepared according to Rasa tarangini(RT) and analysis were done with respect to various parameters. Rajata patra purchased from authenticated source and which was cut in to small pieces, then samanya sodhana of Rajata done by kanji, takra, kulatha kwatha, gomutra, and tila taila for 3 times. Then visesha sodhana done in Agastya patra swarasa for 3 times. Then it is subjected to marana karma (incineration process) with haratala, gandhaka and parada. Here, 2 kinds of puta were carried out to examine the change of Rajata bhasma. Kukkuta puta done by taking equal quantities of Rajata, Gandhaka and Haratala. Total number of puta was 9 in number. Another was Laghu puta done by equal quantities of Rajata, gandhaka, Parada and half of Haratala. Total number of puta was 21 in number. **Results:** Kukkuta putita bhasma (Sample1Prepared in Kukkuda puta) was blackish in colour and Laghu putita bhasma (Sample 2/ sample prepared out by Laghu puta)) was brownish in colour. Both these bhasmas were analysed by classical bhasma pareeksha, physico chemical analysis like Loss on Drying, Total ash, Acid insoluble ash, Water soluble extractive, Alcohol soluble extractive, pH value, Fineness of powder and Advanced Instrumental Analysis like XRD (X-ray diffraction), SEM-EDX (Scanning Electron Microscopy-Energy Dispersive X-Ray Analyzer), Particle size analysis by Laser diffraction. **Conclusion:** By all the above parameters it is concluded that Rajata bhasma prepared with parada shows better quality.

KEYWORDS: Rajata, Rajata bhasma, Bhasma analysis, Bhasma pareeksha, Puta.

INTRODUCTION

One of the potent formulation in the field of Rasashastra is Bhasma. Reduced particle size of bhasma helps its fastest absorption with in minute dose itself. Acharyas included Rajata(Silver) as one among suddha loha¹. Acharyas mentioned different incinerating methods of Rajata. Different incinerating agents are also mentioned for the marana of Rajata like gandhaka, haratala etc. The procedure of Bhasmeekarana includes samanya and visesha sodhana of metal, trituration with mentioned liquid media, preparation of chakrika, samputeekarana and finally marana according to specific puta. Here Rajata bhasmeekarana done with and without mercury by kukkuta puta and laghu puta. Kukkuta puta taken 9 number and laghu puta taken 21 number to turn proper bhasma. Analysis of the prepared bhasma done by classical bhasma pareeksha, physico chemical analysis like acid value, ash value, acid insoluble ash, pH etc and

modern instrumental analysis like XRD, SEM-EDAX, Particle size by laser diffraction.

MATERIALS AND METHODS

Rajata, Parada, Gandhaka and Haratala were purchased from authenticated sources and Sodhana, Marana procedures were done in Department of Rasashastra and Bhaishajya Kalpana, Amrita School of Ayurveda, Amritapuri, Kollam.the Raw drugs for Sodhana procedure collected from botanical garden of the Institute.

Steps involved in the preparation of Rajata Bhasmas are

1. Purification of *Rajata, Pārada, Gandhaka, Haratāla* as per classical method.

- Preparation of *Agastya Swarasa*, *Bṛīṅgārāja Swarasa*, *Kuṣmānda Swarasa*, *Kulatha Kvātha*, *Kāñji*, *Takra* for *Śodhana* as per classical method.
- Preparation of *Rajata Bhasma* as per classical *Putā* methods.

Rajata Samanaya Shodhana^[2]

Rajata Patra 196g taken and heated up to red hot and dipped in *Kāñji*, *Takra*, *Kulatha Kvātha*, *Gomūtra*, *Tila Taila* respectively 3 times each with fresh liquid media.

Rajata Vissha Shodhana^[3]

190g of Samanya Sodhita Rajata patra taken and Nirvapa in Agstya patra swarasa each with 400ml for 3times.

Gandhaka Sodhana^[4]

487 g of Aśuddha Gandhaka taken and melted by heating and dipping in *Bhringaraja swarasa* for 7 times. Each proess repeated by taking fresh swarasa. Washed by hot water.

Haratala Sodhana^[5]

520 g Aśuddha Haratāla taken in a cloth and tied well. Then it is tied in a pot filled with *Kushmanda swarasa* and boiled for 3 hrs. Then it is washed dried and again boiled with *Churnodaka* for next 3 hrs.

Parada Shodhana^[6]

Aśuddha Parada and Sudhā Cūrṇa 250g each taken in a *Khalva yantra* and trituration done for 72 hrs. Then it was taken out and washed with hot water. Then again, the Parada trituated with 200g of *Laśūna* and 100g of *Saindhava Lavaṇa* for next 36 hrs (up to blackish colour). Finally, it was washed with warm water and stored as *Sodhita Parada*.

Rajata Marana

First sample^[7]: *Śuddha Rajata*-90 g, *Śuddha Gandhaka*-90, *Śuddha Haratāla* -90 g taken in *khalva yantra* and

trituated. Then it is taken in *sarava* and *samputa* done. Total number of *Kukkuta puta* was 9 by using 60 *vanopala*.

Second sample^[8]: *Śuddha Rajata*-90 g, *Śuddha Pārada* -90g taken in *khalva yantra* and trituated with *Nimbu swarasa* for 1 day till the *amalgam* formation. The washed by hot water and trituated by 90 g of *Śuddha Gandhaka*, *Śuddha Haratāla*-45 g. This mixture taken in *sarava* and *samputa* done properly. This was subjected to 21 *laghu puta* by using 8 *vanopala*.

RESULTS

Table No. I: Showing Results of Classical Bhasma Parīkṣa.

Sl. No	Classical parameters	Rajata Bhasma	
		Sample -1	Sample -2
1	<i>Rekhāpūrna</i>	Positive	Positive
2	<i>Niśchandrata</i>	Positive	Positive
3	<i>Vāritara</i>	Positive	Positive
4	<i>Unnama</i>	Positive	Positive
5	<i>Apunarbhava</i>	Positive	Positive
6	<i>Nirutha</i>	Positive	Positive
7	<i>Nirdhūma</i>	Positive	Positive

Table No. II: Showing Organoleptic characters of Rajata Bhasma.

Sl. No	Parameters	Observations	
		Sample -1	Sample- 2
1	Colour	Black	Brown
2	Odour	Odourless	Odourless
3	State	Powder	Powder
4	Taste	Tasteless	Tasteless

Table No. III: Showing Physico-Chemical parameters of Rajata Bhasma.

Sl. No	Parameters	Observed values of Rajata Bhasma	
		Sample -1	Sample- 2
1	Loss on drying	1.65%	1.54%
2	Total ash	99.97%	57.46%
3	Acid insoluble ash	92.7%	47.96%
4	Water soluble extractive	0.5648%	2.1%
5	Alcohol soluble extractive	0.098%	1.0352%
6	pH value (5% solution)	3.24	3.19
7	Fineness of Powder	-Fine powder (d 50: falls between 75 μm – 250 μm)	-Fine powder (d 60 less than 75 μm)

Table No. IV: Showing Physico-Chemical parameters of Rajata Bhasma.

Sl. No	Name of Advanced Instrumental analysis	Result	
		Sample -1	Sample- 2
1	X-Ray Diffraction	-Silver in the form of Silver Sulphide Crystallite size= 52.98nm	-Silver in the form of Silver Oxide Crystallite size= 45.25nm
2	SEM	The smallest particle size obtained =0.75μm	The smallest particle size obtained =0.41μm

3	EDAX	Atomic percentage of elements are:- Silver-30.51% Sulphur-4.03% Oxygen-38.79%	Atomic percentage of elements are: - Silver - 23.67% Sulphur- 16.99% Oxygen-15.35% Mercury-19.85% Arsenic -12.2%
4	Particle size by Laser diffraction	20.08 μm	47.68 μm

DISCUSSION

LOD: Sample-1 possessed 1.65% and sample-2 possessed 1.54% of LOD. Hence sample 2 has least chance of deterioration.

pH: 5% aqueous solution of Sample 1 has a pH 3.24 and sample 2 has pH 3.19. This value indicates the acidic nature of the drug, which might be due to heat treatment. As a rule, acidic drugs are rapidly absorbed from the G.I tract. They act rapidly on oral administration and might get absorbed through the stomach by passive diffusion of unionized mostly across a lipid membrane.

Total Ash: Percentage of total ash in sample 1 is 99.97% and sample 2 is 57.46%.

Acid insoluble ash: The acid insoluble ash measures the acid insoluble materials like silica and calcium compounds. Acid insoluble ash of sample 1 is 92.7% and sample 2 is 47.96%. Acid insoluble ash represents insoluble inorganic content. Sample 2 should be physiologically more available as the drug must first pass in to solution before it can be absorbed.^[9]

Extractive values: Water soluble extractive value of Sample 1 is 0.5648% and alcohol is 0.098%. Sample 2 shows water soluble extractive value of 2.1% and alcohol soluble extractive value of 1.0352%. This shows the presence of soluble solids are more in sample 2 as compared with sample 1. When *Pārada* used in the preparation, the salts getting more absorption. i.e, Sample 2 shows more solubility in water and alcohol.

Fineness of powder: Fineness of powder analysed by sieve method, by mesh size 120 and 200. Sample 1 comes under very fine category by 38.8% particles finer than 75 μm . Comes under Fine powder, 63.9% particles finer than 75 μm .

^[10]During the sieving process, these particles tend to reduce their size dramatically due to abrasion and collisions, leads to inaccurate results .ie, size distribution of particles in particular sample may be altered.

XRD: XRD data of sample -1 has 3 major peaks of 2-Theta ° values are 34.365, 37.713, 36.779. These values are compared with JCPDS standards and substance identified as Ag₂ S.

X- Ray diffraction study of *Rajata Bhasma* to graph pattern showed crystalline structure. According to identified peaks of sample -1 having chemical formula Ag₂ S. Silver found in the sample was in the form of Sulphide compound, it might be because of *Rajata* incinerated with *Śuddha Gandhaka* during *Mārāṇa* procedure.

XRD data of sample-2 has 2-Theta degree value of peaks 27.86, 33.356, 29.848. Silver Mercury Arsenic Sulphide and Silver oxide (Ag₂ O). It might be because of *Rajata* incinerated with *Śuddha Gandhaka*, *Śuddha Pārada* and *Śuddha Haratāla* during *Mārāṇa* procedure. The crystalline structure identified by using Scherrer formula shows the 52.98nm for sample1 and 45.25nm for sample 2. This value shows the smallest crystalline size of *Rajata Bhasma* which is incinerated with *Pārada*. (Figure I)

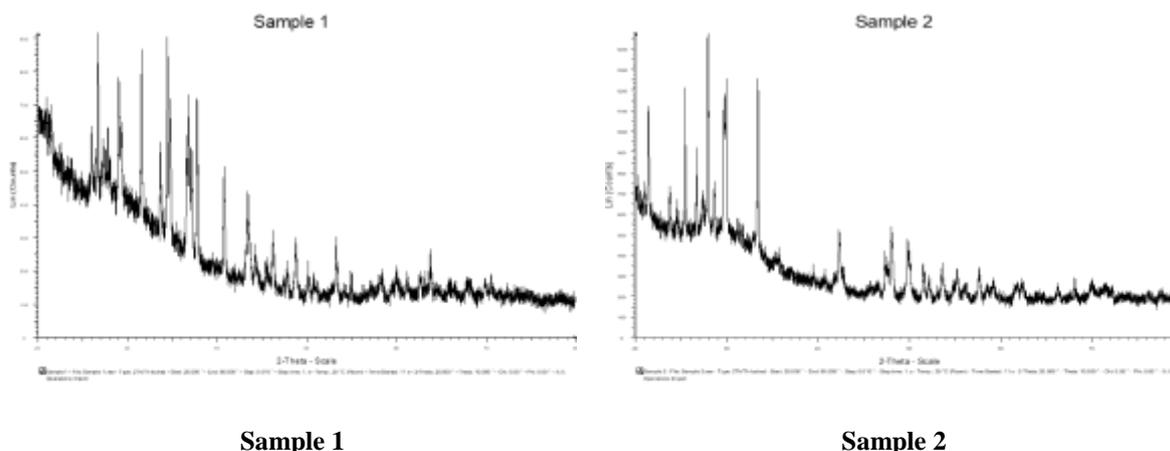


Figure I: X-ray diffraction.

SEM Analysis: Both samples showing Nanoparticles in both samples. Smallest size of particle obtained in sample 1 is $0.75\mu\text{m}$ and sample 2 is $0.41\mu\text{m}$. This result showing the smallest particle size found in *Bhasma* prepared with *Pārada*. Both samples of *Bhasma* come under Nanoparticle.

EDAX: *Rajata Bhasma* sample-1 has showing 30.51% of Silver. This sample also contains the 4% atomic % of sulphur, 38.79% atomic % of oxygen, 14.99% atomic % of silicon, 2.57% atomic % of carbon and 9.1% atomic % of aluminium. This atomic percentage clearly gives the

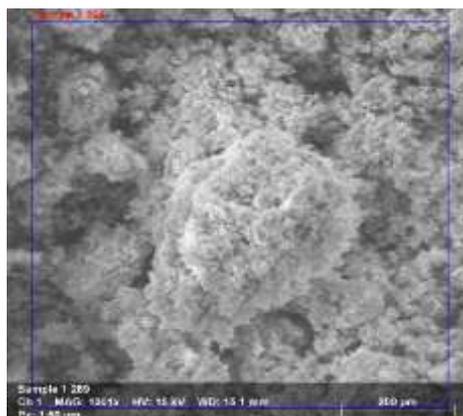
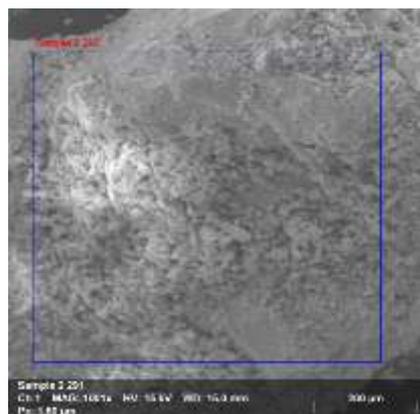


Figure II: EDAX of sample 1

inference that the product is in the form of silver sulphide and minority silver oxide.

The *Rajata Bhasma* sample-2 has showing 23.67% of Silver. This sample also contains the 16.99 % atomic % of sulphur, 15.35 % atomic % of oxygen, 4.3% atomic % of silicon, 4.31% atomic % of carbon, 3.33 % atomic % of aluminium, 12% atomic % of arsenic and 19.85% atomic % of mercury. This atomic percentage clearly gives the inference that the product is partially in the form of Silver Mercuric Arsenic Sulphide and Silver Oxide. (Figure II).



EDAX of sample2

Particle Size Analysis by Laser diffraction: This method randomly drawn two samples of *Rajata Bhasma*. In sample 1 the mean diameter of particle is $20.04\mu\text{m}$. In Sample 2 mean diameter of particle is $47.68\mu\text{m}$. 50% of samples were below $35\mu\text{m}$. The lacuna of instrumentation detects the complete regular spherical particles. If the size of the particle is small, but not completely spherical, it is not detected under the lower limit of the particle size, but it will pass by the upper limit of the particle size.

CONCLUSION

The crystallite size and particle size reveal that the *Rajata Bhasma* prepared with *Pārada* having smaller size. Water and alcohol soluble extractive value of *Rajata Bhasma* with *Pārada* shows the presence of more soluble solids compared to *Rajata Bhasma* without *Pārada*. i.e, *Rajata Bhasma* prepared with *Pārada* shows more solubility in water and alcohol. By these it is concluded that, *Rajata Bhasma* prepared with *Pārada* shows better quality.

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