

PHARMACEUTICO-ANALYTICAL STUDY OF PANCA-PUTI RAJATA BHASMA

Dr. Amrutha Shivaji G.*¹, Dr. Sulochana Rathod², Dr. Usha M.³ and Dr. Ravi R. Chavan⁴¹P.G. Scholar, Dept. of P.G. Studies in Rasashastra and Bhaishajya Kalpana, Taranath Govt. Ayurveda Medical College and Hospital Ballari. Karnataka.²Professor, Dept. of P.G. Studies in Rasashastra and Bhaishajya Kalpana, Taranath Govt. Ayurveda Medical College and Hospital Ballari. Karnataka.³Associate Professor, Dept. of P.G. Studies in Rasashastra & Bhaishajya Kalpana, Taranath Govt. Ayurveda Medical College and Hospital Ballari. Karnataka.⁴Professor and HOD, Dept. of P.G. Studies in Rasashastra & Bhaishajya Kalpana, Taranath Govt. Ayurveda Medical College and Hospital Ballari. Karnataka.***Corresponding Author: Dr. Amrutha Shivaji G.**

P.G. Scholar, Dept. of P.G. Studies in Rasashastra and Bhaishajya Kalpana, Taranath Govt. Ayurveda Medical College and Hospital Ballari. Karnataka.

Article Received on 10/08/2022

Article Revised on 31/08/2022

Article Accepted on 21/09/2022

ABSTRACT

Background: Bhasma are the metallic preparations obtained by the process known as Marana. Marana involves trituration with herbal drugs followed by Pelletization and subjecting to the graded heat which is repeated till Bhasma siddhi lakshana. Bhasma literally means the one which has lost the lustre. Rajata bhasma is useful in conditions like Prameha, Madatyaya, Visha Vikara, Jeerna jwara, Plihodara, Kshaya, Naadi shula, Apasmara, Udararoga. **Methods:** Crude Rajata was procured from local jeweller. Rajata Samanya and Vishesh Shodhana and later Marana using Parada, Gandhaka, Haratala help in the reduction of Rajata dhatu to nano form and hence enhance its therapeutic efficacy. Ancient parameters like Rekhapoorna, Varitara, Uttama, Nirdhuma, Niruttha, Apunarbhava tests were performed. Characterisation of Rajata Bhasma was done using sophisticated instruments like Scanning Electron Microscopy, Energy Dispersive X-ray Diffraction, ZETAPALS and Fourier Transformation Infrared Spectroscopy. **Results:** Zeta-Pals reported the particle size to be 526 nm. This reduction in particle size was further confirmed by SEM. EDX revealed concentrations to be Ag-32.68 %, S-48.01 % & Mg-17.5 %. FTIR revealed the presence of organic groups like Alkenes, Alkynes and Carboxylic acids. **Conclusion:** Rajata bhasma was prepared in five Laghu puta which fulfilled the classical Bhasma pariksha revalidated by the sophisticated instrumentation.

INTRODUCTION

Ayurveda an indigenous system of medicine states “*Swasthasya swaasthya rakshanam aaturasya viakra praashamanam*”^[1], which means to promote the health of healthy individuals by adhering to the Regimens of Dinacharya, Rtucharya, Achara Rasayana and pacifying the vitiated dosha in the disease afflicted individuals by adopting Trisutra^[2] (Hetu, Linga and Aushadha).

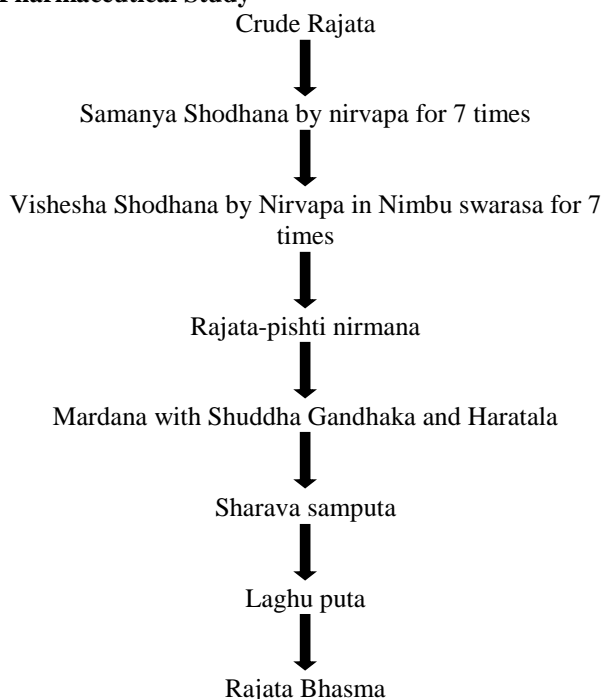
Rasashastra emphasis on the use of drugs of mineral origin like Mercury, Sulphur, Gold, Silver and drugs of Marine origin like Coral, shells, Gemstones. Numerous formulations containing Parada and other minerals and visha dravya are enumerated with their therapeutic utility along with Shodhana and Marana of drugs used are found in the classical texts of Rasashastra. Marana is a specialised technique adopted for bhasmikanana of rasadravya.^[3] Bhasma are the unique dosage forms specially known for minimal dose, fast action and quick results in both acute and chronic conditions.^[4] Mrutani lohani rasi bhavanti^[5] i.e. Bhasma enter the Rasa, Rakta

dhatu and provide instant nourishment to dhatu. Bhasma can be used individually or administered in various dosage forms such as kharaliya, Parpati, Kupi or Pottali kalpa. Rajata bhasma has properties like- Kashaya and amla rasa, guna-sara, lekhana, snigdha, madhura vipaka, sheeta veerya, karma- balya, aayushya, medhya, rasayana, vrushya, vayahsthapaka, vishaghna, jaatharagnidiptikrut, garbhashaya vishodhana, smrtikanti vardhana. Hence useful in conditions like- trushna, shosha, bhrama, Apasmara, vata-pitta roga nashaka.^[6] Silver nanoparticles possess anti-bacterial, anti-fungal, anti-inflammatory, anti-viral and anti-cancer activity.

MATERIALS AND METHODS

An effort has been made to prepare Rajata Bhasma in 5 laghu puta as per Rasa Tarangini. The process was carried out in two steps:

1. Pharmaceutical Study
2. Analytical Study.

Pharmaceutical Study**Shodhana**

Samanya Shodhana of Rajata Patra was carried out by Nirvapa i.e. heating till red hot and quenching them subsequently into Tila Taila, Takra, Gomutra, Kanji and Kulattha Kwatha for seven times each.^[7] After each Nirvapa, the liquid medium was changed.

Vishesha Shodhana of Samanya Shodita Rajata patra was carried out by Nirvapa in Nimbu swarasa for 7 times. This process was repeated for 6 more times by taking fresh Nimbu swarasa each time.^[8]

Shodhana of Parada extracted from Hingula was carried out by doing mardana with 1/8th part of Haridra churna for one day.^[9] After trituration for one day, the mixture was washed with hot water to obtain Shuddha Parada.

Gandhaka Shodhana was performed by Bhudhara yantra method. Cow's milk was poured in the wide mouthed ghee smeared earthen pot. The mouth of pot was covered with double layered cotton cloth and coarsely powdered Gandhaka was spread evenly over it. An iron vessel lid was inverted over the pot. The pot was buried up to the neck in a pit and 8 Cow dung cakes were placed above it.

After ignition of Cow dung cakes, Gandhaka melted and dropped into milk through the cloth. After self-cooling, the apparatus was removed out of the pit and opened. Purified Gandhaka was collected at bottom of the pot in the form of small droplets and washed with hot water and dried.^[10]

Haratala shodhan was performed by Dolayantra swedana in Choornodaka for one yama (3 hours). After the completion of one yama, Hartala was washed with hot water and dried.^[11]

Marana^[12]

Marana of Vishesha Shodhita Rajata Patra was done by triturating in a Khalwa yantra with equal quantity of Shuddha Parada to form an amalgam i.e. Rajata Pishti. Shuddha Gandhaka & Shuddha Hartala were added to Rajata Pishti and triturated till homogenous mixture was obtained. This homogenous mixture was subjected to Laghu by placing it in a sharava samputa after sandhi bandhana. This process was repeated for 5 times to obtain Rajata Bhasma. Equal quantity Gandhaka & ¼ th quantity Haratala was added till 3 puta.

Analytical study^[13]

Nirdhoomatva: A pinch of Rajata bhasma was sprinkled over a red-hot charcoal, it did not produce any smoke. Hence implies that the bhasma is properly prepared.

Apunarbhava^[14]: Mitra panchaka (Guda, gunja, Madhu, Sarpi and) and Rajata bhasma each 2 gm each heated in a musha. After cooling it is observed for the presence of shining metal particles in it. No shining particles were present, it shows that the bhasma is complete.

Niruttha^[15]: 2 gm Rajata bhasma was heated with 2 gm copper and the weight of copper was checked. The weight of copper was unchanged, hence bhasma is complete. The same test was repeated using Rajata patra.

Scanning Electron Microscopy and Electron Dispersive X-ray Spectroscopy (SEM &EDX), Zeta Potential (ZP), Particle Size Analysis were performed at Department of Material Science, Mysore University, Mysore. Fourier Transform Infrared Spectroscopy (FTIR) was performed at CSIR-CFTRI Mysore.

OBSERVATIONS AND RESULTS

Table no 1: Showing Marana of Rajata Ref- RT 16/ 21-22.

No.of Puta	Rajata (weight in gm)	Shuddha Gandhaka	Shuddha Haratala	Weight before Puta	Weight after Puta
1.	100	100	100	300	200
2.	200	50	50	300	180
3.	180	-	-	180	150
4.	150	-	-	150	125
5.	125	-	-	125	120

Table no 2: Classical analytical findings of Rajata Bhasma.

Sl.No.	Tests	Finding
1.	Rekhapaoorna ^[16]	Positive(after 3 Puta)
2.	Varitara ^[17]	Positive(after 3 Puta)
3.	Unama ^[18]	Positive(after 3 Puta)
4.	Apunarbhava	Positive(after 5 Puta)
5.	Niruttha	Positive(after 5 Puta)
6.	Nirdhooma	Positive(after 5 Puta)

Table no-3: Organoleptic Characters of Rajata Bhasma.

Sl.No.	Parameter	Finding
1.	Varna(color)	Raktotpala
2.	Sparsha(Texture)	Komala
3.	Rasa(Taste)	Nirasa
4.	Gandha(smell)	Nirgandha

Table No. 4: Showing the quantity of all the elements in Rajata bhasma.

Element	Weight %
Ag	32.68 ± 3.19
S	48.01± 1.35
Mg	17.5 ± 1.35
Si	1.01 ± 0.28
Ca	0.79 ± 0.50

Table No. 5: Various peaks in FTIR analysis of Rajata bhasma and their correlation with compounds.

Sample peaks Cm ⁻¹	Standard Peaks Cm ⁻¹	Bond	Functional groups
3232,3271,3294,3365,3432,3459,3499	3500-3200	O-H	Alcohols,phenols
2914,2993	3000-2850	C-H	Alkenes
2660	3300-2500	O-H	Carboxylic acids
2115	2260-2100	-C(triple bond)	Alkynes
1645,1666	1680-1640	-C=C	Alkenes
1453	1470-1450	C-H	Alkenes

Table 3: Showing Particle Size of Rajata Bhasma.

Percentiles	
%tile	Size(nm)
10.00	386
20.00	430
30.00	465
40.00	498
50.00	531
60.00	568
70.00	612
80.00	672
90.00	786
95.00	961

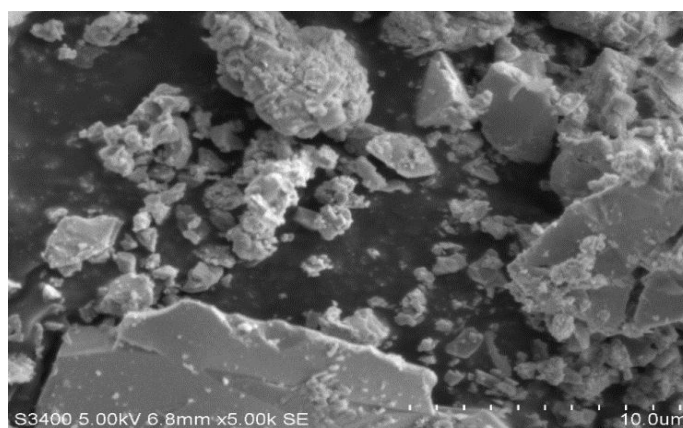


Image No. 1: Showing SEM result of Rajata bhasma (Mag. 5Kx).

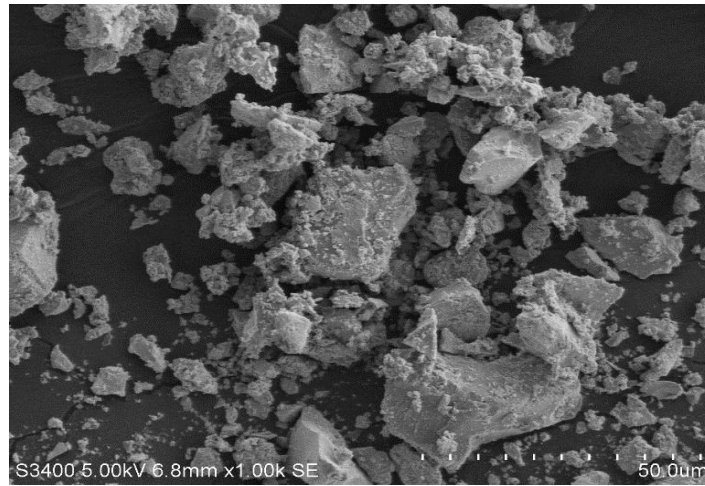
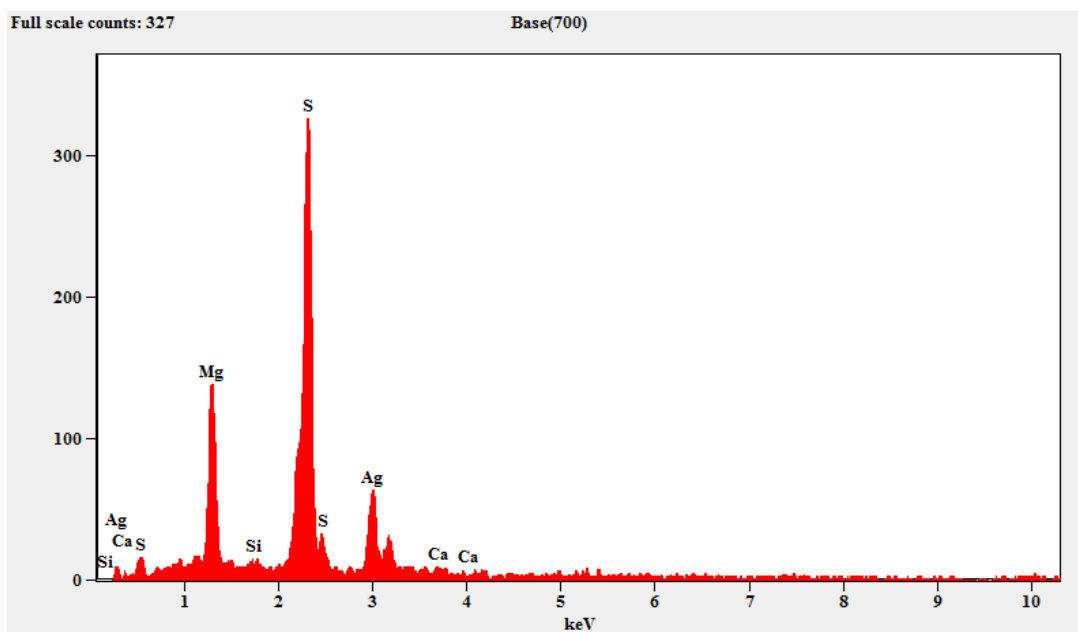
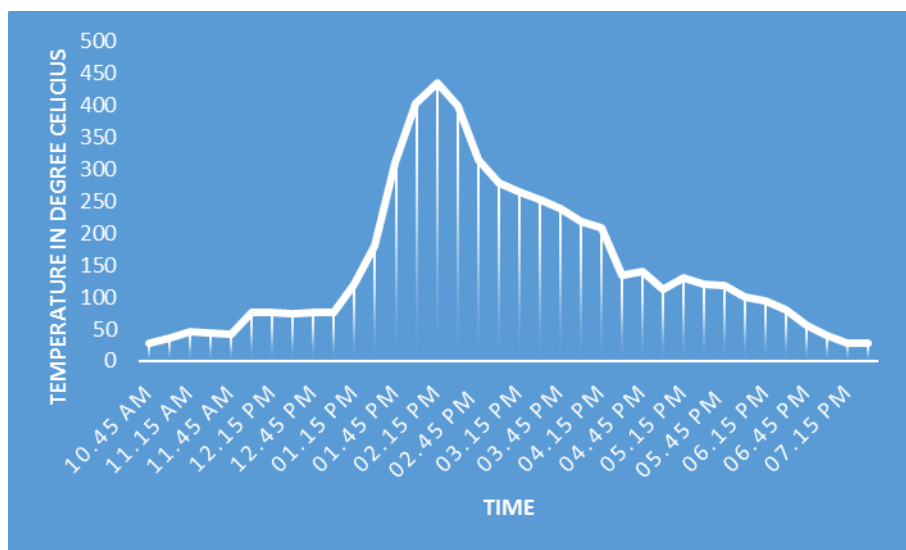


Image No. 2: Showing SEM result of Rajata bhasma (Mag. 1Kx).



Graph No. 1: Showing EDS graph of Rajata bhasma.



Graph. No.2: The graph showing the Time & Temp during Laghu puta.

PHOTOS



DISCUSSION

Samanya shodhana of Rajata patra

Tila Taila: It has Sukshma and Ashukari properties, by these properties it may easily and rapidly enter into the material through the cracks and intermolecular space, and makes film coating and causes chemical reaction, compound formation and breaking of the material. Takra: It is having Tikshna, Samghata-Bhedana and Shaithilikaran properties by which it may cause softening and breaking of the material. Gomutra: It has Dahana and Pachana properties. So it may worn-out the material and this way it may cause eradication of undesired substances from the material. Aranala / Kanji: It is also having the same properties like Takra and may cause softening and breaking of the material. Kulattha Kwatha: It has Ashmari Bhedana property. By this property it may cause breaking of the material. All these liquid medium act as cooling media during process of Nirvapa, these may serve a favourable atmosphere to the material for occurrence of particular chemical reaction and compound formation. According to Rasarnava, the Kshara dravya are used for eliminating impurities. Amla rasa Dravya are used to introduce Prabhodhana in the metal and Sneha Dravya are used to produce softness in the metal. They may also act as source of inorganic traces. After Shodhana in all medium 1 gm loss in weight was observed.

Vishesha Shodhana of Rajata patra

When Nirvapana of Rajata is done in Nimbu Svarasa, due to Ushna, Tikshna, chedana, bhedana, deepana, pachana karma there may be Shithilata in Dravyasanghatana or Dravyasamyojana. The nimbu swarasa contains citric acid, Citrine 76%, and Sulphuric acid. The pH 1.8 – 2.0 is Acidic in nature and nimbu swarasa may be responsible for corrosive effect on the

metal. After vishesha shodhana the metal become more brittle.

Laghu Puta

Heat flow in Puta can be explained by the mechanism of conduction. Heat can be conducted only when there is a temperature gradient, i.e. heat flows from a hot surface to a cold surface. In case of Putapaka process heat is applied to the Sharava Samputa from all side, and there is a clear temperature gradient between the outer and inner parts of Sharava Samputa.

Marana dravya

Four Marana media have been explained in Rasaratna Samuchchaya. If Parada is used as Maraka Dravya, the Bhasma formed is considered as best. Rasa and Rasa Bhasma greatly help in the disintegration of metal to finest sub divisions. As it do not adulterate the final product in any way as they are totally removed by heat treatment. Shuddha Gandhak can convert all the metal and minerals in Sulphide form very easily and helps in easier disintegration of metals and minerals. Shuddha Hartala: snigdha-ushna guna, katu vipaka breaks down the Silver molecules and form bhasma. Rekhapoorna indicates the fineness, Varitara- Lightness, Nischandra-absence of metallic particles, Apunarbhava & Niruttha-tests of perfectness of Rajata Bhasma. Mitrapanchaka when heated turns to carbon and this carbon acts as a reducing agent thus bringing out the loosely bonded metal from the bhasma. The Tankana helps in reducing the melting point of metal and hence if the bhasma is not properly prepared or unstable, the shining particles are seen. Rasendra Chudamani explains the special procedure to do Niruttha test for Rajata, Tamra Patra should be taken instead of Rajata for Niruttha Test. If the bhasma is unstable then the free metal present in the

bhasma will combine with Copper thus increasing its weight in Niruttha. Nirdhooma is specially done for bhasma containing Gandhaka. EDS of Rajata bhasma confirmed the presence of elements like Silver, Sulphur, because of the Gandhaka & Hartala being used in the preparation of Rajata Bhasma. The mean particle size of Rajata Bhasma is 526 nm. Particle size reduction will result in precise drug delivery and thereby increasing the bio availability of the drug. Rajata bhasma sample showed a Zeta potential value of -2.3 mV, which indicates colloidal stability. FT- IR analysis of Rajata bhasma reveals the presence of functional groups like Alkenes, Alkynes & Carboxylic acid. Citric acid has carboxylic acid as its functional group. SEM revealed the particle shape. RB particles were irregular in shape, agglomerates were observed. The smallest particle of 137nm was detected by SEM.

CONCLUSION

The Rajata bhasma passed Bhasma pariksha viz. Varitaratwa, Rekhapurnata, Nischandrata, Nirdhooma, Niruttha & Apunarbhava, Which proves that Rajata has attained its Bhasma form properly. The analytical study depicts the vision of the ancient seers regarding the pharmaceutical procedure adopted in the preparation of Bhasma in making them completely safe for therapeutic usage which was reflected in all the sophisticated analytical tests employed in this research work. Nanosize of Rajata bhasma and presence of organic functional groups make it more bio-compatible than the chemically synthesised silver nanoparticles. An effort has been made to characterise the preparation of Panca-puti Rajata Bhasma using ancient as well as sophisticated tools as a step towards standardisation of Bhasma. These findings align with the ancient parameters for Bhasma siddhi lakshana.

BIBLIOGRAPHY

- Acharya Agnivesha, Charaka Samhita, annotated by Charaka and redacted by Dridhabala with the Ayurveda Dipika commentary of Chakrapani Datta, edited by Yadavji trikamji Acharya, Varanasi, Chowkhamba krishnadas academy prakashan 2014, 30th chapter, verse 26.
- Acharya Agnivesha, Charaka Samhita, annotated by Charaka and redacted by Dridhabala with the Ayurveda Dipika commentary of Chakrapani Datta, edited by Yadavji trikamji Acharya, Varanasi, Chowkhamba krishnadas academy prakashan 2014, 1st chapter, verse 24.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 10th chapter, verse 47, 242.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 28th chapter, verse 1, 633.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 5th chapter, verse 140, 169.
- Sri Sadananda Sharma, Rasa Tarangini, edited by Kashinatha Shastri, 11th Edn, New Delhi, Motilala Banarasidas publication, 1979, 16th Chapter, verses 46.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 5th chapter, verse 11, 143.
- Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11th Edn, New Delhi, Motilal Banarasidas publication, 1979, 16th chapter, verses 10-12, 388.
- Sri Sadananda Sharma, Rasa Tarangini, edited by Kashinatha Shastri, 11th Edn, New Delhi, Motilala Banarasidas publication, 1979, 5th Chapter, verses 38-42, 82.
- Acharya Sri Madhava, Ayurveda Prakasha, Hindi commentaries, edited by Shri GulrajsharmaMishra, reprint, Varanasi, Chaukhambha Bharati Academy publication, 1999, 2nd chapter, verses 19, 260.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 3rd chapter, verse 74, 75.
- Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11th Edn, New Delhi, Motilal Banarasidas publication, 1979, 16th Taranga, verse 17-21, 389.
- Durga Bhavani M, Mahesh Raju, Sridurga, Venkata Subbaiah K. Analytical Standardization of Rajata Bhasma. International Journal of Research in AYUSH and Pharmaceutical Sciences, 2018; 2(3): 229-238.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 8th chapter, verse 28, 212.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 8th chapter, verse 30, 213.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 8th chapter, verse 27, 212.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 8th chapter, verse 28, 212.
- Vagbhatacharya, Rasa Ratna Samucchaya, Edited by Prof. Siddhinandan Mishra, 1st Edn, Varanasi, Chaukhambha Orientalia, 2011, 8th chapter, verse 29, 213.