



## PREPARATION OF NANO RAJATA BHASMA AND EVALUATION OF PHYSICOCHEMICAL PARAMETERS

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### ABSTRACT

Rajata Bhasma (RB) is the incinerated form of silver mentioned in Ayurveda in classic texts. This attempt is made to prepare nano particle of rajata bhasma by a novel green method of synthesis without the use of any chemicals. Prepared Nano Rajata Bhasma (NRB) is subjected to traditional evaluation like rupa, varna, nishchandratvam, varitara, rekhapurnatavam, rasa and gandha, in addition to the following tests pH, loss on drying, total ash, specific gravity, total plasmon resonance, zeta potential and FAAS. Marketed rajata bhasma was purchased from local ayurvedic pharmacy and subjected to tests applicable. The results

proved that rajata bhasma available from market and prepared nano rajata bhasma were qualitatively the same, in that both contain silver as proved by Atomic Absorption Spectroscopy (AAS).

**KEYWORDS:** Rajata Bhasma, Green synthesis, Nano rajata bhasma, Atomic Absorption Spectroscopy.

### INTRODUCTION

Rajata Bhasma (RB) is the incinerated form of silver mentioned in Ayurveda in classic texts on *Rasashastra* like Charaka Samhita and Susruta Samhita. RB is widely used in various herbo-mineral formulations like kasturi bhairav rasa, jayamangala rasa, grahanikapata rasa, mahamraganka rasa, lakshmvilasa rasa, trilokyachintamani rasa, vatagajankusha rasa, and vijaya parpati.<sup>[1]</sup> RB is used to treat diabetes, vitiligo, tuberculosis, anemia, dyspnea, cough, piles, thirst, emaciation, consumption, epilepsy, alcoholism, delirium, urinary disorders, bile

& splenic disease, ophthalmic disorders, poison, fever, psychological disorders, liver disorder, and uterine disorder.<sup>[2,3]</sup> RB is reported to have anxiolytic effect, free radical scavenging effect, and can reduce infertility.<sup>[4]</sup> RB is suggested to be taken as a medicine along with the adjuvants like honey, sugar, ghee, vetiver kasaya, and juice of other plant materials.<sup>[5]</sup> It is stated that improper preparation of RB may lead to the anemia, itching, fever, headache, dyspepsia, constipation, weakness, cachexia, malaise, body odour and oligospermia.<sup>[5,6]</sup> Excessive exposure to silver will cause argyrosis.<sup>[7]</sup> This study proposes a novel method of synthesis by applying green nanotechnology for the preparation of rajata bhasma containing nanoparticles of the same. The prepared novel nano rajata bhasma (NRB) is compared with marketed rajata bhasma. Results showed that both are qualitatively same. Both have silver as proven by the tests.

## **MATERIALS AND METHODS**

Silver foil, *Aloe vera* extracts and deionized water. All other chemicals and reagents were of analytical reagent grade.

## **PREPARATION OF NANO RAJATA BHASMA**

The raw materials were collected from authentic sources. A determined amount of pure silver foil was triturated in 20 ml of deionized water and mixed along with 20 ml of *Aloe vera* extract. The mixture was stirred vigorously at room temperature for 30 minutes. It was transferred to a sealed Teflon-lined vessel of 100 mL capacity which was stirred at room temperature for 15 minutes. This mixture was transferred to a water bath sonicator and sonicated for 24 hours at 80°C. The colored solution was collected and observed as dark yellow to brown coloured solution. The final solution is known as nano rajata bhasma.

## **MARKETED RAJATA BHASMA**

The standard against which the formulated RB is tested was obtained from Dhivya pharmacy, A-1 Industrial area, Haridwar – 249401, Uttarakhand. Batch No: RJ3006.

## **QUALITATIVE ANALYSIS OF RAJATA BHASMA**

The quality and characteristic features of marketed RB and prepared NRB were ascertained through different classical, physico-chemical, and quantitative analysis.

## 1. Classical parameters

RB samples were analyzed for standard parameters like rupa, varna, nishchandravam, varitara, rekhapurnatavam, rasa, and gandha (Table 1).

**Appearance (rupa):** The physical state of the sample was analyzed.

**Color (varna):** Each bhasma has a specific color arising from principle base material. The color of the bhasma was observed physically and recorded.

**Lusterless (nishchandravam):** Bhasma will be lusterless. The presence of luster is the indication of improper preparation. Sufficient amount of bhasma was placed in a Petri dish and observed under bright sunlight through magnifying glass for the presence of luster.

**Lightness (varitara):** Bhasma will float on standing water surface. In this test a small amount of the bhasma was sprinkled over the still water in a beaker and observation were recorded.

**Fineness (rekhapurnatvam):** Bhasma shall enter into the finger lines and it shouldn't get easily washed out. In this test a pinch of bhasma was taken in between the thumb and index finger and rubbed to feel the fineness.

**Rasa (taste):** Properly incinerated bhasma will be devoid of metallic taste and transformed to neutral tasteless compound.<sup>[8,9]</sup> In this test a small amount of bhasma was kept on the tongue and tasted.

**Smell (gandha):** Bhasma will not have any specific smell. In this test the small amount of bhasma was taken and smelled.

**Test for irreversibility (apunarbhavata):** Bhasma shouldn't regain its original metallic form. In this test bhasma was taken in earthen pots and mixed with equal amount of Mitra Panchak (seeds of *Abrus precatorius*, honey, ghee, borax and jaggery) and heated to the temperature which is used to prepare that particular bhasma. Presence of lustrous particles indicates the improper preparation and formation of free metal. After self-cooling, the product was observed.<sup>[8]</sup>

**Table 1: Organoleptic evaluation.**

Parameter	RB	NRB
Appearance	Solid	Liquid
Color	Black Powder	Dark yellow to Brownish yellow colored clear solution
Lightness	Floats on water	Miscible in water
Taste	Nil	Nil
Lusterless	No luster observed	No luster observed
Smell	Nil	Nil
Fineness	Very fine	Not applicable
Inability to regain original metallic form (Apunarbhava)	No luster	No luster

RB – Market Rajata Bhasma; NRB- Nano Rajata Bhasma.

## 2. Physico-chemical parameters

RB and NRB samples were analyzed for following physico-chemical parameters as per Ayurvedic Pharmacopoeia of India (API). The parameters are pH, loss on drying, and total ash value (Table 2).

- a) **pH:** About 100 mg of sample was dissolved in 100 mL of distilled water and pH was measured using pH meter (DURALAB pH Meter).
- b) **Loss on drying:** A clean, dried, tared petridish was used. 1 g of sample was taken in it, placed in hot air oven for 3 hours, cooled in a desiccator and weighed.

### Calculation

$$\text{Loss on drying in \% w/w} = \frac{(W2-W3) \times 100}{(W2- W1)}$$

Where,

W1: Weight of empty petridish, in g

W2: Weight of sample and petridish before drying, in g

W3: Weight of sample and petridish after drying, in g

- c) **Total ash:** A clean silica or platinum crucible ignited in muffle furnace at 600 °C for 30 minutes. About 1 g of sample in a tared crucible ignited in muffle furnace at 600 °C until free from carbon, cooled in a desiccator and weighed without delay.

**Calculation**

$$\text{Total ash in \% w/w} = \frac{(W3-W1) \times 100}{(W2- W1)}$$

Where,

W1: Weight of empty crucible in g

W2: Weight of sample and crucible before ignition, in g

W3: Weight of residue and crucible after ignition, in g

**Table 2: Physico-chemical parameters.**

Tests	RB	NRB
pH	3.85	2.9
Loss on drying	1.22% w/w	NA*
Total Ash value	70.6% w/w	NA*

\*NA- Not Applicable

### 3. Other analysis of NRB

Other characterization tests are specific gravity (only for NRB –liquid), UV Visible spectrophotometer and Zeta Potential Analyzer (Table 3).

**a) Specific gravity:** The specific gravity of NRB was evaluated using Pycnometer. The weight of water and sample were measured individually in a clean, dry Pycnometer.

$$\text{Specific gravity} = \frac{\text{Weight of Pycnometer with sample}}{\text{Weight of Pycnometer with water}}$$

**b) Surface Plasmon resonance:** The surface Plasmon resonance was measured by UV-Visible spectrophotometer (UV-2600, Shimadzu). The maximum absorption wavelength was measured with water as blank for baseline correction.

**c) Zeta potential:** The Zeta potential is an electrostatic potential which is related to both the surface charge and the local environment of the particle (10). The Zeta potential of NRB was measured by Zeta Potential Analyzer of (ZS-90 Zeta sizer, Malvern).

**Table 3: Qualitative analysis.**

Tests	NRB
Specific gravity	0.96 to 1.10
Surface plasmon resonance	400 to 420 nm
Absorbance	0.85 to 1.30
Zeta potential	-5 to -25 mV

**d) Determination of silver by flame atomic absorption spectrometry (FAAS).**

Atomic absorption spectrophotometer (Agilent 200 series AA). with an air Acetylene burner or nitrous oxide-acetylene burner for flame.

AAS metal standard stock solutions (1000 mg/l) available in readymade (primary 1°), For Silver, Lamp: Hollow cathode lamp, Silica crucible (50 ml capacity), Hot plate – with heating control, to heat up to about 300°C, Furnace – programmable, or muffle furnace with 450° ± 25°C, Glass wares (beaker, pipettes (5 ml & 10 ml) & standard volumetric flask, Thermometer (up to 200°C), Nitric acid, concentrated, reagent grade 69 %, Perchloric acid, concentrated, reagent grade 70 %, Hydrochloric acid, concentrated, reagent grade 36%.

**Working standard solution:** Dilute standard solution of silver stock solution in 0.2 % nitric acid, stabilized by the addition of a one drop of 5% potassium permanganate in 100 ml solution, to a range of standards (0.5 to 5 ppm) that covers the linear range of the element to be determined.

**Instrumentation conditions for determining metals by AAS.**

Metals	Wave length (nm)	Slit width (nm)	Mode of operation
Ag	328.1	0.5/0.8	Air acetylene

**Sample preparation for silver.**

The product was weighed accurately, digested with 5ml of concentrated nitric acid and made upto 10 ml with distilled water. A standard curve is plotted using three known concentrations of silver standard. The digested sample is nebulized and the concentration of silver in the sample is calculated. Both RB and NRB were subjected to AAS. Results of AAS showed that both RB and NRB contain silver.

**RESULTS AND DISCUSSION**

The Nano Rajata Bhasma was prepared by novel method, devoid of mercury utilization. Comparative analyses of Nano Rajata Bhasma (NRB) and Market available Rajata Bhasma (RB) were performed. The NRB was examined for classical, physico-chemical and quantitative parameters and the results shown in tables.

**CONCLUSION:** The prepared NRB is qualitatively similar to marketed RB.

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