WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 8, Issue 3, 884-894. Research Article ISSN 2277– 7105

STANDARD OPERATING PROCEDURE (SOPs) OF *SAMEERA PANNAGA RASA* PREPARED THROUGH VERTICAL ELECTRIC MUFFLE FURNACE

Madhvi Sharma[1]*, Prashant Bedarkar[2] and B. J. Patgiri[3]

[1]Ph.D. Scholar, Department of Rasashastra and Bhaishajya Kalpana including Drug Research, Institute for Post Graduate Teaching & Research in Ayurveda (IPGT & RA), Gujarat Ayurved University (GAU), Jamnagar-361008, Gujarat, India.

[2]Asst. Prof., Department of Rasashastra and Bhaishajya Kalpana including Drug Research, Institute for Post Graduate Teaching & Research in Ayurveda (IPGT & RA), Gujarat Ayurved University (GAU), Jamnagar-361008, Gujarat, India.

[3]Professor & Head, Department of Rasashastra and Bhaishajya Kalpana including Drug Research, Institute for Post Graduate Teaching & Research in Ayurveda (IPGT & RA), Gujarat Ayurved University (GAU), Jamnagar-361008, Gujarat, India.

Article Received on
01 Jan. 2019,
Revised on 22 Jan. 2019,
Accepted on 13 Feb. 2019
DOI: 10.20959/wjpr20193-14285

***Corresponding Author**
Madhvi Sharma
Ph.D. Scholar, Department of Rasashastra and Bhaishajya Kalpana including Drug Research, Institute for Post Graduate Teaching & Research in Ayurveda (IPGT & RA), Gujarat Ayurved University (GAU), Jamnagar-361008, Gujarat, India.

ABSTRACT

Kupipakwa Rasayana is among unique Ayurvedic dosage forms prepared by *Kupi Paka* method (specific pharmaceutical heat treatment in glass bottle through sand bath). *Sameera Pannaga Rasa* is a *Kupipakwa Rasayana* containing *Shuddha* (processed) *Parada* (Hg), *Shuddha Gandhaka* (S), *Shuddha Somala* (As_2O_3), *Shuddha Haratala* (As_2S_3) and *Shuddha Manahshila* (As_2S_2) in equal quantity. Ingredient *Manahshila* is absent in formulation mentioned in ancient text; *Rasa Chandamshu* which was later added by author of recent principally compilation text; *Ayurvediya Aaushadhi Guna Dharma Shastra* which is also mentioned in Ayurvedic Formulary of India**.** *Sameera Pannaga Rasa* is extensively used and effective in the management of *Tamaka Shwasa* (bronchial asthma). In view of critical issues in the preparation of *Sameera Pannaga Rasa*, present study was conducted to develop its standard operating procedure (SOP), as till date it is lacking. *Kajjali* was prepared with *Shuddha Parada*, *Shuddha Gandhaka*, *Shuddha*

Haratala, Shuddha Somala & Shuddha Manahshila in equal quantity. *Kancha Kupi* (mud smeared glass bottle) was filled with *Kajjali* up to 2/3rd part and *Sameera Pannaga Rasa* was prepared as per standard procedure. Standard temperature conditions and necessary precautions were followed during the preparation. *Talastha* (bottom of bottle) greenish black and *Kanthastha* (neck of bottle) silvery shine coloured *Sameera Pannaga Rasa* was obtained. Total yield of *Sameera Pannaga Rasa* (combined products *Talastha* and *Kanthastha*) was 83.5%, 78% and 80.55% respectively from each batch of 200g of *Kajjali*. Total 37:35hrs. of active heating with maximum temperature of 520^{0}C in graded manner through VEMF (Vertical electric muffle furnace) were needed to obtain desired product. The present method can be considered as standard operating procedure (SOP) for preparation of *Sameera Pannaga Rasa* in VEMF for 200g batch.

KEYWORDS: Arsenic, *Kanthastha*, *Kupipkwa Rasayana*, Mercury, Orpiment, Realgar, *Sameera Pannaga Rasa*, *Talastha*, VEMF (Vertical electric muffle furnace).

INTRODUCTION

In *Ayurveda*, *Kupipakwa Rasayana* is the most popular, unique and highly significant pharmaceutical preparation. *Kupipakwa Rasayana* is made up of four words that is *Kupi*-glass bottle, *Pakwa*- heating or *Paka*, *Rasa- Parada* (Hg), *Aayana- sthana* (place). Formulations prepared in *Kanchakupi* (glass bottle) are known as *Kupipakwa Rasayana* and also known as *Sindura Kalpana* as their final product is red in colour.[1] Sri Harisharanananda has mentioned 256 different *Kupipakwa Rasayana* in *Kupi-Pakwa Vijnaniyam.* In context of *Rasa Bhasma, Rasa Prakasha Sudhakara* is the first text to describe *Kupipakwa Rasayana,*[2] (*Udaya bhaskara Rasa*). According to *Rasendra Chintamani,* there is specific heating pattern for *Kupipkwa Rasayana* named as *Kramagni paka* i.e. increasing manner of heat (*Mruduagni*-mild heat, *Madhyamagni*-moderate heat and *Tivragni*-high heat), each for a specified period. This methodology is used in practice now a days with some modifications. These *Rasayana* are prepared in especially classically designed device called *Valuka Yantra* (Sand bath assembly). The medicines prepared in 7 layered mud smeared glass bottle, by applying heat through *Valuka Yantra* or Vertical Electric Muffle Furnace are known as *Kupipakwa Rasayana.* In *Kupipkwa Rasayana Parada* (mercury) and *Gandhaka* (sulphur) are the chief ingredients along with other metals and minerals. *Rasaushadhi* are considered as best when compared to the drugs of herbal origin in view of their properties like small therapeutic dose, rapid action and palatability made *Kupipakwa Rasayana* on superior

position.[3,4] *Sameera Pannaga Rasa* (SPR) is one of the renowned *Kupipakwa Rasayana* of metallic origin. Primarily *Sameera Pannaga Rasa* has been mentioned in *Rasa Chandamshu* with the name of *Vata Pannaga,*[5] containing *Parada, Gandhaka, Haratala* and *Somala* in equal parts, in which *Manahshila* has not been mentioned as a component. But later, *Ayurvediya Aaushadhi Guna Dharma Shastra* added *Manahshila* in *Sameera Pannaga Rasa* which has been accepted by Ayurvedic Formulary of India.[6] *Sameera Pannaga Rasa* containing *Gandhaka, Haratala* and *Manahshila* are categorized under *Uparasa varga,*[7] whereas *Somala* comes under *Sadharanarasa varga.*[8] *Parada, Haratala, Manahshila* and *Somala* are highly potent metal/mineral/metalloids which are included in the list of poisonous drugs by Drug & Cosmetic Act 1940 under Schedule E(1) because of their highly toxic nature in crude form,[9] but they are often used not only in therapeutics but also in pharmaceutics too, necessarily after *Shodhana* (unique, controlled, pharmaceutical drug processing aimed to alter properties of drug as desired) and or *Marana* etc procedures. Several pharmacological properties of *Sameera Pannaga Rasa*(*Tridoshaghna, Vatahara* etc.) are mentioned in classical texts on *Rasashastra.*[10] It (SPR) is mentioned for the management of *Sandhivata* (osteoarthritis), *Unmada* (insanity-mental disorder), *Kasa* (cough), *Jwara* (fever) etc. It has been used extensively for *Tamaka Shwasa* (bronchial asthama),[11] and it also shows good effects on *Amavata.*[12] In commentary on *Rasa Yoga Sagara* by Pandit Hariprappanaji *Arka Kshira* has been advocated as *Bhavana dravya* of *Sameera Pannaga Rasa* without *Manahshila,* whereas *Ayurvediya Aaushadhi Guna Dharma Shashtra* has mentioned *Tulasipatra Swarasa* (Basil leaves juice) or *Ghritkumari Swarasa* (Aloe Vera juice) as *Bhavana drava* of *Sameera Pannaga Rasa* with *Manahshila.* It is to be heated through *Valuka Yantra* method.[10,13] *Rasa Chandamshu* advocated dose of SPR as 2 *Gunja* (250mg) with betel leaf as *Sahapana* (co-adjuvant), while in *Ayurvediya Aushadhi Guna Dharma Shastra*; it is mentioned as 1 *Gunja* (125mg) along with *Sahapana* (co-adjuvant) of beetle leaf. Review of previous research works reveals that SOP of *Sameera Pannaga Rasa* has not been developed yet. Hence, the present study was conducted to develop a standard operating procedure (SOP) of *Sameera Pannaga Rasa* in vertical electric muffle furnace followed by reference of AFI-1.[14]

MATERIAL AND METHOD

In present study, *Sameera Pannaga Rasa* was prepared as per the reference of *Ayurvediya Aushadhi Guna Dharma Shastra* (AFI-1).[14]

Total three batches of *Sameera Pannaga Rasa* were prepared to develop the SOPs.

Parada, Gandhaka, Haratala, Somala & *Manahshila* was procured from Pharmacy department, Gujarat Ayurved University, Jamnagar, while leaves of *Tulasi* (*Ocimum sanctum* Linn) were collected from periphery of Jamnagar and authenticated by Pharmacognosy laboratory of IPGT&RA, GAU, Jamnagar.

Pharmaceutical manufacturing of *Sameera Pannaga Rasa* was carried out at department of Rasa Shastra & Bhaishajya Kalpana, IPGT & RA, GAU, Jamnagar.

Table 1: Ingredients of *Sameera Pannaga Rasa* with their ratio.

Sr. No.	Ingredients	English name/Latin Name	Qty./Proportion (given)	Qty. (Taken)
1.	*Shuddha Parada*	Mercury	1 Part	40g
2.	*Shuddha Gandhaka*	Sulfur	1 Part	40g
3.	*Shuddha Haratala*	Orpiment	1 Part	40g
4.	*Shuddha Somala*	White Arsenic	1 Part	40g
5.	*Shuddha Manahshila*	Realgar	1 Part	40g
Total Quantity = 200 g				
	Bhavna dravya			
1.	*Tulasi Patra Swarasa*	*Ocimum sanctum* Linn.	Q.S.	Q.S.

Equipments: weighing balance, VEMF (vertical electric muffle furnace), edge runner, iron rod, cotton cloth, mud (fuller's earth), *Kupi* (funnel), *Kancha Kupi* (amber glass bottle), torch, coin.

Table 2: Circumference specification of *Kacha Kupi* (glass bottle).

Bottle	Before *Kapadmitti*	After 7 layers of *Kapadmitti*
Height	27.9 cm	28.4 cm
Mouth	09.1 cm	14.08 cm
Neck	14.05 cm	17.08 cm
Bottom	24.2 cm	26.09 cm
Weight	421.04g	636.1 g

Pharmaceutical process of *Sameera Pannaga Rasa*

Equal quantity of *Shuddha Parada* (Hg) and *Shuddha Gandhaka* were taken and *Mardana* (dry trituration) was carried out in edge runner till it became *Nishchandra* (lusterless) *Kajjali* then equal amount of powdered *Shuddha Haratala* (As_2S_3) and *Shuddha Manahshila* (As_2S_2) were added respectively and homogenous mixture was prepared by continuous trituration. At the end, powdered *Shuddha Somala* (As_2O_3) was added to it with continuous trituration and homogeneous mixture of all ingredients was prepared. *Bhavana* (levigation/wet trituration) of *Tulasipatra Swarasa* (leaves juice of *Ocimum sanctum* Linn.) was given three times to

prepared *Kajjali*. A clean *Kancha Kupi* (amber colored narrow mouth, vertical glass bottle, cylindrical body, base and conical neck-Table 2) with volume of 750 ml was taken and mud (fuller's earth) smeared cotton cloth pieces were wrapped on *Kupi* for 7 times uniformly & consecutively applied only after complete drying of former layer. The *Kajjali* was filled up to 2/3rd in 7 layered *Kancha Kupi* (amber colored glass bottle) and properly adjusted in VEMF (vertical electric muffle furnace). *Kajjali* containing *Kancha Kupi*, was heated gradually in vertical electrical muffle furnace at three different temperature i.e. *Mriduagni* (mild heat), *Madhaymagni* (moderate heat) and *Tivragni* (high heat) for certain time period. During preparation of *Sameera Pannaga Rasa*, variation in heating temperature were observed (Table 4).

To confirm the melting & boiling stage of *Kajjali, Shita Shalaka* (cold iron rod) was inserted into the neck of *Kupi* as and when necessary. *Tapta Shalaka* (red hot iron rod) was inserted into the neck of *Kupi*, to clear deposited materials inside the mouth of the *Kupi*. After 37.35hrs of active heating, with maximum temperature of 520°C, vertical electrical muffle furnace was switched off and *Kupi* was kept for self cooling. Once *Kupi* was cool, it was taken out and cleaned carefully. *Kupi* was broken in the middle so as to separate the lower and upper halves. For this, a kerosene dipped thread was wrapped on *Kupi* and ignited; then after the fire extinguished, wet cloth was wrapped immediately on *Kupi*. After breaking of *Kupi, Sameera Pannaga Rasa* deposited at either places i.e. *Talastha* (bottom of glass bottle) & *Kanthastha* (neck of glass bottle) was procured by careful scrapping and gentle tapping. The product was scraped, collected & stored in air tight container. During the entire process, care was taken to avoid mixing of glass particles and product. Above mentioned method was repeated in successive batches.

OBSERVATIONS AND RESULTS

Observations during preparation of *Kajjali*

Shuddha Parada & *Shuddha Gandhaka* were mixed and grinded together firmly turned in to black coloured *Kajjali*. *Kajjali* became *Nishchandra* (lusterless) after 23 hrs. of dry trituration. On addition of powered *Shuddha Haratal* & *Shuddha Manahshila* in *Kajjali*, it becomes slightly yellowish-orange in colour (initially) and after addition of *Shuddha Somala* powder, *Kajjali* turned into slight grayish tinge. *Bhavana* with *Tulasi Swarasa* to the *Kajjali* turned it to slight greenish black in colour. Characterstic odour of *Tulasi Swarasa* was evident during preparation of *Kajjali*.

Table 3: Organoleptic characters of raw material and *Kajjali*.

Ingredients	Colour	Odour	Touch
Shuddha Parada	Silvery	---	Smooth
Shuddha Gandhaka	Light yellow	Characteristic	Slight rough
Shuddha Haratala	Yellow	Characteristic	Smooth
Shuddha Somala	Off white	Characteristic	Smooth
Shuddha Manahshila	Deep orange	Characteristic	Fine
Kajjali (with *bhavana dravya*)	Greenish black	Characteristic	Fine (*Rekhapurnatva*)

Table 4: Average observations during preparation of *Sameera Pannaga Rasa*.

Time in Hrs.	Temperature (C^0)	Observations
00:00	00	Vertical electric muffle furnace switched on
Start	100	No observation
1	150	Mild whitish fumes with characteristic smell like *Tulasi Swarasa*
1.35	200	Clear whitish fumes followed by mild yellowish fumes
3:35	210	Yellowish fumes
4.40	220	Yellowish fumes; neck of *Kupi* looks yellowish
5.40	230	Yellowish fumes increased; mild characteristic odour of G*andhaka* (Sulphur); *Kajjali* started to melt (slight muddy consistency)
6.35	240	Neck of *Kupi* becames yellowish coloured; yellowish fumes with intense smell; whitish fume seen on *Kajjali* surface inside *Kupi.*
6.55	250	Yellowish granules like few crystals stuck to the rod when it was inserted at the level of neck. Thick muddy consistency of *Kajjali* revealed by insertion of cold rod.
9.35	270	Yellowish granules like mild crystals stuck to the cold iron rod, intense characteristic smell; *Kajjali* molten and became muddy in consistency.
11.35	290	Whitish and yellowish fumes with characteristic unpleasant smell
13.15	300	*Kajjali* became soft and dense yellowish fumes was seen
14.55	315	Molten *Kajjjali* started to stick on the tip of *Sheeta Shalaka;* dense yellowish granules like material stick on *Sheeta Shalaka*
16.35	320	Shiny reddish orange coloured crystals seen at inner wall of bottle neck.
24.25	330	Yellowish fumes disappeared; *Kajjali* became shiny and got molten; *Kajjali* started raised up
25.25	340	*Sheeta Shalaka* was inserted frequently at regular intervals of 10-15 min., so as to prevent spillage by rising level of molten *Kajjali*. *Sheeta Shalaka* was done to pushed down the raised *Kajjali*;
26.35	350	*Kajjali* became soft & molten completely; dark orange colour was visible on *cold iron rod*
28.35	360	Mild whitish fume with shiny particles were visible inside the *Kupi*; insertion of *Sheeta Shalaka* was conducted at 10-15 min intervals
29.35	370	Mild whitish fumes with appearance of shiny particles inside the *Kupi*; *Sheeta Shalaka* inserted 10-15 min intervals; Shining particles float around the neck of *Kupi* (honey comb appearance); *Ushna Shalaka* (red hot iron rod)inserted to clean the neck of *Kupi* and to avoid the choking due to the raised *Kajjali*

31.05	390	*Sheeta Shalaka* inserted to push the material downwards; dense orange coloured fumewith mild yellowish on *Sheeta Shalaka*
32.05	400	Molten *Kajjali* frequently raised upwards; slight black with dense orange coloured deposition on *Sheeta Shalaka; Sheeta Shalaka* inserted at 10-15 min intervals
33.05	410	Molten *Kajjali* frequently raised upwards; slight black with dense orange coloured deposition on *Sheeta Shalaka;* Cold iron rod inserted at 10-15 min intervals
33.35	420	Deposition of reddish black with orange tint was observed on *Sheeta Shalaka; Kajjali* raised upwards & *Sheeta Shalaka* & *Tapta Shalaka* was done alternatively respectively
34.05	430	Neck was cleaned with red hot *Shalaka*; deposition in sequence of black, orange, faint yellow & white was seen on *Sheeta Shalaka;* raised *Kajjali* was pushed down with *Sheeta Shalaka.*
34.40	450	Mild whitish fumes were observed; boiling of *Kajjali* was seen inside the *Kupi* with the help of torch light; *Sheeta Shalaka* was done; faint free radicals of mercury was seen on *Sheeta Shalaka;* compactness of *Kajjali* was seen on *Sheeta Shalaka*
35	460	A depostion in sequence like black, orange followed by light yellow were observed; boiling of *Kajjali* was seen inside the *Kupi* with the help of torch light; *Sheeta Shalaka* was done; faint free radicals of mercury was seen on *Sheeta Shalaka;* compactness of *Kajjali* was seen on *Sheeta Shalaka*
35.35	480	Deposition on *Sheeta Shalaka* in sequence of black, orange, yellow with faint white were seen from bottom to top; upper layer of boiling *Kajjali* was visible and it appears to be golden yellow; *Tapta Shalaka* was inserted to clear the neck of *Kupi*, bright grayish material gets attached on *Sheeta Shalaka*
36.20	500	Deposition of dark black followed by reddish orange colour matter was seen on *Sheeta Shalaka*, material settled down, a golden layer was seen on the upper layer of boiling *Kajjali*
36.50	520	Deposition in sequence of black (3/4)-reddish orange-yellow-grey (1/4) was observed; clear golden layer was seen on the surface of boiling *Kajjali.*
37.35	Switched off	Switched off of vertical electric muffle furnace & *Kupi* left for self cooling.

- During the process, overall heat pattern was as below

Mridu agni for 11:35hrs (100-250ºC)

Madhyamagni for 19:07hrs (250- 400ºC)

Tivragni for 6:03hrs (400-520ºC)

- *Kanthastha* (neck portion of bottle) product (*Sameera Pannaga Rasa*) was shiny and reddish in colored.
- *Talastha* (bottom portion of bottle) *Sameera Pannaga Rasa* was dark greenish black and compact in nature.

Table 5: Details results of *Sameera Pannaga Rasa*.

Batch	Total Time	Temperature	Initial Weight	Final Weight		% yield	Loss (%)
				Talastha	*Kanthastha*	(*Talastha*+*Kanthastha*)	
B1	37 hrs. 35 min	100ºC -520ºC	200 g	141 g	26 g	83.5%	16.5%
B2	37 hrs. 35 min	100ºC-520ºC	200 g	136 g	20 g	78 %	22%
B3	37 hrs.35 min	100ºC -520ºC	200 g	141 g	20 g	80.5%	19.5%

DISCUSSION

There are few critical issues in the preparation of *Sameera Pannaga Rasa*. Frequently percent yield of *Kanthastha* (neck of the bottle) and *Talastha* (bottom of the bottle) product varies, which may also alter the composition of ingredients of either products. As ingredients of formulation are classified under schedule E (1) and are poisonous, if unprocessed. Hence this probable variation in nature of product may be of great significance in view of safety as well as efficacy. Further *Manahshila* being explosive in nature and all the ingredients (*Rasagandha Kajjali*, *Haratala*, *Manahshila*) are sulphur containing, hence variation in temperature pattern may affect the pressure of gas inside the bottle after corking significantly, if optimum characteristics of completion of *Kupipaka* during preparation of *Sameera Pannaga Rasa* are not strictly and precisely monitored. This may lead to blast of bottle leading to accident, loss of product as well as is serious inhalational safety concerns too. Previous researchers have also reported reduction in yield with increase in maximum temperature given during its preparation. However they reported batch failure due to blast of glass bottle. Hence in present study, corking was not done and glass bottle was allowed for self corking by avoiding insertion of hot rod inside neck of *Kupi* and allowing block at bottle neck by product sublimation itself, thus reducing chance of significant increase of gaseous pressure inside the bottle and thus avoided blasting. Batch size was also comparatively less (200g) for similar dimensions of glass bottle. The maximum temperature for product preparation was also kept less (520°C) than that of previous studies so as to get more product yield.[15]

Sameera Pannaga Rasa was prepared with the composition of *Sh. Parada*, *Sh.Gandhaka*, *Sh. Haratala*, *Sh. Manahshila* and *Sh. Somala* using the reference of AFI-1. Equal amount of *Sh. Parada* and *Sh. Gandhaka* were grounded in edge runner around 20hrs to attain *Siddhi Lakshana* (specific characters) of *Kajjali* i.e. fine-smooth texture, black in color and lusterless in appearance. Fine powders of *Sh. Haratala*, *Sh. Manahshila* and *Sh. Somala* were added respectively into *Kajjali* and trituration was done till mixture became homogeneous. *Sh. Haratala* must be added in fine powder form otherwise it becomes dificult to make it luster

free. *Bhavana* (levigation) of *Tulasipatra swarasa* (leaves juice of *Ocimum sanctum* Linn.) was given to *Kajjali*. An average 630ml of *Tulasipatra swrasa* was used for *Bhavana* of 1kg of *Kajjali*. Heat was given for 37:35 hrs in three phases i.e. *Mridu agni* (mild heat) for 11:35hrs, *Madhyamagni* (moderate heat) for 19:07hrs and *Tivragni* (high heat) for 6:03hrs in vertical electric muffle furnace in each 200g batch (3 batches) of *Sameera Pannaga Rasa*. Mild whitish fumes with characteristic smell of *Tulasi patra swarasa* at 150ºC temperature, yellowish & white fumes with characteristic smell of *Gandhaka* and melting of *Kajjali* was observed at temperature of 220ºC-290ºC. *Kajjali* felt soft upon probing with cold *shalaka*, got molten and started raising upwards. Shiny reddish colored crystals were seen on inner wall of *Kupi* (glass bottle) and dark orange color along with mild whitishness was observed on *Sheeta Shalaka* (cold iron rod) in between the temperature of 320ºC-400ºC. In between 410ºC-500ºC temperature, deposition in sequence of black, orange, faint yellow & white was seen on *Sheeta Shalaka*, boiling of *Kajjali* was visible inside the *Kupi* with the help of torch light and few, fine globules of condensed, sublimed mercury were seen on *Sheeta Shalaka*. Compactness of *Kajjali* was revealed on *Sheeta Shalaka* and molten grayish material inside *Kancha Kupi* attached on *Sheeta Shalaka* which has tendency to get hard at room temperature. At temperature of 520ºC, deposition of *Sheeta Shalaka* was observed in sequence of black (3/4)-reddish orange-yellow-grey (1/4) respectively and clear golden layer was seen on the surface of boiling *Kajjali*. At the stage when blackish deposition takes place on cold rod suspended in the middle of the bottle space, deposited blackish material (Sulphur/organosulphur compounds) remains semi liquid even at room temperature for some time and it is very elastic which can be drawn to wires. This is evidence of change of form of Sulphur (possibly beta sulphur / its compounds). Yellow deposition is usually crystalline which is similar to Alpha (rhombohedral) form of sulphur. Whitish deposition is probably due to evaporation of Arsenic vapors initially and on the verge of completion of heating process just before self corking, due to mercury. But there is difference in whitish deposition of sublimates at initial stage and final stage. The whitish deposition at the end of heating process leads to formation of lustrous globules of free mercury, where as initial whitish deposits are amorphous powder with slight elasticity upon rubbing. Thus this cold iron rod test reflects significant chemical processes at different levels inside the *Kupi* in accord with sublimation temperatures of intermediate products formed during heating process. Raising band width of lower blackish band and vice a versa with other bands with subsequent heating suggests slowly raising of temperature level at different heights inside the *Kupi*. After this, coin was placed over mouth of glass bottle for a while which showed condensed vapors of

free Hg. *Sheeta Shalaka* (cold iron rod) as well as *Tapta Shalaka* (hot iron rod) was inserted into the bottle space throughout the process as per need. Electric muffle furnace was switched off and *Kupi* was left for self cooling. Final *Kanthastha* (neck portion of bottle) product was obtained shiny and reddish in color; and the *Talastha* (bottom portion of bottle) product was porous, dark greenish black and compact in nature. Obtained total yield from each batch of 200g was- 167g (141g of *Talastha* and 26g of *Kanthastha*), 156g (136g *Talastha* and 20g *Kanthastha*) and 161g (141g *Talastha* and 20g *Kanthastha*) respectively. Total duration of 37:35hrs. of active heating with maximum temperature of 520°C was required for the preparation of *Sameera Pannaga Rasa* in EMF (Vertical Electric Muffle Furnace) with desirable quality. An average yield of *Sameera Pannaga Rasa* was observed as 80.66% (*Talastha*+ *Kanthastha*). Loss of product can be assumed due to evaporation of mercury (*Parada*) during *Paka* and during breakage of *Kancha Kupi.*

CONCLUSION

Sameera Pannaga Rasa was prepared by following the reference of Ayurvedic formulary of India, with modifications i.e. heating through vertical electric muffle furnace at different three phases of heating temperature. Maximum 520ºC temperature was given for 37:35hrs heating process. Finally an average of 80.66% (*Talastha*+ *Kanthastha*) compact, tasteless *Talastha Sameera Pannaga Rasa* was obtained. This present method may be considered as the standard operating process for the preparation of *Sameera Pannaga Rasa* in vertical electrical muffle furnace for the batch of 200g of *Kajjali*.

REFERENCES

1. Mishra S. Ayurvediya Rasashastra. 14th ed., Varanasi; Chaukhambha Orientalia, 2004; 254-256.
2. Bhatta Y. Rasa Prakasha Sudhakar. 3rd ed., Varanasi; Chaukhambha Orientalia, 2004; 3/10: 53.
3. Tripathi I. Rasarnava. 4th ed., Varanasi; Chaukhambha Sanskrit Series Office, 2001; 5.
4. Bhoyar MS, Khiyani RM. (Conceptual and Pharmaceutical Review of Kupipakva Rasayana). Int. J. Ayu. Alt. Medi., 2014; 2(4): 7-13.
5. Datta V. Rasa Chandamshu. 3rd ed., Utara khanda; Shri Gajanan Book Depot, 1983; 321.
6. Gune G. Ayurveda Aushshadhi Gun Dharma Shastra. 1st ed., Ahmadnagar; Vaidyak Grantha Bhandar, 2005; 4: 514.
7. Vagbhata A. Rasaratnasamucchaya. New Delhi; Meharchand Prakashan, 1998; I(3/1): 42.

8. Vagbhata A. Rasaratnasamucchaya. 3rd ed., Varanasi; Chaukhambha Prakashan: Chapter, 2006; 3/126: 37.
9. Malik V. Drug and Cosmetic Act 1940. 18th ed., Lucknow; Eastern Book Company, 2005; 282.
10. Krishnanand. Rasatantrasara & Siddha Prayog Sangraha. 8th ed., Ajmer; Krishna Gopal Ayurved Bhawan: Kupipakwa prakarana, 2010; 138.
11. Agnivesha et.al. Charaka Samhita. Varanasi; Chaukhambha Orientalia: Chikitsa Sthana, Hikkashwasa Chikitsa Adhyaya, 2011; 17/11; 533.
12. Babu GC, Bhuyan et al. (The effect of Sameera Pannaga Rasa and Pippali Vardhamana Ksheerapaka in the management of Amavata). JRAS, April –June 2009; 30(2): 19-32.
13. Pandit HS. Rasa Yoga Sagar. Reprint, Varanasi; Chaukhamba Krishnadas Academy: part II/1239-1242, 2004; 489.
14. Anonyms. Ayurvedic Formulary of India. 2nd ed., New Delhi; Ministry of Health and Family Welfare, Government of India, Department of AYUSH: part 1, 2003; 212.
15. Mashru M. et al. Pharmaceutical standardization of *Sameera Pannaga Rasa* and its effect on *Tamaka Shwasa* (Bronchial Asthma). Jamnagar, MD (Ayu) dissertation, Department of RS&BK, IPGT&RA, Gujarat Ayurved University, 2011; 114-117.