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Pharmaceutical Standardization of Rajata Bhasma (Incinerated Silver Ash) Prepared with Two Methods by Using Classical Heating and Muffle Furnace

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KEYWORDS

Classical technique, Muffle Furnace, Pharmaceutical preparation, *Puta*, *Rajata Bhasma*, *Rasa Shastra*, Temperature,

ABSTRACT:

Introduction: Pharmaceutical preparation of *Rajata Bhasma* (incinerated processed Silver) with two methods by using classical heating and muffle furnace is an original research work based on *Rasa Shastra* (Indian Science of Alchemy, Metallurgy and Iatrochemistry) to determine the differences in preparation along with observation of various changes occurring during both processes, time taken and temperature required. The completion of both processes is evaluated by classical *Bhasma* (Ash) assessment parameters. The importance of this work was determined on the premise of increasing popularity of nanoparticle of Silver in therapeutic usage and a need for alternative methods of preparation for the same.

Objectives: Comparative understanding of preparation of *Rajata Bhasma* using classical heating techniques (*Puta*) as well as the use of Muffle furnace with standardized temperature range using both *Hartala Marita Rajata Bhasma* (purified Arsenic trioxide processed Silver Ash) and *Kajjali Marita Rajata Bhasma* (Black mercuric sulphide processed Silver Ash).

Methods: *Hartala Marita Rajata Bhasma* (purified Arsenic trioxide processed Silver Ash) and *Kajjali Marita Rajata Bhasma* (Black mercuric sulphide processed Silver Ash) were prepared by adopting different purificatory process explained in Ayurved Rasashastra.

Results: Modified heating pattern (Preparation of ash in Muffle furnace) has reduced number of repetition of heating. The maximum temperature was around 600^0C.

Conclusions: The method of preparation of *Rajata Bhasma* using *Kenduka yantra* and Muffle Furnace required 14 *puta* and therefore, can help with reducing the time and fuel consumption in comparison to the classical method which required 17 *puta*.

1. Introduction

Traditional herbo-mineral preparations have been described in detail in various Rasa Shastra (Indian Science of Alchemy, Metallurgy and Iatrochemistry) texts. They include multiple methods of processing of minerals and methods to make them bioavailable for

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therapeutic purposes and safe for consumption. Of these, Bhasma (Ash/ incinerated material) preparations are currently under extensive study as they have presence of micro and nanoparticles of minerals and metals. The process by which Bhasma are prepared is called Marana (incineration). Amongst the metals and minerals, currently, silver nanoparticles and synthesis of silver nanoparticles are being studied across the world for therapeutic use. Hence, Rajata (Silver) Bhasma was considered. A larger number of easy to prepare and utilize Bhasma have been clinically validated through several research works and clinical usage on OPD levels. However, given the extensive number of texts and cryptic references, there are a large number of methods to prepare the same. This study has been conducted to carry out a comparative understanding of preparation of Rajata Bhasma (incinerated processed Silver) using classical heating techniques (Puta) as well as the use of Muffle furnace with standardized temperature range using both Hartala Marita Rajata Bhasma (purified Arsenic trioxide processed Silver Ash) and Kajjali Marita Rajata Bhasma (Black mercuric sulphide processed Silver Ash) references from Rasatarangini text.

2. Objectives

To prepare both Hartala Marita Rajata Bhasma (purified Arsenic trioxide processed Silver Ash) and Kajjali Marita Rajata Bhasma (Black mercuric sulphide processed Silver Ash)

3. Methods

Procuring of Materials

The main element, Silver (Ag) of 99.9% purity (BIS Certified) was obtained in rectangular plate form from a reputed source. To classically carry out Shodhana (purification) of this silver for therapeutic purposes, Tila taila (Sesamum indicum seed oil) was obtained from FSSAI certified source, Takra (Buttermilk from Cow milk fat) was obtained from local dairy farm and pH was tested in-house to ascertain purity, Gomutra (Cow Urine) was obtained from local dairy farm and tested in-house for pH and specific gravity to confirm purity, Aranala (supernatant water from fermented cooked Oryza sativa grains) was prepared classically, in-house and pH tested to confirm suitability for use in Shodhana, Kulattha Kwatha (Decoction of Macrotyloma uniflorum grains) was prepared in-house classically; from locally sourced and authenticated grains. Agastya Patra swarasa (Juice of leaf of Sesbania grandiflora) was prepared in-house from authenticated green fresh leaf for Vishesha Shodhana (Specified/specific purification). Purified Hartala (Arsenic trioxide), Purified Gandhaka (elemental Sulphur) and Purified Parada (elemental Mercury) was prepared in-house after obtaining raw material from verified source. Fuel for classical Bhasma preparation, Upala (standardized dried cow dung cakes) were procured from local dairy farms. Khalwayantra (Mortar and pestle), Sharava (shallow, concave earthen plates), cotton cloth, binding clay were all procured from local sources. Muffle furnaces were procured from trusted laboratory equipment manufacturers. Nimbuka swarasa (juice of Citrus limon) was collected fresh as and when required..

Method of Preparation:

1. Method of Shodhana of Rajata

The Samanya Shodhana of Rajata[1] was carried out using the Nirvapa (Heating metals/minerals to red hot and dipping it in appropriate liquid media) Method as per classical guidelines. First, the Rajata plate was heated by placing it on a pan and blasting with flame gun till it turned red hot. Once heated in this manner, it was dipped in Tila Taila then left to cool. Once cooled, it was taken out, dried and subjected to the same process for six more times. Next, using the same process as above, the heated Rajata was dipped in Takra[2] for seven times, then in Gomutra for seven times, then in Aranala[3] for seven times, then in Kulattha Kwatha4 for seven times. The above entire sequential process is called Samanya (generalised) Shodhana. The next step was Vishesha Shodhana5 where, same Nirvapa method was used with the liquid media Agastya Patra Swarasa for three times.

2. Method of Preparation of Kajjali 6

The preparation of Kajjali was done as per classical guidelines of Sama Guna (equal quantity) Kajjali, where purified Parada was taken in a stone mortar and pestle and equal quantity of purified Gandhaka was added little by little while being mixed by grinding to form finely powdered, homogenous black sulphide of mercury.

3. Method of Rajata Marana (incineration) with Kevala (only) Kajjali 7

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The prepared Kajjali was applied to the purified Rajata and triturated using a mortar and pestle with Nimbuka Swarasa till it formed an amalgamated mass. This mass was then made into coin sized discs of even thickness and placed equidistantly on a Sharava. This was allowed to dry. On drying of the amalgam discs, the Sharava was covered with another Sharava placed upside down to create a biconvex container-like structure called Sharava Samputa. The joint of the two Sharava were sealed using a cloth smeared with binding clay and dried. This was subjected to heat using the following two methods.

A.) Classical puta 8- Cow dung cakes were taken as fuel as per classical guidelines and half were placed in a brick furnace. The Sharava Samputa was place on it and covered with remaining half which were placed above it. Heating fuel was evenly distributed around the Sharava Samputa. It was ignited and the temperatures were noted every 30 mins. After self-extinguishing of the flames, the set up was allowed to cool down before extracting the Sharava Samputa from within. The Sharava Samputa was opened and the amalgam discs were transferred to mortar and pestle and ground together. Preliminary examination for particle size were carried out as per classical guidelines. This process was repeated till fine particle size was observed.

B.) Muffle Furnace- the Sharava Samputa was placed in a Muffle furnace with the temperature set to degrees based on previously established temperature charts. It was extricated on cooling and the amalgam discs transferred to a mortar and pestle and ground finely. The process was repeated till very fine particle size was obtained.

Alternate method in Muffle Furnace- After obtaining moderately fine sized particles, the amalgam ash was transferred in powdered form into a Kenduka (small pot with a lid) and the lid and mouth joint was sealed with cloth and binding clay and dried. This was subjected to gradually increasing heat till 350 degrees Celsius in a smaller Muffle Furnace and maintained for 30 mins. The ash was preliminarily assessed for particle size as per classical guidelines

4. Method of Rajata Marana (incineration) with Kajjali and Hartala 9 The prepared Kajjali was triturated in a mortar and pestle with purified Rajata and purified Hartala by adding Nimbuka Swarasa till an amalgamated paste was formed. This black amalgam was shaped into coin-like discs and placed equidistantly in a Sharava. On drying, Sharava Samputa was prepared.

A.) Classical puta- A brick furnace base was lined with cow dung cakes as fuel, as per classical guidelines. The Sharava Samputa was placed on these and covered with remaining cow dung cakes. The set up was subjected to heat and temperature recorded every 30 mins. On cooling, the Samputa was extricated and the contents transferred to a mortar and pestle. On grinding to prepare a homogenous mixture, the powder was tested for particle size as per classical parameters.

B.) Muffle Furnace- The Sharava Samputa was placed in the Muffle Furnace at specific temperature of degrees for hours as per previously documented temperature charts. The contents were triturated in mortar and pestle and particle size was assessed as per classical guidelines.

Alternate method in Muffle Furnace- Moderately sized particles were filled into a Kenduka and sealed close. This was subjected to 350 degrees Celsius in Muffle Furnace for 30 mins and allowed to sit for self-cooling. Obtained amalgam ash was further powdered using mortar and pestle resulting in homogenous mixture which was tested as per classical methods for particle size.

Method of Assessment

For initial assessment during preparation, the following classical Bhasma pareeksha 10(Ash assessment) techniques were used.

1. Varitaratva- Floats when sprinkled on a glass of clear water.

2. Unama- Rice grain placed on the floating Bhasma floats on top of it.

3. Rekhapurnatva- So fine that it settles between the ridges of the finger.

4. Niswadu- Tastelessness

5. Nirdhuma- No fumes emitted on exposure to heat source.

6. Apunarbhava- No recurrence of original material on processing with mitra panchaka (Gunja -seeds of Abrus precatorius, Ghrita- clarified butter from cow milk fat, Madhu- Honey, Tankana- Borax, Gud- boiled molasses of juice of Saccharum officinalis)

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Observation

Method of Preparation

Fig.1.1 Heating of *Rajata* till red hot.

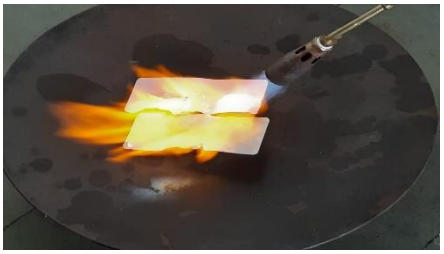

Fig.1.2 Dipping of heated Rajata in liquid media

Table 1.1 Time taken for *Rajata* to turn red hot.

Time (min.)	Taila	Takra	Gomutra	Aranala	Kulatthaja
1st nirvapa	8	7	5	13	7
2nd nirvapa	5	5	7	6	4
3rd nirvapa	6	5	5	5	4
4th nirvapa	6	5	6	5	4
5th nirvapa	5	6	4	5	4
6th nirvapa	5	7	5	5	3
7th nirvapa	7	5	6	5	7

Table 1.2 Temperature Chart for *Rajata Samanya Shodhana*

MEDIA	1st Nirvapa	2nd Nirvapa	3rd Nirvapa	4th Nirvapa	5th Nirvapa	6th Nirvapa	7th Nirvapa
	TEMPERATURE IN ^{0}C						
Taila	45	45	50	45	58	58	50
Takra	40	40	40	40	43	45	42
Gomutra	51	54	51	51	48	48	50
Aranala	44	59	54	60	44	54	45
Kulattha Kwatha	55	59	63	59.2	54.2	50	48.2

Table 1.3 Temperature Chart for *Rajata Vishesha Shodhana*

AGATSYA PATRA SWARASA	TEMPRATURE (in ^{0}C)
1st Nirvapa	47
2nd Nirvapa	38

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3rd Nirvapa	41

Table 1.3 Number of *Puta* required

RAJATA BHASMA	**IN *SHARAVA SAMPUTA***	**IN *KENDUKA***
With *Hartala*	15	12
Without *Hartala*	16	14

Table 1.4 Temperature of RB-1 A

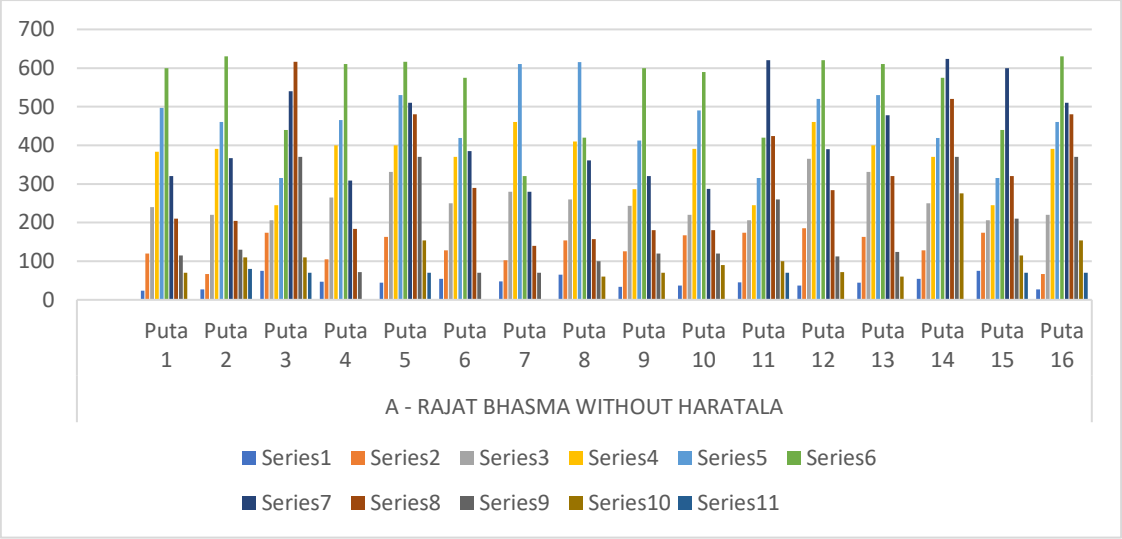

Table 1.5 Temperature of RB-2 A

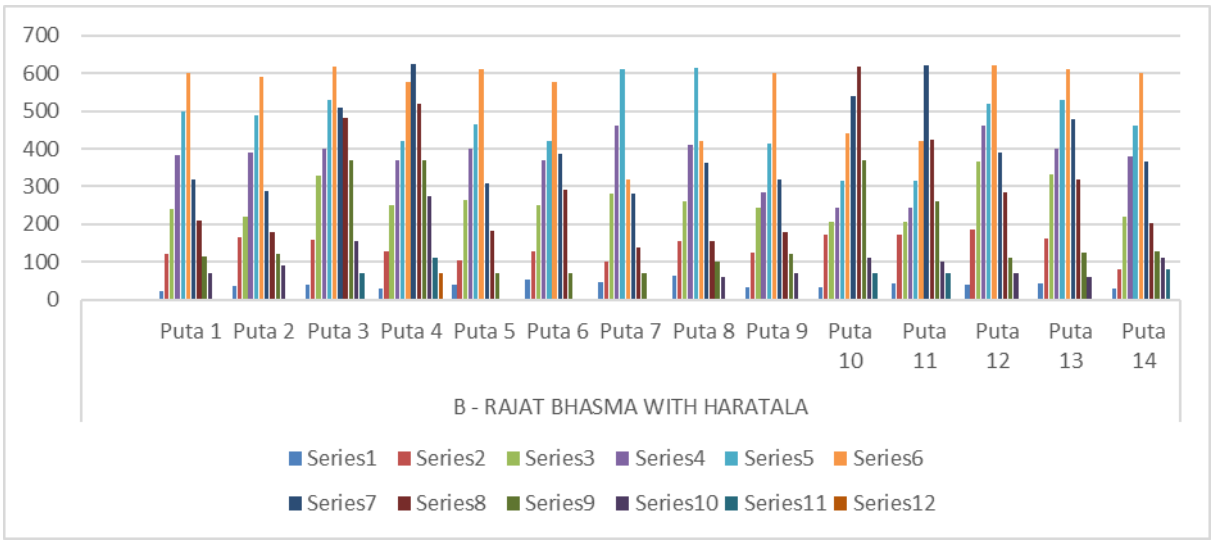

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Table 1.6 Temperature of RB-1 B

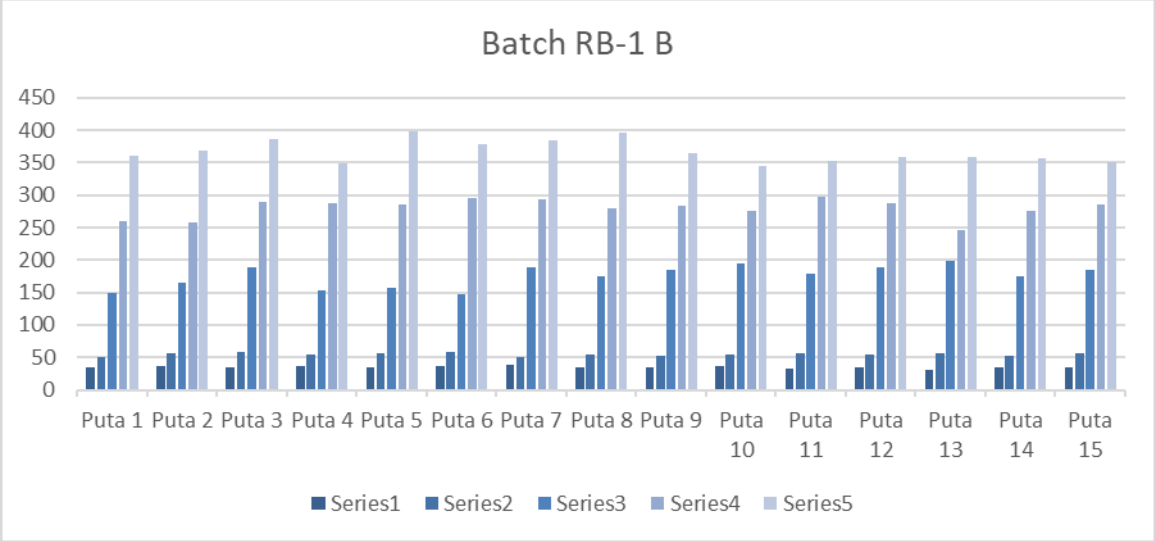
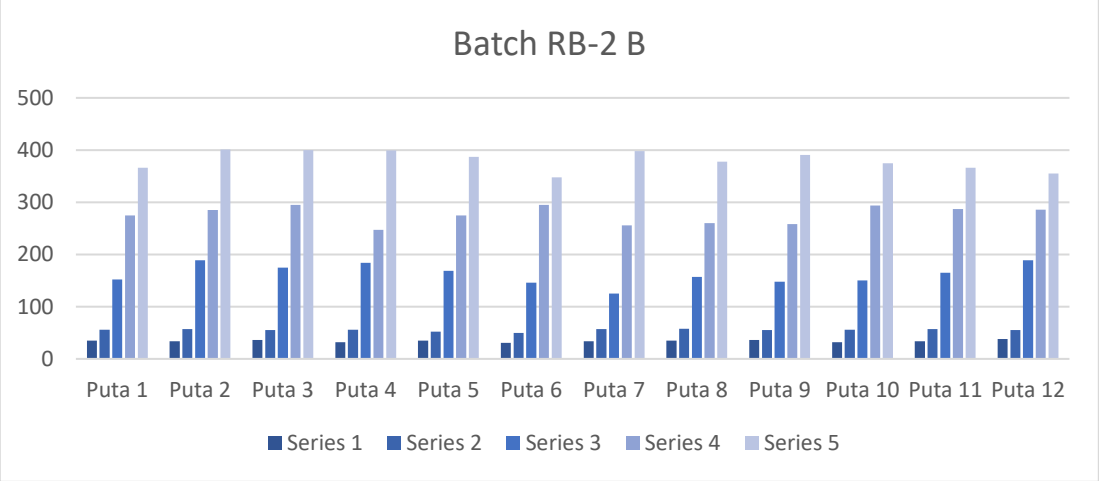


Table 1.7 Temperature of RB-2 B



Results

Fig. 2.1 *Varitara* test of *Rajata Bhasma*

Fig 2.2 *Unama* test of *Rajata Bhasma*

Fig. 2.3 *Rekhapuranatwa* test of *Rajata Bhasma*

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Table 2.1 *Bhasma pareeksha* after key *Puta* (Classical)

RAJATA BHASMA		***Varitaratva***	***Unama***	***Rekha-purantawa***	***Niswadu***	***Nirdhuma***	***Apunarbhava***
With *Hartala* (RB-1 A)	**5th Puta**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**
	10th Puta	**Present**	**Absent**	**Partially Present**	**Present**	**Absent**	**Absent**
	15th Puta	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**
Without *Hartala* (RB-2 A)	**5th Puta**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**
	10th Puta	**Present**	**Absent**	**Partially Present**	**Present**	**Present**	**Absent**
	15th Puta	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**

Table 2.2 *Bhasma pareeksha* after key *Puta* (Muffle Furnace)

RAJATA BHASMA		***Varitaratva***	***Unama***	***Rekha-purantawa***	***Niswadu***	***Nirdhuma***	***Apunarbhava***
With *Hartala* (RB-2 A)	**3rd Puta**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**
	6th Puta	**Absent**	**Absent**	**Partially present**	**Present**	**Absent**	**Absent**
	12th Puta	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**
Without *Hartala* (RB-2 B)	**3rd Puta**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**
	6th Puta	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**	**Absent**
	12th Puta	**Present**	**Present**	**Present**	**Present**	**Present**	**Present**

Discussion

The purification of *Rajata, Hartala, Parada* and *Gandhaka* was done as per classical guidelines. During the process of *Rajata Shodhana*, the temperature of the liquid media was noted, as was the time taken for the heating of the *Rajata* plate. Observations noted during this show that initially the temperature of the liquid media increases and then subsequently comes back to room temperature. The time taken for *Rajata* to heat up is initially longer, which eventually decreases. This could potentially be due to the weakening of the bonds present in the element due to the extreme acidic and alkaline nature of the different liquid media such as *Triphala Kwatha* (pH 4) and *Gomutra* (pH 13). The preparation of *Rajata Bhasma* was started by adding *Kajjali* and *Shodhita Rajata* while the other batch contained *Shodhita Rajata, Hartala* and *Kajjali*. On preparation of the amalgam, both were subjected to heat. The observations that were drawn through this were that the classical method of preparation required more amount of *puta* in both the samples whereas the *Kenduka yantra* and

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Muffle Furnace method required lesser amount of *puta*. In the Classical Method of preparation of *Rajata Bhasma*, the number of *puta* were 16 for only *Kajjali Marita Bhasma*, whereas it was 15 for *Hartala Marita Bhasma*. On further observation, the temperatures in the Classical Method were crossing 600 degrees Celsius, whereas in the Muffle Furnace, the same result was obtained at around 358 to 400 degrees Celsius with use of *Kenduka Yantra* in just 12 rounds for *Hartala Marita Rajata Bhasma* and 14 rounds for *Kajjali Marita Bhasma*. This shows that the *Kenduka Yantra* and the use of Muffle furnace not only quickened the process but required less cow dung fuel to obtain a classically perfect *Bhasma*. Previous studies of preparation of only *Kajjali Marita Rajata Bhasma* by classical methods (*Gokarn Rohit, et al (2013). Pharmaceutical Standardization Of Rajata Bhasma (Incinerated Silver) By Two Different Methods, Annals of Ayurvedic Medicine2347 - 6923. 2. 7-15.*), show the requirement of approximately 17 *Puta*, unlike the 14 using *Kenduka* method. As per previous studies, using *Sharava Samputa* methods show a pellet forming stage which was not observed during the *Kenduka Yantra* method. This signifies that there was a uniform breakdown of the amalgam which could have contributed to faster preparation of the *Bhasma*. The fact that *Hartala Marita Bhasma* required lesser *puta* could be due to the chemical reduction of Silver by Arsenic trioxide and formation of intermediary compounds to hasten the process.

Conclusion

The method of preparation of *Rajata Bhasma* using *Kenduka yantra* and Muffle Furnace required 14 *puta* and therefore, can help with reducing the time and fuel consumption in comparison to the classical method which required 17 *puta*. Apart from this, the obtained *Bhasma* satisfies every classical assessment parameter for particle fineness and colour, which is matte jet black, making this technique an easier process to adopt for pharmaceutical purposes.

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References

1. Shastri A. Rasaratnasamuchchya of Vagbghata. 9th ed. Varanasi: Choukhamba Sanskrit Publication; 1995. p. 5/13
2. Mishra Brahmashankara and Vaishya Rupalalaji. (2010). Bhavaprakasha Nighantu of Bhavaprakasha, 11th Ed. Vol I, Takra Varga Adhyaya Verse 2-8. Varanasi: Chaukhamba Sanskrit Bhawan, 771
3. The Ayurvedic Formulary of India, Part 1, p. no. 348, 2nd revised English edition, Gov. of India, Ministry of Health & Family welfare, New Delhi.
4. Adhamalla, Commentator. Sharangdhara Samhita, Madhyama Khanda, 2/1, 5th edition, Chaukhamba Orientalia, Varanasi, 2005;144.
5. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, 16/6 p. 387.
6. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, 2/27 p. 16.
7. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, 16/26 p. 360
8. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, 3/32 p. 35
9. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, 16/17 p. 386
10. Sharma Sadanand, Rasa Tarangini. 11th Edition, New Delhi: Motilal Banarasidas; 1979, p. 22