

A PHARMACEUTICAL AND PHYSICO-CHEMICAL ANALYSIS OF KASISA BHASMA

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ABSTRACT

Rasashastra can be defined as a science of study of mineral and metallic substances with respect to their therapeutic utility including processing of these substances to prepare a drug. In today's scientific parlance 'Rasashastra' can be equated with 'Iatrochemistry'. To evaluate the quality of finished products, it becomes most important to subject the drugs in the prospect of modern era. Kasisa is known as chemically Ferrous sulphate which is more popular among all the iron compounds. Sodhana is the first step to be completed during any drug (Bhasma) formulation, so it has placed unique importance in Ayurveda. In Rasa-Shastra Marana represents the process of Bhasmikanana means to make Rasa dravyas in Bhasma form. The prepared Kasisa Bhasma was analysed with ancient Ayurvedic parameters like Varnam, Rekhapurnatva, Varitara, Slakshanatva, Gatarasatva as well as modern analytical parameters such as A.A.S. (Atomic Absorption Spectroscopy), X.R.D. (X-ray Diffraction), SEM (Scanning Electron Microscopy) and other tools also.

KEYWORDS: Kasisa, Shodhan, Maran, Bhasma.**1. INTRODUCTION**

Pharmaceutical study includes mainly preparation of crude drugs and pharmaceutical processing, process standardization in which drug ratio, *drava* quantity, intensity of fire and duration etc. In this era of globalization, it is the need of time to explore the scientific bases of medicaments of *Ayurveda*. The *Shodhana* process described in classical texts of *Ayurveda* is not merely a process of separation, purification or detoxification rather it increases the therapeutic potency of the drug also. The *Shodhana* process includes medium of acidic nature (e.g. Lemon, Butter-milk, *Kanji*), alkaline nature (e.g. *Curnodaka*) and of neutral nature (e.g. water). Before subjecting any *Rasadravyas* for its *Marana*, the first and the foremost important step to be performed is *Shodhana*. Processing the substance along with the specific indicated *Shodhana dravya* through the procedure like *Peshana* (trituration) etc. so as to remove the *Malas* from the substances, is called as *Shodhana*.^[1] *Marana* is an indigenous process of *Rasashastra* in which metals and minerals are converting in to *Bhasma* form. This process is also called *Bhasmikanana*. *Marana* is a process by which, raw materials like metals, minerals and gems etc. are converted into a micro fine, tasteless, non-hazardous, acceptable & absorbable form, which can be used as a medicine. *Kasisa* is an important mineral of Indian Iatrochemistry and an important haematinic mineral.

Chemically it is $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$. According to modern description, the mineral of iron sulphate is Melanite. It is obtained by decomposition of iron sulphide. Known since ancient times as coppears and as green vitriol, the blue-green heptahydrate is the most common form of this material. *Kasisa* is obtained in natural form where presence of hot springs of sulphur and iron is also. So, sulphur reacts with iron and ferrous sulphate and other compounds of sulphur are formed. A beautiful description to make *Kasisa* artificially is available in *Rasa tarangini*.^[2] The metals and minerals used in *Rasa shastra* have possessed so many impurities like physical or chemical so there *Shodhana* is important for every raw drug. There are so many different methods are available in our texts for *Shodhana* of *Kasisa* as like *Bhavana*, *Swedana*, *Nimajjana*. Description about *Marana* process of *Kasisa* is found in latest texts as like *Rasatarangini*, *Rasamritam* etc.

2. MATERIALS AND METHODS

1. *Kasisa* Shodhana by - Bhringaraja swarasa^[3]
2. *Kasisa* Marana by - Nimbu sawarasa^[4]

Procurement of Kasisa - Ashuddha Kasisa was obtained from Post graduate department of Rasa-Shastra G.A.C.H. Patna.

The study was carried out in following steps:

1. Preparation of Bhringaraja swarasa

2. Kasisa Shodhana
3. Kasisa Marana

Preparation of bhringaraja swarasa

Material: *Bhringaraja Panchanga*

Apparatus: Mixer machine, Knife, Steel vessel, Measuring glass, Spatula, weight balance, cotton cloth.

Procedure:

- Fresh *Bhringaraja Panchanga* was taken and cleaned well with water.
- *Mula*(Root) of *Bhringaraja* was cut and removed with the help of knife and made small pieces of *Bhringaraja*.
- Thereafter take pieces of *Bhringaraja* and made in to paste form with the help of mixer machine and then obtained *Bhringaraja swarasa* by squeezing through cotton cloth and finally measured amount.

Observations:

- The paste form of *Bhringaraja* was dark green in colour
- *Swarasa* of *Bhringaraja* was blackish green in colour

Kasisa shodhana

Material: *Ashuddha Kasisa*

Bhringaraja swarasa

Method: *Bhavana* process (wet grinding)

Apparatus: Stone *Khalva yantra* (mechanical), Pestle, Spatula, Tray, Measuring glass.

Procedure:

- ❖ *Ashuddha Kasisa* was taken in *khalva yantra* and prepared fine powder through trituration.
- ❖ Fresh *Bhringaraja swarasa* is added in to *khalva yantra* and thereafter mixture was subjected for trituration. After trituration it was kept properly in tray for dry.
- ❖ Again, the same procedure is repeated two times for 2nd and 3rd *Bhavana* of *Kasisa*.
- ❖ For *bhavana* every time fresh *Bhringaraja swarasa* was used.
- ❖ *Shuddha Kasisa* is dried well for further Marana process.

Observation

- *Ashuddha Kasisa* in raw form was green in colour, lustrous and crystalline in nature. But after making in powder form it became lustreless and whitish green in colour.
- On adding *bhringaraja swarasa*, *Kasisa* easily well mixed in to *swarasa* and looked like greenish.

- After 3rd *shodhana* of *Kasisa* its colour was change to whitish green.
- *Kasisa* in powderd form soaked *Bhringaraja swaras* very well.

Kasisa marana

Material: *Shuddha Kasisa*

Nimbu swarasa

Type of procedure - *Putapaka (Marana)*

Drug for Marana - *Shuddha Kasisa*

Media for Bhavana - *Nimbu swarasa*

Equipments – Stone *khalva yantra* (mechanical) and pestle, weighing machine, measuring glass, knife, *sharava* (earthen saucers), mud smeared cotton cloth, pyrometer, cow dunk cakes.

Procedure:

- *Shuddha Kasisa* taken in *khalva yantra* thereafter *Nimbu swarasa* added till *Kasisa* powder becomes immersed completely.
- Then levigated continuously for one hours till it becomes thick paste.
- *Chakrikas* (pellets) were prepared, dried and arranged in *sharava*. This *sharava* is closed by another *sharava*.
- This *sharava* was sealed by double folded mud smeared cloth and allowed it for drying.
- Sealed *sharava* was subjected for *Putapaka*.
- After *swangashitata* (self-cooling) the *sharava samputa* was taken out, cleaned and opened carefully.
- The material was collected and powdered. Again, this procedure was repeated five times more.

Making chakrikas (Pelletization):

Small amount of *bhavita* doughy mass taken and making it round, flat pellets and thereafter kept in saucer.

Preparation of Sharava samputa:

After dried *chakrikas*, were arranged it in to a *sharava* in single layer. Thereafter closed this *sharava* by another one, properly sealed with cloth, clay and lastly dried it.

Observation:

- ❖ In *Marana* process fourteen *sharava* were used for observing that there is gross wt. loss or other any changes in comparison with all *sharava*.
- ❖ After 1st *puta* greenish white *shuddha Kasisa* was changed in to brownish red colour.
- ❖ During making *chakrikas* the paste of *Kasisa* with *nimbu swarasa* was so sticky.



Figure 1: Asuddha Kasisa.



Figure 2: Bhringaraj.



Figure 3: Bhringaraj swaras.



Figure 4: Shuddha Kasisa.



Figure 5: Puta.



Figure 6: Kasisa cakrika.



Figure 7: Sharava samputa.



Figure 8: Kasisa bhasma.

3. RESULTS

Bhringaraja swarasa:

Total time taken to obtain Swarasa : 4 hours
 Weight of Bhringaraja: 20 kg
 Weight of Bhringaraja (Without mula): 16 kg
 Total Bhringaraja swarasa obtained: 4 litres
 Total Bhringaraja swarasa obtained (%): 25.00

Organoleptic test:

Colour: Blackish green
 Taste: *Katu, Tikta*
 Odour: Specific odour of Bhringaraja

Kasisa shodhan:

Total time taken for dry: 4 days (For one *Bhavita*)
 Time taken for trituration : 1.30 hours
 Weight of Asuddha Kasisa : 16 kg
 Weight of Shuddha Kasisa finally: 14.85 kg
 Weight loss: 1.15 kg

Reason of wt. loss -

- ☞ During trituration some amount dropped out from *khalva yantra*.
- ☞ Due to crystallization of water.

Table 1: Showing Observation during Shodhana process of Kasisa

Bhavana	Wt. of Kasisa (in kg)	Bhringaraja Swarasa (in lt.)	Trituration Time (in Hours)	Wt. of Kasisa After Bhavana (in kg)	Wt. Loss (in kg)
1 st	16.00	4	1.30	15.50	0.50
2 nd	15.50	4	1.30	15.10	0.40
3 rd	15.10	4	1.30	14.85	0.25

Kasisa marana:Total amount of *Shuddha Kasisa* (kg): 14.85Final total amount of *Kasisa bhasma* (kg): 3.220**Table 2: Showing observation related to puta.**

Putra No.	No. of Putra required to prepare Kasisa Bhasma	Maximum temperature (°C)	Time requires to reach the maximum temperature	Time requires to fall the temperature up to 50°C
1	6	705	1.30 h	10.45 h
2	6	780	1.15 h	12.00 h
3	6	820	1.30 h	12.00 h
4	6	729	1.30 h	11.15 h
5	6	735	1.30 h	11.45 h
6	6	712	1.15 h	11.30 h

The Qualitative analysis of *Kasisa* is analyzed in three stages i.e., Raw *Kasisa*, *Shuddha Kasisa* and *Kasisa Bhasma* -

Table 3: Showing qualitative analysis of kasisa.

Properties	Raw Kasisa	Shuddha Kasisa	Kasisa Bhasma
Colour	Greenish white	Greenish white	Brownish red
Taste	Astringent	Metallic	Tasteless
Odour	Metallic	Metallic	No smell
Consistency	Hard	Smooth	Smooth

Evaluation on Classical analytical methods (*Bhasma Pariksha*):

The observation of the *Bhasma Pariksha* of *Kasisa Bhasma* has been presented in tabular format below-

Table 4: Showing classical bhasma pariksha for kasisa bhasma.

Bhasma pariksha	Result
Varna	Brownish red
Rekhapurnatva	+ve
Varitara	+ve
Slakshanatva	+ve
Gatarasatva	+ve

Evaluation on modern analytical methods:

p^H, Loss on Drying, Total Ash, Acid insoluble ash, Water soluble ash of *Kasisa Bhasma*, AAS for Iron as Fe, XRD and SEM were done.

Table 5: Showing analytical report of kasisa bhasma.

Parameter	Result
p ^H	8.94
Loss on Drying (% w/w)	0.05
Total Ash (% w/w)	99.45
Acid insoluble ash (% w/w)	97.79
Water soluble ash (% w/w)	1.75

Table 6: Showing AAS for iron of kasisa bhasma.

Sample	Iron as Fe (%w/w ppm)
Kasisa Bhasma	31.82

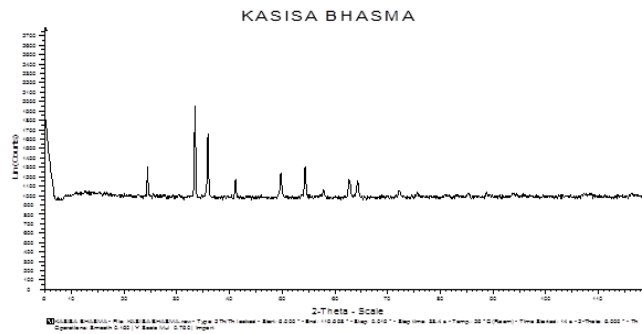


Figure 9: XRD Pic 1.

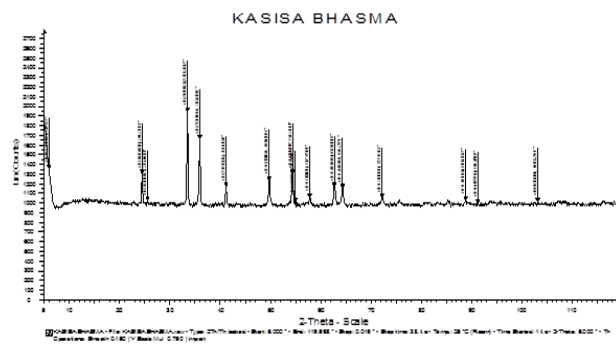


Figure 10: XRD Pic 2.

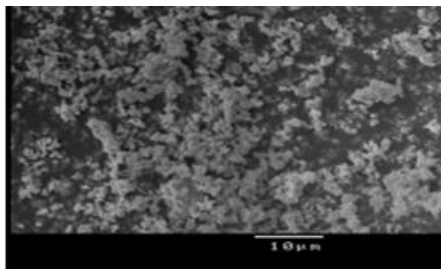


Figure 11: SEM Pic 1.

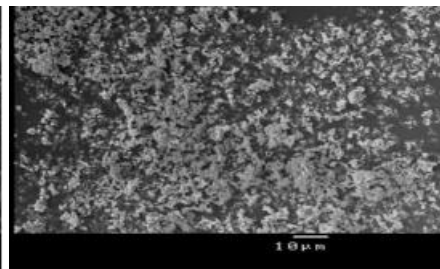


Figure 12: SEM Pic 2.

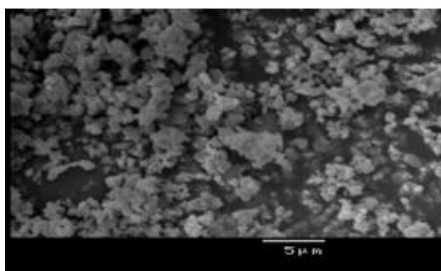


Figure 13: SEM Pic 3.

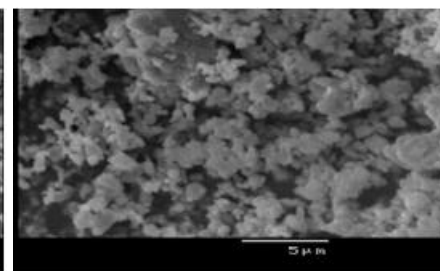


Figure 14: SEM Pic 4.

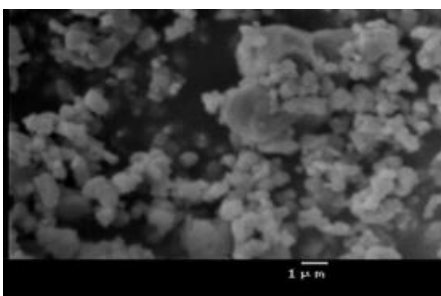


Figure 15: SEM Pic 5.

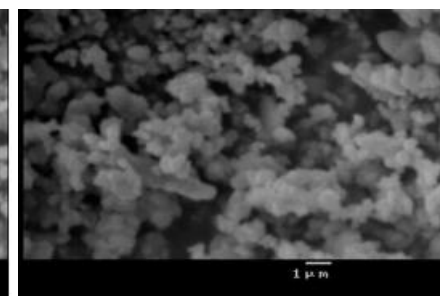


Figure 16: SEM Pic 6.

4. DISCUSSION

In today's scientific parlance 'Rasashastra' can be equated with 'Iatrochemistry'. Physicians using 'Rasaushadhi' in the management of disease are known as 'Rasa-vaidya'. *Rasaushadhi* are therapeutically effective even when administered in a small dose. These products are unpalatable and produce their therapeutic effects instant.^[5] The *Shodhana* process mentioned in classics of *Rasa-Shastra* is not merely a process of separation, purification or detoxification; it increases the therapeutic potency of the particular drug also. *Sodhana* is the first norm to be completed during drug formulation, so it has placed unique importance in. Trituration of the material, completely soaked in prescribed liquid media, till the liquid is completely evaporated and the material is dried, is termed as 'Bhavana'. Sometimes the material may be soaked and left for drying on its own without grinding. During *Bhavana*, the physical form of the material is changed when stress in the form of friction is applied. It is observed that finer particles are achieved. In *Rasa-Shastra Marana* represents the process of *Bhasmikiranana* means to make *Rasa dravyas* in *Bhasma* form. During *Putapaka*, final change in the physical form of the material takes place. *Put* helps to eliminate *Doshas* from the *Bhasma* as well as enhances *Gun*as of *Bhasma*. During the preparation of *Kasisa bhasma*, it is stated that *puta* process needs to be repeated till it became 'Niramla'. In this present study, completely absence of *amlata* i.e. *Niramlat*a of *Kasisa Bhasma* was found after six *puta*. And finally *Kasisa Bhasma* was passed all the examination for any *Bhasma* preparation. *Shodhana dravya* for *Kasisa Shodhana* was *Bhringaraja*. It has *Katu*, *Tikta rasa* and *Kaphavata-shamaka* properties. *Nimbuka* is selected for *Marana* of *Kasisa*. It has *Amla rasa*, *Kaphavata-shamaka* properties and also a good source of Vitamin C. There is a hypothesis behind the thought was that both drugs are rich source of Vitamin C and Citric acid. So these help in the conversion of Ferric iron to Ferrous iron which is most absorbable form. *Kasisa* hold an important position in *Rasa-Shastra*. There is no any classification about *Kasisa* is mentioned in *Charaka*, but *Sushruta* and *Vagbhata* are kept it in to *Usakadi varga*. In *Rasamrita* it is described under *Dhatuvarga* and in *Rasatarangini* under *Updhatu varga*.

Otherwise all *Rasacharyas* are kept it in to *Uparasa varga*. *Kasisa* is obtained naturally and artificially. Average 4 litres of *Bhringaraja swarasa* was obtained from average of 16 kg of without *mula Bhringaraja*. It means 25% of *swarasa* was obtained. This process was repeated for 2nd and 3rd *shodhana* process. The colour of *Bhringaraja swarasa* was blackish green. *Shodhana* of *Kasisa* was done by three *bhavana* of *Bhringaraja swarasa*. 16 Kg. of raw *Kasisa* was taken for *Shodhana*. It was observed that 1.15 kg. loss found in *Bhavana* method. It may be due to some amount of the *Kasisa* was lost during trituration in mortar and was also stucked to in the surface of the mortar. There is excess amount of water present in *Kasisa*, so one reason may be due to evaporation of water when it was subjected to sunlight for drying. The colour of *Suddha Kasisa* was whitish green. In *Marana* process 14.50 kg *Shuddha Kasisa* was divided in to fourteen *Sharavas* (No. A-N) for observing loss or any changes in colour. In first *puta* process this was difficult to make *chakrikas* of *Kasisa*. So it was trituated with *Nimbu swarasa* and kept in *sharavas* without making *chakrikas*. After *puta* colour of *Kasisa* was changed from whitish green to brownish red that was an ultimate change in colour. *Chakrikas* were having 3 cm in diameter and 1.5 cm in thickness. *Chakrikas* were took long time for drying, because it has tendency to absorbed moisture from air. Six *puta* were given in *marana* process. After six *puta* average 3.220 kg *Kasisa bhasma* was obtained from 14.500 kg *Shuddha kasisa*. That means 22.20% *Kasisa* was obtained. Finally it was observed that there was minute different in loss of all fourteen *sharavas* and not any change in colour. In present study *Ardha gajaputa* was given for *Kasisa marana*. The colour of *Kasisa Bhasma* was brownish red. Specific colour of the *Bhasma* indicates formation of particular metallic compounds because each chemical compounds possesses particular colour. After *marana* process the ferrous sulphate change in to ferric or ferrous oxide which imparts red coloured to it. This *pariksha* is directly relates to the partial size of the *Bhasma*. *Kasisa Bhasma* was passed this test. *Kasisa Bhasma* was found *varitara*. *Kasisa Bhasma* was found smooth in touch. *Kasisa Bhasma* was observed tasteless. *Kasisa Bhasma* should be *Niramlatva*, if there is *amlata* is present indicating the need of further *puta*.

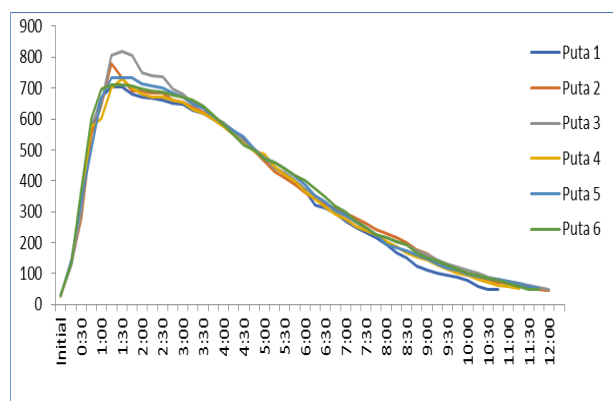


Figure 17: Puta (In graph).

5. CONCLUSION

In preparation of *Bhringaraja Swarasa* average 4 litres of *Bhringaraja Swarasa* was obtained from average of 16 kg fresh *Bhringaraja Panchanga* (without Mula). *Shodhana* of *Kasisa* was done by *Bhringaraja swarasa*. In *Shodhana* process *bhavana* method was adopted. 16 Kg. of raw *Kasisa* was taken for *Shodhana*, finally it was observed that 1.15 kg. loss found finally in this method. *Marana* of *Kasisa* was done by *Nimbu swarasa*. 3.220 kg *Kasisa bhasma* was obtained from 14.85 kg *Shuddha Kasisa*. Evaluation on classical analytical method i.e. *Bhasma pariksha* for *Kasisa bhasma* and Evaluation on modern analytical methods viz. Determination of p^H , Loss on drying, Determination of Ash value, Acid insoluble ash, Water soluble ash, Total solid content of *Bhringaraja Swarasa*, XRD study, SEM study, AAS for Iron as Fe and Disintegration time. *Rasamritam Shodhana* and *Marana* process for *Kasisa* are found best on the basis of easy, economic and time saving. The *Ardha-gajaputa* was given for preparing *Kasisa Bhasma*. After 1st *puta* colour of *Kasisa Bhasma* was changed in to brownish red from Greenish white. 57.24% loss was observed after 1st *puta*, due to loss of water part from *Kasisa*. *Niramlatvata* (Sour tastelessness) of *Kasisa Bhasma* was found after 6th *puta*. Iron as Fe (%w/w ppm) was found 31.82 in *Kasisa Bhasma*.

Acknowledgement: Nil

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