WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 6, Issue 8, 2437-2450. Research Article ISSN 2277– 7105

PHARMACEUTICAL STANDARDIZATION OF "PARADA MARITA AND VANASPATI JARITA MARITA YASHADA BHASMA" – A COMPARATIVE STUDY

Seetha Chandran*[1], B. J. Patgiri[2], Prasanth Bedarkar[3], Sasikumar Nechiyil[4], Galib R.[5]

[1]PhD Scholar, Dept. of Rasasastra and Bhaishajya Kalpana, IPGT and RA, Gujarat Ayurveda University, Jamnagar, 361008.

[2]Professor and H.O.D, Dept. of Rasasastra and Bhaishajya Kalpana, IPGT and RA, GAU, Jamnagar, Gujarat.

[3]Asst. Professor, Dept. of Rasasastra and Bhaishajya Kalpana, IPGT and RA, GAU, Jamnagar, Gujarat.

[4]Professor and HOD, Dept. of Rasasastra and Bhaishajya Kalpana, PNNM Ayurveda Medical College, Cheruthuruthi, Kerala.

[5]Assoc Professor, Department of Rasasastra and Bhaishajya Kalpana, All India Institute of Ayurveda, New Delhi, India.

Article Received on
18 June 2017,

Revised on 09 July 2017,
Accepted on 30 July 2017

DOI: 10.20959/wjpr20178-9195

***Corresponding Author**
Dr. Seetha Chandran
Department of Rasasastra and Bhaishajya Kalpana, IPGT & RA, G AU, Jamnagar.

ABSTRACT

Introduction: *Yashada bhasma* (Calx of Zinc) is a metallic preparation, which is mainly indicated in the management of *Prameha* (Diabetes), *Rajasrava* (menorrhagia), *Kampavata* (Parkinsonism), *Netra vikara* (Eye disorders) etc. Though previous research works emphasizing on pharmaceutical standardization of *Yashada bhasma* are available, a comparative pharmaceutical and physico-chemical profile of *Yashada bhasma* prepared using *Parada* (Mercury) and *Vansapati* (Herbal) media is not available till date. Current study was done to establish standard manufacturing procedure (SMP) of *Parad marita Yashad bhasma* and *Vanaspati jarita marita Yashad bhasma* and to compare the impact of media on marana based on analytical parameters. **Materials and Methods:** Raw materials were collected, authenticated and subjected to *shodhana* (purification) procedures. Then *Yashada bhasma* was prepared by using two different medias in electric muffle furnace as per classical guidelines. **Results and Discussion:** *Parada marita Yashada* (PMY) fulfilled classical parameters of *bhasma* after 7th *puta* (incineration setup),

whereas *Vanaspati jarita marita Yashada bhasma* (*JMY*) required 5 *putas* for the same. Marked variations were observed in the pharmaceutical profiles of samples. **Conclusion:** To prepare *Vanaspati jaritha Yashada Bhasma*, five *Puta* with peak temperature of 550^0C was required and for *Parada marit Yashada Bhasma*, it took seven *Puta* with peak temperature of 700^0C. *Jarana* makes the *Marana* process of *Yashada* easy. The current data on pharmaceutical profile of *PMY* and *JMY* may be considered as standard in future studies.

KEYWORDS: Jarana; Marana; Pharmaceutical; Standardisation; Yashada Bhasma; Zinc.

INTRODUCTION

Bhasma are unique Ayurvedic preparations of metal, mineral, ore or alloy origin. *Yashada bhasma* is one such preparations, which has been first enumerated under classified group "*Dathu"* by Author Rasamadhava.[1] *Yashada* was known to ancient scholars of Rasashastra (Ayurvedic Pharmaceutical science principally dealing with inorganic drugs of metal, mineral, ore origin) as *satva* of *Kharpara (*extract of Zinc carbonate*). Yashada* is indicated in *Netra vikara* (eye diseases), *Prameha* (diabetes), *Pandu* (anaemia), *Kasa shwasa* (respiratory disorders), *Dushta vrana* (non-healing wounds), *Srama* (Exertion), *Avasada* (generalized weakness), *Rajasrava* (menorrhagia), *Kampavata* (parkinson's disease) and many disorders with imbalance of *Kapha* and *Pitta*.[2] Administration of improperly processed *Yashada Bhasma* may cause diseases like- *Prameha*, *Kshaya* (tuberculosis) and *Kushtha* (skin diseases).[3] Hence, seers recommend to follow *Shodhana* (- purification) and *Marana* (incineration) of *Yashada* properly to avoid above mentioned blemishes of *Yashada*. Such methods may not only reduce the toxicity, but may also help to increase assimilation, bio-compatibility, targeted delivery and therapeutic efficacy of the drug, as bhasmas are due bio active nanoparticles

Numerous methods for *Shodhana* and *Marana* of *Yashada* are mentioned in various texts of Rasashastra. But establishment of standard operative procedure (SOP) as a part of pharmaceutical standardization, ensures batch to batch consistency, good manufacturing practices thus help in product reproducibility. Ancient scholars of Rasashastra consider *Marana* of *Lauha* (*Dhatu* or *Rasavarga Dravya* with metallic properties) with use of Mercurials as best method among methods of *Marana*, whereas *Marana* with derivatives of herbs is considered as comparatively inferior in qualities.[4] Current study is based on this principle and was done to establish standard manufacturing procedure (SMP) of *Parada*

marita Yashad bhasma and *Vanaspati Jarita marita Yashad bhasma* and to compare the impact of media on marana based on analytical parameters.

MATERIALS AND METHODS

1. Procurement and Authentication of raw drugs

Raw Zinc (*Yashada*), Mercury (*Parada*) of 99.99% purity (MERCK Company), Sulphur (*Gandhaka*) and *Apamarga* (*Achyranthes aspera* Linn.) were collected from the pharmacy of Gujarat Ayurved University, Jamnagar. *Kumari* (*Aloe barbadensis* Mill.) and *Nimbu* (*Citrus acida* Linn.) were collected from local market of Jamnagar. They were selected on the basis of classical characteristic features of acceptable variety and authenticated by the subject experts. Melting point of raw *Yashada* was recorded with telethermometer. Herbal drugs were authenticated at Pharmacognosy laboratory of the Institute.

2. Pharmaceutical procedure

This includes all the pharmaceutical procedures carried out in the current context. *Samanya* (general) and *Vishesha* (specific) *Shodhana* of *Yashada*, *Jarana* of *Shodhita Yashada*, *Shodhana* of *Parada*[5] and *Gandhaka*[6] were carried out as per classical guidelines. *Samanya Shodhana* of *Yashada* was carried out by heating and quenching (*Dhalana*) successively in *Tila Taila* (oil of *Sesamum indicum* Linn.), *Takra (*Butter milk*), Kanji* (fermented sour gruel), *Gomutra* (cow's urine) and *Kulattha Kwatha* (decoction of *Dolichos biflorus* Linn.), with three consecutive quenching in each [Figure. 2, 3A and 3B].[7] For *Vishesha shodhana, churnodaka*[8] (lime water) was used for *Dhalana*.[9] *Shodhita Yashada* was subjected to *Marana* by two methods –In first method, *Marana* through preparation of *Pishti* with *Parada* and *Gandhaka*, and 2nd group through an intermediate step called *Jarana* (Avapa method). Rest of the procedures adopted for both the *Marana* methods were kept uniform except temperature pattern [gradual increment of peak temperature in successive *Puta* i.e. up to700^0C in first method (PMY) and 500^0C in second method (JMY)].

Equipments list for preparation of *Yashada Bhasma*- *Pithara yantra* (assembly for quenching) was used for *Shodhana* of *Yashada*, Iron ladle (*Darvi*) for *Gandhaka Shodhana*, *Khalva Yantra* and end runner for *Parada Shodhana*, Butterfly grinder for levigation and Electric muffle furnace (EMF) for *Bhasmikarana*.

Associated equipments: Stainless steel vessels, earthen saucers (casserole), gas stove, knife, juice extractor, thermo couple etc.

***Marana* of *Yashada*: PMY Method:**[4] Procedure was carried out in following steps with three batches.

Preparation of *Yashada Pishti: Shodhita Yashada* (500g) was melted in iron vessel and poured in iron mortar containing *Shuddha Parada* (500gms) followed by vigorous trituration. *Khalwa yantra* was heated using flames and continued trituration. After 3 hrs of trituration, when it was no more possible to bring about much change in the mixture, sufficient quantity (700 ml) of lemon juice was added to enhance homogenous mixing and further the mixture was triturated for half an hour. Later on Rock salt (500 gms) was added, grounded well and washed with hot water. Washing process with saltwater was repeated 5 times, until the drained water became clear. On completion of washing, *Shodhita Gandhaka*- 500g was added to it and again triturated till it becomes homogenous and dry [Figure. 4].

Levigation: *Yashada pishti* was made into fine powder using *Khalwayantra*. *Kumari swarasa* (Juice) was used as *Bhavana Drava* (levigation media) to prepare pellets (*Chakrika*). The process was continued until the mixture forms a doughy consistency.

Pellatization: Small pellets of the mass approx. 2-3 cm in diameter were prepared and shade dried.

Sharava Samputikarana: On complete drying of pellets, they were arranged in earthen saucer keeping minimal space, to prevent direct contact, between two pellets. Saucer was closed with another earthen saucer kept inverted and junction was sealed with mud smeared cloth to form *Samputa* and sun dried [Figure.5].

Puta (incineration setup): Successive *Puta* were given in electric muffle furnace (EMF) with 700°C as peak temperature until attainment of chief desired characteristics (CDC) of *Yashada Bhasma*. On self-cooling of the set-up, *Samputa* (above mentioned assemblage of sealed saucers) was removed, pellets were procured. After every *Puta*, pellets were powdered and grounded well with 500 g of *Gandhaka* for 1 hr in mortar before levigation with *Kumari swarasa* [Figure. 6].

***Marana* of *Yashada*- JMY Method:**[10]*Shodhita Yashada* was subjected to *Jarana* for which, ¼th part dried *Apamarga Panchanga* (whole plant) was used as *Avapa*.

Jarana- Shodhita Yashada was taken in an iron pan, melted over intense fire (400- 450^{0}C) and vigorous trituration was done with an iron pestle by adding *Apamarga panchanga churna.* Rubbing with *Apamarga* while heating was continued till all *Yashada* got converted into lustreless fine powder. The powder was collected at centre and covered with an earthen saucer. Heat was increased till the bottom of the vessel became red hot. When it became red hot, heating was stopped and left for self-cooling [Figure. 7]. Later washing of *Jarita Yashada* with potable water was done and after complete drying, it was weighed and subjected to *Marana*.

Levigation with *Kumari swarasa*, pellatization and *sharava Samputikarana* was done and the *Samputa* was kept in EMF for calcination. The whole process was repeated with three batches until the CDC of *Yashada Bhasma* was achieved. [Figure.8]

OBSERVATION AND DISCUSSION

PMY Method: It took 5 hrs to make *Parada pishti* ie., around 3hr for homogeneous mixing of *Parada* and *Yashada* and 2 hr grinding with *Gandhaka choorna*. Before every *Puta*, *Pishti* was subjected to levigation for 3 hrs in *Kumari Swarasa* to form doughy consistency, enough to prepare pellets. During every *Puta* at 200-250^{0}c, there was slight odour of SO_2 and by 300-350^{0}C, it became distinct and fumes were visible. Seven *Puta* were required for attainment of all *Bhasma Lakshana* in every three batches (Enlisted in table No. 1 and2).

Table No. 1: Weight variations in PMY samples after each *Puta.*

Puta No.	Wt before *Puta* (g) (3 batches)			Liquid for levigation (ml) (ml) each *Puta*	Avg. Duration of grinding (hr)	Wt. after *Puta* (g)			% loss		
	PMY1	PMY2	PMY3			PMY1	PMY2	PMY3	PMY1	PMY2	PMY3
1	1045	1418	1200	500	5.5	1010	1484	1100	3.5	4.6	8.33
2	1226	1273	1190	500	2.30	904	998	1100	26.2	21.6	7.56
3	1161	1249	1300	400	2.30	772	868	1000	33.50	30.50	23.07
4	968	1080	1250	400	2.30	750	842	950	22.52	22.03	24
5	951	1067	1120	400	2.30	681	791	900	28.39	25.86	19.64
6	891	1031	1200	400	2.30	675	678	860	24.24	34.23	28.33
7	860	928	1000	400	2.30	665	637	800	22.67	31.35	28.57
Total wt. loss (gms)	**380**	**781**	**400**						**36.36**	**57.07**	**33.33**

Table No. 2: Inprocess observations during *Marana* of PMY samples.

No. of *Puta* and Peak Temp.	Observations	Behaviour of batches			*Bhasma Pareeksha* (tests)
		PMY1	PMY2	PMY3	
1st- 450^{0}c	Half of the pellet were greenish and other half was grayish, presence of metallic particles, Spongy layer on top of some pellets	-	-	-	Didn't passed *Varitaratwa* test
2nd-500^{0}c	Pellets were slightly hardened, grayish in color with greenish tinge on 1/4th part	-	-	-	Didn't passed *Varitaratwa* test
3rd-500^{0}c	Pellets were grey colored with blackish tinge and uniform color within same pellet	+	+	+	100 % of *bhasma* passed *varitaratwa* test
4rth-550^{0}c	Soft consistency, Blackish tinge increased, luster reduced	+	+	+	Didn't passed *Niruttha* and *Apunarbava*
5th- 600^{0}c	Very soft so that almost half pellets turned to powder, mild luster present.	+	+	+	-
6th- 650^{0}c	90 % of pellets got powdered, no glistening, Became dark black in color with grayish tinge	+	+	+	*Dantagre kachakachatwa*, Didn't passed *Niruttha* and *Apunarbava*
7th- 700^{0}c	90 % of pellets got powdered, no glistening, with grayish black color.[11]	+	+	+	Passed all *Bhasma pareeksha*

Note-(+) Present, (-) Absent.

JMY Method

Offensive grey smoke was evolving during *Jarana process*, which made it very difficult for continuing the process. But *Mardana* was continued using the mask. After 3 hours of continuous trituration, mixture was converted into blackish gray coloured powder. *Jarita Yashada* was greyish in colour. An average of 3.5 % loss was observed after washing of *Iarita Yashada*. An average of 8 hrs levigation was done with *Kumari Swarasa* in butterfly wet grinder before every *Puta*, to get doughy consistency sufficient enough to mould to pellets. In subsequent *Puta*, amount of *Kumari Swarasa* required for levigation and time for grinding to prepare doughy mass was decreased. Metallic particles were observed in all three batches even after second *Puta*. From 3rd *Puta* onward, pellets were uniform in colour (from top to bottom and centre to periphery), dark cream colour was observed. Five *Puta* were required in all the three batches for attainment of all *Bhasma Lakshana*. By fifth *Puta*, colour became light cream.[12] [details in table 3and 4].

Table No 3: Weight variations in JMY samples after each *Puta*.

Puta No.	Wt. before *Puta*			Liquid for *Bhavana* (ml)	Duration of *Mardana* (hr)	Wt. after *Puta*			% loss		
	JMY-1 (g)	JMY-2 (g)	JMY-3 (g)			JMY-1 (g)	JMY-2 (g)	JMY-3 (g)	JMY-1 (g)	JMY-2 (g)	JMY-3 (g)
1	440	440	440	400	8	410	425	433	0.3	0.05	0.07
2	535	520	530	400	7	500	470	450	0.35	0.5	0.8
3	520	510	470	300	7	420	400	400	1.00	1.1	0.7
4	510	500	480	300	6	400	390	400	1.1	1.1	0.8
5	410	400	405	300	6	290	330	335	1.2	0.7	0.7
Total loss				**1700**	**34**	**150**	**110**	**105**	**3.95**	**3.45**	**3.07**

Table No 4: Behaviour of JMY samples during *Marana*.

No of *Puta* and Temp	Observations	Behavior of batches			*Bhasma Pareeksha*
		JMY-1	JMY-2	JMY-3	
1st- 500^{0}C	Pellets were soft with uniform light grey color	+	+	+	
2nd-500^0 C	Pellets were soft with grayish colour and creamy tinge	+	+	+	*Dantagre kachakachatwa* present and didn't passed *Varitara* test
3rd-500^0 C	Pellets were uniform in colour, creamy tinge increased	+	+	+	100 % of *bhasma* passed *varitara* test. But *Niruttha* and *Apunarbhava* tests were negative
4rth-500^0 C	Soft in consistency, became whitish creamy in colour	+	+	+	*Bhasma* passed *rekha poornata* test and it was tasteless too.
5th- 550^0 C	Pellets were slightly cracked but not powdered, more soft in texture, colour became whitish creamish.	+	+	+	*Danthagre kachakachatwa* was absent. *Bhasma* passed *Niruttha* and *Apunarbhava* tests.

Table 5: Organoleptic characters of *Yashada*.

Sample	Colour	Consistency	Touch	Smell	Sound	Characters
Raw *Yashada*	Silvery whitish	Solid, hard	Smooth	No	Metallic	Metallic
PMY *bhasma*	Grayish Black	Fine powder	Soft	No	No	No metallic characters
JMY *bhasma*	Whitish cream	Fine powder	Soft	No	No	No metallic characters

Figure 1: Raw *Yashada.*

Figure 2: *Shodhita Yashada.*

Figure3A: Melting of *Yashada.*

Figure 3 B: Molten *Yashada* Poured to pitara Yantra.

Figure 4: *Yashada Pishti.*

Figure 5: *Sharava Samputa.*

Figure 6: PMY after 7th *Puta.*

Figure 7: *Jarana of Yashada.*

Figure. 8: JMY after 5th *Puta.*

Figure 9: PMY *Bhasma* prepared using stone mortar.

DISCUSSION

PMY method: In this method, incineration was carried out in 3 steps. Preparation of *Pishti*, *Bhavana* and *Marana* (*Puta*). *Parada Yashada Pishti* (Zinc amalgum) is *a Dhatu Pishti;* one among the five types of *Murchana*[13] and a variety of *Pishti bandha*. *Pishti* posses *Deepana, Pachana* property (reactivity of resultant amalgam may be more than that of Mercury).[14]

Later it was subjected to *bhavana* with lemon juice. *Bhavana* is also one type of *Samskara* responsible for transformation, having its utility in almost all pharmaceutical processing.[15] As the quantity of *Bhavana Drava* (levigating media) and duration of levigation are not mentioned, sufficient quantity of Juice of *Kumari* was used and triturated until the mass became dry. Lemon juice is a weak acid in nature, with average 5-6 % citric acid. *Yashada bhasma* (Zinc oxide) is amphoteric and partially soluble in organic acids.[16] There might be possibility of neutralization taking place when the two media inter-react during levigation. Here grinding was done in *tapta kalwa* (heated mortar), for augmenting the formation of *Pishti*. But care should be taken to keep internal temperature of Mortar bellow 357^0C to prevent evaporation of Hg. To convert elemental mercury (Hg) in-to amalgam and to stop mercury vapours being emitted, citric acid and zinc is a wonderful combination.[17] During levigation, Zinc citrate may form. As Zinc forms amalgam with Hg, there is possibility of formation of amalgam of Hg too. Thus formation of organomercuric and organomercury metallic compounds ie., amalgams with ligands happens.[18] Though in traces, there is a possibility of formation of citrates of cast material from mortar like Iron citrate, Manganese citrate etc, which may further get amalgamated with mercury (except Fe). Grinding in lemon juice, helps in faster amalgamation of the *Pishti* and impart stability to mercury, may incorporate trace elements in-to formulation.

Afterwards *Pishti* was ground with *Saindhava* and washed with hot water. *Mardana* with *Saindhava* helps to get rid of toxic products formed during *Pishti* preparation and improves

bandhana property (stability) of *Parada*. Thus it may be considered as a *Murchana samskara* as there is *Mardana* of *pishti* with *Lavana* and *Amla drava* in hot mortar.[19] Also *Parada* loses its *chapalya* (mobility) and *ghanatwa* (heaviness) and becomes *sukshma* like *kajjali*.[20]

After *proper mixing of Pishti with Gandhaka*, it was subjected to *bhavana* with *Kumari Swarasa* for 3 hrs, and then before every *Puta.* This is similar to the surfactant mediated production of nano particles.[21] As period of levigation increases, particle size gets reduced and more solid contents gets impregnated with in compound. *Kumari swarasa* has an important role in *Shodhana* of *Parada* (removes *Mala dosha*) and in *Bhasma prakriya* (incineration). It helps to remove the *Apakwa dosha* (incomplete burned impurities) formed during the process,[22] imparts proper binding, Therapeutic properties of levigation media may also get assimilated in to the drug during grinding. [enlisted in table.7].

Bhavana drava forms a herbal coat over metallic particle surface and form a surfactant, facilitating further processing. When this is subjected to incineration, due to the presence of herbal coating, the superficial surface of *Yashada* particles may react and oxides may get formed. These oxides again may get reduced to their initial form and separated from core particles. Thus repeated levigation and incineration cycles may cause repeated oxidation, reduction, resulting in conversion of metal into micro and nano particles in *Bhasma* form.[23]

Gandhaka which helps in the incineration was added to the mixture after every *Puta*. It helps to increase the thermostabiltiy of *Parada*[24] and enhance the therapeutic property[25] and safety of mercurial.[26] Vapours of sulphur were noticed from EMF, at 300^0C.

Use of EMF instead of classical *Puta* system helps to maintain the temperature pattern and save energy, as it is a closed method. Chances of contamination are also less with EMF heating.[27] Seven successive *Puta* were given in EMF with 700°C as peak temperature, for attaining the *bhasma pareeksha* (CDC) of *Yashada Bhasma*. Blackish colour and softness of pellets got increased with each *Puta*. Three batches were prepared using *loha khalwa*, for *bhavana* due to which, the pellets prepared in it appeared greyish black. Yellow colour was observed for PMY in previous works.[28] Hence another batch was prepared using stone pestle mortar with same parameters, yielding yellowish pellets on completion of *Marana*[29] [Figure.9]. Hence it is recommended to use Stone mortar and pestle to prepare *Yashada bhasma*.

In the current work, weight loss was observed after incineration. Documentation of weight changes is an essential part of drug standardization. This gives pharmacist an idea to choose quantity of initial material to procure desired quantity of finished product.

JMY method: In this method, incineration was carried out in 3 steps. *Jarana, Bhavana* and *Marana*. During *Jarana* of *Yashada* in *Apamaraga*, ash of *Apamarga* deeply incorporates in to the particles of *Yashada*. Further helps in micronization of metal along with probable incorporation of *tikshna (*penetrating*), shulaghna* (pain releiving) like properties of *Apamarga kshara* in to the metal.[30] The metallic form of Zinc gets converted to its oxidised form by this process. The process also helps to convert Zinc in to compounds with significantly high melting point than that of Zinc. *Jarita Yashada* was washed with hot water to remove the excessive *kshara* and other water soluble impurities possibly present in *Yashada* or generated during *Jarana*. Although, *Jarita Yashada* can be administered internally, suggesting significance of *Jarana* equal to that of *Marana*. To assure more safety and to increase the therapeutic efficacy through making finer particle size and better bioavailability, *Marana* was done after *Jarana* in this study. Compared to the PMY batch, five successive *Puta* were given in EMF with 550°C as peak temperature, for attaining CDC of *Yashada Bhasma*. Also administration of high temperature will cause *kharagnipaka* (overheating) of *bhasma* leading to formation of a different compound having hard consistency and bright yellow colour.[31] Moreover in case of *Jarita bhasma*, the product is somewhat similar to *Bhasma*, hence excess temperature may not mandatorily required.

CONCLUSION

To prepare *Vanaspati jaritha Yashada Bhasma*, five *Puta* with peak temperature of 550^0C was required and for *Parada Marit Yashada Bhasma*, it took seven *Puta* with peak temperature of 700^0C. *Jarana makes the preparation of Yashada bhasma easier.*. The current data on pharmaceutical profile of *PMY* and *JMY* may be considered as standard in future studies.

Conflict of Interest: Nil.

Financial Support: IPGT and RA, GAU, Jamnagar.

ACKNOWLEDGEMENT: Authors acknowledge the sincere support of Laboratory worker Ashwin babulal Joshi.

REFERENCE

1. Madava upadyaya, chapter 2/ 182, Ayurveda prakasha, Edited with Arthavidyotini and suspshtarthaprakshini commentaries by Vaidya Gualraja Sharma misra, Varanasi, Choukampa bharati academy, 2007; 388.
2. Sree sadanandha Sharma, Chapter 19/ 120-123, Rasatharangini, Reprint Edition, Varanasi;Mothilal banarasi das Publishers, 2009; 576.
3. ibidem Rasatharangini (2), Chapter 19/ 97: 575.
4. Rasa Vagbhata, chapter 5/12, Rasaratnasamuchaya, Sidhipradha Hindi Vyakyana of Sidhinandha Misra, 1st edition, Varanasi; Choukamba Orientalia publications, 2011; 143.
5. Sree sadanandha Sharma, Tharanga – 5 / 27-30, Rasatharangini, Reprint Edition, Varanasi;Mothilal banarasi das Publishers, 2009; 76.
6. Rasa Vagbhata, chapter 3/21, Rasaratnasamuchaya, Sidhipradha Hindi Vyakyana of Sidhinandha Misra, 1st edition, Varanasi; Choukamba Orientalia publications, 2011; 28.
7. Sharngadharacharya, Madhyama Khanda, chapter. 11 /2-3, Shargadhara samhita with Adhamalla deepika and Kashirama's Gudartha deepika, Pandit parasuram sastri (editor), Varanasi, Choukambha Orientalia, 2008; 240.
8. SriGovindasena, Tritiya Khanda 186-187, Vaidyaka Paribhasha Pradipa, 1st Edition, 2003: 2003; 79.
9. Sree sadanandha Sharma, Chapter 19/ 98-99, Rasatharangini, Reprint Edition, Varanasi; Mothilal banarasi das Publishers, 2009; 576.
10. Sree sadanandha Sharma, Chapter 19/ 112-115, Rasatharangini, Reprint Edition, Varanasi;Mothilal banarasi das Publishers, 2009; 576.
11. Raseshaacharya sree Charan Teerth, sloka-237, Rasodhara Tantra,, 1st ed., Rasashala oushadashram publishers, Gondal, 2000; 438.
12. Sree sadanandha Sharma, Chapter 19/113, Rasatharangini, Reprint Edition, Varanasi;Mothilal banarasi das Publishers, 2009; 587.
13. Sree Madava, chapter 2/6, Ayurveda prakash with Arthavidyatini and Arthaprakashini Sanskrit and Hindi commentaries, Sri Gularajsharma mishra (Editer)., Varanasi, Choukamba Bharati Academy, 2008; 254.
14. Rasa Vagbhata, chapter 11/61, Rasaratnasamuchaya, Sidhipradha Hindi Vyakyana of Sidhinandha Misra, 1st edition, Varanasi; Choukamba Orientalia publications, 2011; 126.
15. Shuchi Mitra, P. K. Prajapati1, V. J. Shukla2, B. Ravishankar, Impact of *Bhavana Samskara* on physico-chemical parameters with special reference to *Gandhaka Rasayana*

prepared by different media and methods, AYU, Jul-Sep 2010; 31(3): YU | Jul-Sep.[Available from http://www.ayujournal.org on Monday, July 3, 2017; IP: 49.34.6.28].

16. Available from https://www.quora.com [last accessed 0n 03.06.2017].
17. Available from https://www.fishersci.com/shop/products/nps-mercsorb-mercury-amalgamation-powder-amalgam-powder/19066526 [last accessed on 03.06.2017].
18. Available from https://en.wikipedia.org/wiki/Amalgam_(chemistry), [last accessed on 13.07.2017].
19. Sree ranjana prasad gupta, chapter 8/120,-128, Parada samhita, 2nd ed. Newdelhi, Delhi pustak kendra, 70.
20. Ibidem Parada samhita (19) chapter 8/179: 73.
21. Dhirajsingh.S.Rajput, Rohit. A. Gokarn, Shukla.V. J, Patgiri. V. J, Pharmaceutical standardization of naga bhasma (incinerated lead) prepared by using herbal media, Ayur pharm int J Ayur Alli Sci., 2013; 2(7): 212- 223.
22. Jadhav kalyani, Role of kumari in Rasasastra and Bhaishajya kalapana, International journal of app, 1(2): 1193-1197.
23. Dhirajsingh.S.Rajput, Rohit. A. Gokarn, Shukla.V. J, Patgiri. V. J, Pharmaceutical standardization of naga bhasma (incinerated lead) prepared by using herbal media, Ayur pharm int J Ayur Alli Sci., 2013; 2(7): 212- 223.
24. Ayurveda prakash, Sree Madava, Editer. Sri Gularajsharma mishra, Arthavidyatini and Arthaprakashini Sanskrit and Hindi commentaries, chapter 2/6p, Varanasi, Choukamba Bharati Academy, 2008; 254.
25. Sree sadanandha Sharma, Chapter 8/37, Rasatharangini, Reprint Edition, Varanasi; Mothilal banarasi das Publishers, 2009; 184.
26. ibidem, Rasatarangini (25), Chapter 8/38: 184.
27. Dhirajsingh.S.Rajput, Rohit. A. Gokarn, Shukla.V. J, Patgiri. V. J, Pharmaceutical standardization of naga bhasma (incinerated lead) prepared by using herbal media, Ayur pharm int J Ayur Alli Sci., 2013; 2(7): 212- 223.
28. Ingole Rajesh. Kundlikrao, Patange Ravish Shamsunder, Dhanurkar Santosh Ramchandra, Bakare Sunil Chandrakan, Preparation of parad marit yashad bhasma and hartal marit yashad bhasma with their comparative analytical study, Int. J. Res. Ayurveda Pharm, Jul – Aug 2013; 4(4). [Available from www.https/ /www.ijrap.net] [last accessed 0n 03.06.2017].
29. Harisharanandha Vaidya, Bhasma Vijnan – Chathurtha pada, Amrthsar, Ayurveda vijnan Granthamal karyalay, 9.

30. Sree sadanandha Sharma, Tharanga 40/ 65, Rasatharangini, Reprint Edition, Varanasi; Mothilal banarasi das Publishers, 2009; 336.
31. Vishwanath dwivedi, Dwitheeya prakarana, Bharateeya Rasasastra, Nagpur, sree Sharma ayurveda mandhir, 2000; 576.