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STANDARD MANUFACTURING PROCESS (S.M.P) OF MALLA-SINDURA

Dr. Upendra U. Zala*[1] and Prof. Dr. Pradip U. Vaishnav[2]

[1]Associate Professor, Post Graduate, Department of Rasashastra and Bhaishajya Kalpana, J. S. Ayurved College, Nadiad-387001,Gujarat, India.

[2]Principal, Professor and Head, Post Graduate, Department of Rasashastra and Bhaishajya Kalpana, J. S. Ayurved College, Nadiad, Gujarat, India.

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***Corresponding Author**
Dr. Upendra U. Zala
Associate Professor, Post Graduate, Department of Rasashastra and Bhaishajya kalpana, J. S. Ayurved College, Nadiad-387001,Gujarat, India.

ABSTRACT

Kupipakva process is first time described in *Rasa Prakasha Sudhakara* as "*Udaya Bhaskara Rasa*[1]" in 13th century. *Parada* has prepared through Rasa *Aushadhi*, which is filled in the *Kupi* and put in flame, this process is known as *Kupi Pakva Rasayana*. It is very popular and commonly prescribed preparations among the ayurvedic physicians because its quick action, rasayana, yogavahi & effective in smaller dosage along with long shelf life, but now it is need of time to standardize as per recent era resources, here effort done for Standardize Manufacturing Process (S.M.P) of *Mallasindura* by electric muffle furnace (E.M.F) instead of *valuka yantra*.

KEYWORDS: S. M. P, *Kupipakvarasayana*, E. M. F, *Mallasindura*.

INTRODUCTION

Rasashastra a branch of Ayurveda has been evolved on the principles of converting metals & minerals into their bio-available forms & thus making them therapeutically viable. *Kupi-pakwa-rasayans* are one of the popular prescribed preparations in the Ayurveda, due to its less dose, more potencity and quick efficacy without any haziness for the maintain swasthya.[2,3] In recent era rasashastra formulations, i.e. mercurical preparations have been in limelight for concerns over their quality & safety. So here try to standardize manufacturing process (S.M.P) for *kupipakwa* rasayana specially *Mallasindura*.[4]

Malla-sindura[3] is a well-known drug for its use in various diseases like bronchial asthma, bronchitis, rheumatoid arthritis, diabetes mellitus, vatavyadhi, hystyria, unmad etc.Malla-sindura[4] is prepared by heating a combination of Suddha Parada (Mercury-2part), Suddha Gandhaka (Sulphur-2part) and Suddha Malla (Arsenic trioxide-1part) in beer glass bottle - coated with seven layers of mud-smeared cloth.Jaarana[5] is a one of most important & intermediate process of kupipakwa rasayana on which total therapeutic efficacy & safety depends. The safety & therapeutic efficacy of the Mallasindura increase when Parad and Somal with the process of jaarana with long duration & amount of ghandhak, efficacy & safety of the final product i.e, HgS (Mercuric sulphide)[6,7] was increase.these also contain of arsenic in combination with mercuric sulphide. Temperatures play a vital role in Mallasindura. According to modern science sulphur reduces the toxic action of mercury. The minerals & metals when processed with addition of sulphur or sulphur containg mineral immediately get converted into sulphides & most of these are non-toxic. Cu, Pb, Zn, As etc. are highly toxic if they are in oxide form, but their sulphate compounds are non-toxic or least toxic.[8]

MATERIALS AND METHODS

Raw materials viz, *Hingulotthaparada*, *Gandhaka* & *Malla* (*Somal*). Equipment such as *Kupi* (glass bottle coated with seven layers of mud-smeared cloth), Vertical electrical muffle furnace (EMF), Small & Big Rod, torch, coin & iron cork were used for prepared *Mallasindura* in Rasashastra & Bhaishajya kalpana department of J.S. Ayurveda collage, Nadiad, Gujarat.

Methods:-Three samples of *Mallasindura*[4] were prepared by using the same classical reference-

Malla-sindura were prepared into below stages

1) Hingullotha parad[9]
2) Shodhana of gandhak[10]
3) Shodhana of somala[11]
4) Preparation of kajjali[12]
5) Heating pattern,

i) *Mrudu* Agni (Mild):- 20°C to 250°C
ii) *Madhyama* Agni (Moderate):- 251°C to 450°C
iii) *Tivra* Agni (Intencive):- 451°C to 630 °

6) Final finish product.

1. **Hingullotha parad:** - i) Hingul[13] Shodhana[14] Asuddha Hingula-600g was given 7 bhavana[15] of Adraka swarasa-740mland it was used for Parad niskasan process to get Hingulottha Parad-427g by nadyantra.
2. **Gandhaka shodhana**: - Asuddha Gandhaka-500g was purified by subjecting it to Dhalana[16] (melting and pouring) process in Go-dugdha (Cow's milk) for 3 times.suddha gandhak-438g was washed carefully by hot water, dried and Made fine powder.
3. **Somal shodhana**:- Somal shodhama was done by 3 hours Swedana[17] (boiling) process in Karvellaka Swarasa-2litters in Dolayantra[18] where by small pieces of Asuddha Somal-500g were tied in cotton cloth. After self-cooling of dolayantra, pieces of suddha Somal-486g were obtained & washed carefully with hot water and dried.
4. **Preparation of kajjali**[19]:- Hingulottha parada -400g & Shuddha gandhaka-400g were taken in equal part & triturated in an iron-mortar until the whole mixture converted in to the kajjali (16hrs taken) & again it was triturated with shudhha somal-200g and triturated (5hrs) up to uniform mixing. Bhavana of Kumari swarasa-300ml was given for 7 hours to make a uniform black lusterless dried powder form. This kajjali was filled in the kupi carefully & placed in the center of electric muffle furnace.
5. **Heating pattern**- Mallasindura was prepared in three batches of 300 g kajjali by following kramagni pattern. For three batches the temperature pattern adopted was 6 hrs of mild (Room temperature to 250°C), 6 hrs of moderate (251°C to 450°C), and 6 hrs of intense (451°C to 630°C) heating in electric muffle furnace. Different observations like mild white fumes, thick yellow fumes, blue flame etc. were recorded during each three process. Accumulated sulphur at the neck was burnt by rubbing tapta- Shalaka (Red hot iron rod) repeatedly with the neck of bottle. Confirmative test like cessation of flame, red hot appearance of the bottom, coin test etc. were ascertained before corking and the temperature was increased to facilitate sublimation of the final product at the neck when temperature reach at 630°C than E.M.F was stop.

OBSERVATIONS AND RESULTS

Different stages during the process like fuming, melting of *kajjali*, flaming, confirmative test for completion of product formation, flame disappearance, *shita-shalaka* test, copper coin test, red hot appearance of bottom, etc were observed & recorded.

Table 1: Time, Temprature pattern and Observation of 1st batch of *Mallasindura.*

Temprature pattern			
Time	**Set temprature**	**Observed temprature**	**Observation**
09:15 A.M.	100^0C	16^0C	EMF Started
09:30 A.M.	100^0C	28^0C	
09:45 A.M.	100^0C	100^0C	
09:50 A.M.	100^0C	121^0C	
10:05 A.M.	100^0C	124^0C	
10:20 A.M.	100^0C	119^0C	
10:30 A.M.	120^0C	117^0C	
10:45 A.M.	120^0C	139^0C	
11:00 A.M.	140^0C	139^0C	
11:15 A.M.	140^0C	158^0C	Mild fumes started from the Kupi mouth.
11:30 A.M.	160^0C	159^0C	
11:45 A.M.	160^0C	178^0C	
12:00 Noon	180^0C	179^0C	
12:15 P.M.	180^0C	196^0C	
12:30 P.M.	200^0C	199^0C	
12:45 P.M.	200^0C	218^0C	
01:00 P.M.	220^0C	221^0C	
01:15 P.M.	220^0C	241^0C	
01:30 P.M.	240^0C	238^0C	
01:45 P.M.	260^0C	257^0C	
02:00 P.M.	260^0C	257^0C	
02:15 P.M.	280^0C	272^0C	
02:30 P.M.	280^0C	277^0C	
02:45 P.M.	300^0C	296^0C	
03:00 P.M.	300^0C	296^0C	Dense fumes started from both Kupi
03:15 P.M.	320^0C	316^0C	
03:30 P.M.	320^0C	316^0C	
03:45 P.M.	340^0C	335^0C	
04:00 P.M.	340^0C	333^0C	
04:15 P.M.	360^0C	353^0C	
04:30 P.M.	380^0C	355^0C	
04:45 P.M.	400^0C	406^0C	Grey colour fumes
05:00 P.M.	400^0C	404^0C	
05:15 P.M.	420^0C	415^0C	White colour flame appear in kupi
05:30 P.M.	420^0C	414^0C	
05:45 P.M.	440^0C	431^0C	
06:00 P.M.	440^0C	430^0C	
06:15 P.M.	450^0C	452^0C	
06:30 P.M.	450^0C	481^0C	
06:45 P.M.	450^0C	494^0C	
07:00 P.M.	450^0C	487^0C	
07:15 P.M.	460^0C	504^0C	
07:30 P.M.	460^0C	511^0C	
07:45 P.M.	480^0C	503^0C	

08:00 P.M.	480^{0}C	513^{0}C	
08:15 P.M.	500^{0}C	527^{0}C	
08:30 P.M.	500^{0}C	520^{0}C	Flame decreased
08:45 P.M.	500^{0}C	521^{0}C	
09:00 P.M.	520^{0}C	527^{0}C	
09:15 P.M.	520^{0}C	514^{0}C	
09:30 P.M.	530^{0}C	524^{0}C	
09:45 P.M.	530^{0}C	523^{0}C	
10:00 P.M.	530^{0}C	519^{0}C	
10:15 P.M.	540^{0}C	538^{0}C	Flame Disappear in kupi
10:30 P.M.	540^{0}C	544^{0}C	Coin test done, Corking done Kupi
10:45 P.M.	550^{0}C	545^{0}C	
11:00 P.M.	550^{0}C	549^{0}C	
11:15 P.M.	550^{0}C	548^{0}C	
11:30 P.M.	550^{0}C	551^{0}C	
11:45 P.M.	560^{0}C	559^{0}C	
12:00 Mid night	570^{0}C	560^{0}C	
12:15 A.M.	580^{0}C	571^{0}C	
12:30 A.M.	590^{0}C	580^{0}C	
12:45 A.M.	600^{0}C	592^{0}C	
01:00 A.M.	610^{0}C	602^{0}C	
01:15 A.M.	620^{0}C	610^{0}C	
01:25 A.M.	630^{0}C	620^{0}C	
01:35 A.M.	630^{0}C	630^{0}C	EMF Stop

Table 2: Time Temprature pattern and Observation of 2nd batch of *Mallasindura.*

Temprature pattern			
Time	**Set temprature**	**Observed temprature**	**Observation**
09:00 A.M.	100^{0}C	18^{0}C	EMF Started
09:30 A.M.	100^{0}C	28^{0}C	
09:45 A.M.	120^{0}C	100^{0}C	
10:00 A.M.	140^{0}C	124^{0}C	
10:15 A.M.	140^{0}C	129^{0}C	
10:30 A.M.	140^{0}C	137^{0}C	
10:45 A.M.	140^{0}C	139^{0}C	
11:00 A.M.	160^{0}C	141^{0}C	
11:15 A.M.	160^{0}C	160^{0}C	Mild fumes started from the Kupi
11:30 A.M.	160^{0}C	160^{0}C	
11:45 A.M.	160^{0}C	161^{0}C	
12:00 Noon	180^{0}C	164^{0}C	
12:15 P.M.	180^{0}C	182^{0}C	
12:30 P.M.	200^{0}C	199^{0}C	
12:45 P.M.	200^{0}C	208^{0}C	
01:00 P.M.	220^{0}C	221^{0}C	
01:15 P.M.	220^{0}C	224^{0}C	
01:30 P.M.	240^{0}C	225^{0}C	

01:45 P.M.	240^{0}C	235^{0}C	
02:00 P.M.	240^{0}C	242^{0}C	
02:15 P.M.	260^{0}C	248^{0}C	
02:30 P.M.	260^{0}C	265^{0}C	
02:45 P.M.	280^{0}C	276^{0}C	
03:00 P.M.	280^{0}C	282^{0}C	Dense fumes started from the Kupi
03:15 P.M.	300^{0}C	299^{0}C	
03:30 P.M.	300^{0}C	306^{0}C	
03:45 P.M.	320^{0}C	305^{0}C	
04:00 P.M.	320^{0}C	323^{0}C	
04:15 P.M.	340^{0}C	343^{0}C	
04:30 P.M.	360^{0}C	345^{0}C	
04:45 P.M.	360^{0}C	362^{0}C	
05:00 P.M.	360^{0}C	364^{0}C	
05:15 P.M.	380^{0}C	365^{0}C	
05:30 P.M.	380^{0}C	381^{0}C	
05:45 P.M.	400^{0}C	384^{0}C	
06:00 P.M.	400^{0}C	400^{0}C	Grey colour fumes
06:15 P.M.	420^{0}C	422^{0}C	White colour flame appear in Kupi
06:30 P.M.	420^{0}C	421^{0}C	
06:45 P.M.	420^{0}C	424^{0}C	
07:00 P.M.	420^{0}C	426^{0}C	
07:15 P.M.	440^{0}C	444^{0}C	
07:30 P.M.	440^{0}C	441^{0}C	
07:45 P.M.	440^{0}C	443^{0}C	
08:00 P.M.	440^{0}C	443^{0}C	
08:15 P.M.	460^{0}C	450^{0}C	
08:30 P.M.	460^{0}C	461^{0}C	
08:45 P.M.	460^{0}C	462^{0}C	
09:00 P.M.	460^{0}C	464^{0}C	
09:15 P.M.	480^{0}C	464^{0}C	
09:30 P.M.	480^{0}C	474^{0}C	
09:45 P.M.	480^{0}C	483^{0}C	
10:00 P.M.	480^{0}C	489^{0}C	
10:15 P.M.	500^{0}C	498^{0}C	
10:30 P.M.	500^{0}C	504^{0}C	
10:45 P.M.	500^{0}C	500^{0}C	
11:00 P.M.	500^{0}C	502^{0}C	
11:15 P.M.	520^{0}C	504^{0}C	
11:30 P.M.	520^{0}C	521^{0}C	
11:45 P.M.	540^{0}C	524^{0}C	Flame decreased
12:00 Mid night	540^{0}C	537^{0}C	Coin test done
12:15 A.M.	560^{0}C	541^{0}C	Flame stopped; Corking done in Kupi
12:30 A.M.	560^{0}C	552^{0}C	
12:45 A.M.	580^{0}C	562^{0}C	
01:00 A.M.	580^{0}C	582^{0}C	
01:15 A.M.	600^{0}C	589^{0}C	

01:30 A.M.	600^{0}C	602^{0}C	
01:45 A.M.	630^{0}C	611^{0}C	
01:55 A.M.	630^{0}C	630^{0}C	EMF Stop

Table 3: Time Temprature pattern and Observation of 3rd batch of *Mallasindura.*

Temprature pattern			
Time	**Set temprature**	**Observed temprature**	**Observation**
09:00 A.M.	100^{0}C	20^{0}C	EMF Started
09:30 A.M.	100^{0}C	28^{0}C	
09:45 A.M.	100^{0}C	100^{0}C	
10:00 A.M.	120^{0}C	124^{0}C	
10:15 A.M.	120^{0}C	119^{0}C	
10:30 A.M.	120^{0}C	117^{0}C	
10:45 A.M.	120^{0}C	139^{0}C	
11:00 A.M.	140^{0}C	139^{0}C	
11:15 A.M.	140^{0}C	144^{0}C	
11:30 A.M.	160^{0}C	156^{0}C	Mild fumes started from the Kupi
11:45 A.M.	160^{0}C	162^{0}C	
12:00 Noon	180^{0}C	174^{0}C	
12:15 P.M.	180^{0}C	181^{0}C	
12:30 P.M.	200^{0}C	184^{0}C	
12:45 P.M.	200^{0}C	202^{0}C	
01:00 P.M.	220^{0}C	201^{0}C	
01:15 P.M.	220^{0}C	221^{0}C	
01:30 P.M.	240^{0}C	228^{0}C	
01:45 P.M.	250^{0}C	241^{0}C	
02:00 P.M.	250^{0}C	250^{0}C	
02:15 P.M.	260^{0}C	252^{0}C	
02:30 P.M.	260^{0}C	262^{0}C	
02:45 P.M.	260^{0}C	266^{0}C	
03:00 P.M.	260^{0}C	262^{0}C	
03:15 P.M.	280^{0}C	265^{0}C	
03:30 P.M.	300^{0}C	280^{0}C	Dense fumes started from the Kupi
03:45 P.M.	320^{0}C	305^{0}C	
04:00 P.M.	320^{0}C	323^{0}C	
04:15 P.M.	340^{0}C	343^{0}C	
04:30 P.M.	340^{0}C	345^{0}C	
04:45 P.M.	360^{0}C	346^{0}C	
05:00 P.M.	360^{0}C	364^{0}C	
05:15 P.M.	380^{0}C	365^{0}C	
05:30 P.M.	380^{0}C	382^{0}C	
05:45 P.M.	400^{0}C	385^{0}C	
06:00 P.M.	400^{0}C	403^{0}C	Grey colour fumes
06:15 P.M.	420^{0}C	402^{0}C	
06:30 P.M.	420^{0}C	421^{0}C	
06:45 P.M.	440^{0}C	424^{0}C	White colour flame appear in

			Kupi
07:00 P.M.	440^{0}C	442^{0}C	
07:15 P.M.	460^{0}C	444^{0}C	
07:30 P.M.	460^{0}C	461^{0}C	
07:40 P.M.	480^{0}C	463^{0}C	
08:00 P.M.	480^{0}C	483^{0}C	
08:15 P.M.	500^{0}C	480^{0}C	
08:30 P.M.	500^{0}C	500^{0}C	
08:45 P.M.	520^{0}C	501^{0}C	
09:00 P.M.	520^{0}C	524^{0}C	
09:15 P.M.	520^{0}C	524^{0}C	Flame decreased
09:30 P.M.	520^{0}C	524^{0}C	
09:45 P.M.	520^{0}C	523^{0}C	
10:00 P.M.	520^{0}C	519^{0}C	
10:15 P.M.	540^{0}C	538^{0}C	Flame Disappear in kupi
10:30 P.M.	540^{0}C	544^{0}C	Coin test done, Corking done in Kupi
10:45 P.M.	540^{0}C	540^{0}C	
11:00 P.M.	540^{0}C	539^{0}C	
11:15 P.M.	560^{0}C	542^{0}C	
11:30 P.M.	560^{0}C	561^{0}C	
11:45 P.M.	560^{0}C	562^{0}C	
12:00 Mid night	560^{0}C	560^{0}C	
12:15 A.M.	580^{0}C	561^{0}C	
12:30A.M.	580^{0}C	581^{0}C	
12:45 A.M.	580^{0}C	587^{0}C	
01:00 A.M.	580^{0}C	584^{0}C	
01:15 A.M.	600^{0}C	580^{0}C	
01:30 A.M.	600^{0}C	602^{0}C	
01:45 A.M.	615^{0}C	604^{0}C	
02:00 A.M.	630^{0}C	616^{0}C	
02:25 A.M.	630^{0}C	630^{0}C	EMF Stop

6) **Finished Product-** The bottle was removed from the furnace after self-cooling. *Kupi* was cautiously removed from electric muffle furnace. The layers of wrapped cloth were carefully scraped, bottle was broken with the help of thread dipped in kerosene and the product was collected at the neck. The whole process was reapeated for another two batches. *Mallasindura* collected at the neck of the *kupi* in all three batches and result were observed mention in table 04.

Table 4: Shows finished product result of three batches of Mallasindura.

Mallasindura	Batch- 1	Batch- 2	Batch -3
Colour	Dark red Color	Dark red Color	Dark red Color
Touch	Smooth	Smooth	Smooth
Initial weight of *Kajjali*	300 g	300 g	300g
Weight of *Mallasindura*	112 g	160 g	180g
Loss in weight	188 g	140 g	120g
Loss in %	62.66	46.66	40.00
Yield in %	37.33	53.33	60.00
Total hours taken for heating	16.20	16.55	17.25
Reason of loss	Due to jarana process		

DISCUSSION

The Rasashastra classics claim that *parada* treated with g*andhaka jarana* process becomes highly potentiated and many pharmacological & therapeutic properties, *Mallasindura* preparation chemicaly is mercuric sulphide (Hgs) as well as in *Rasasindura* etc. It is well known fact that temperature and pressure effect molecular structure and ionization potential of element's. Diamond, Graphite & Coal are the purest carbon compound with similar chemical composition but they differ in physical as well as chemical properties due to difference in temperature and pressure during their formation. *Mallasindura* is a *kupipakwa rasayana* formulation which is prepared by heating a mixture of few essential materials in a glass bottle with graded pattern of mild, moderate and intense heat in an electrical muffle furnace. Electric muffle furnace advantages of easy regulation of temperature, lack of source of fuel and free from carben smoke etc. The adopted classical guidelines *shodhana* of *Hingula*, g*andhak* and *Somal* adds to therapeutic activity and curtails potential adverse effect of the purified drug. Total 28hrs triturated in iron-mortar for prepared *kajjali* from *shuddha Gandhaka*, *Hingulottha parad* & *shuddha Somal including kumari swarasa bhavana*. *Kupi* was wrapped seven layers of cotton cloth & mud to strengthen the bottle & product. Graded heating pattern i.e, kramagni in *kupi-pakwa* is essential aspect to get the therapeutic effect of the product. Deposition of Sulphur around neck of *kupi* were cleared by insertion of red hot iron repeatedly. As converted of *kajjali* to *Mallasindura* is dependent on time & temperature pattern.

CONCLUSION

Total 28hrs triturated in iron-mortar for preparation of *kajjali* from *shuddha Gandhaka*, *Hingulottha parad* & *shuddha Somal including kumari swarasa bhavana*. The temperature patterns were observed in Standard Manufacturing Process(S.M.P) of *Mallasindura* in electric muffle furnace(E.M.F)[20] i.e. *Mrudu* (Mild) agni average 18°C to 250°C, *Madyama* (Moderate) agni 251°C to 450°C and *Tivra* (Higher)agni 451°C to 630°C. Fumes appears at the neck of *kupi* indicating Started burning of excess *Sulphur* at Average 158°C, flame of Sulphur and Arsenic appear Average 421°C and disappear Average 539°C, The time duration of flame are Average 06 hrs in all three Batches of *Mallasindura*. Average loss found of three batches were 45.22% and yield were found 54.66%.total time taken for heating in all batches Average 17 hrs.for preparation in S. M. P. of Mallasindura.

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