

VALIDATION OF SMP OF *HINGULOTTHA PARADA* BY *NADA YANTRA* AND THEIR QUALITY PARAMETER

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ABSTRACT

Background: *Parada* (mercury) is an important ingredient of *Ayurvedic* drugs particularly of the *Rasaushadhi* i.e. metallic and mineral formulations. According to the classical texts *Hingulottha Parada* has similar properties to *Ashtasamskarita Parada*. Generally *Parada* is collected by *Urdhva Patana* (upward sublimation), *Adhah Patana* (downward sublimation) and *Tiryanka Patana* (transverse sublimation) method from the *Hingula* (cinnabar) i.e. HgS. **Aim:** To validate the manufacturing procedure of *Hingulottha Parada* and to develop quality control parameter. **Materials and Methods:** Total six batches of *Hingulottha Parada* were prepared by using *Nada Yantra* method. All the involved procedures were followed as per classical guidelines. **Results:** Average 73.9% yield was obtained from processed *Hingula* and their purity was 98.6%. **Conclusion:** *Nada yantra* is the most convenient and economic method of get maximum yield 73.9% with 98.6% purity.

KEYWORDS: *Parada, Ashtasamskarita Parada, Yantra.*

INTRODUCTION

Metals are well known and used for therapeutic purpose since from ancient time. In *Charaka Samhita*^[1] metals and minerals are frequently use in therapeutic purpose. The *Ayurvedic* drugs are categorized in three groups viz. herbal, animal and metals/minerals.^[2] The metal/mineral category includes mercury, gold, copper, silver, tin, lead, iron, gems and precious stones etc. The minerals and herbo-mineral preparation are one of the best among all other treatment modalities due to their qualities like quicker action, effectiveness in small doses, longer stability period and augmenting effect too. The drug formulations are found to be more potent and effective in terms of disease curing.^[3] But these should be used precautiously as adverse effects may be caused if not properly administered based on classical guidelines. Most of *Rasa* formulations have *Parada* (Mercury) as an important ingredient. As per literary survey it is evident that Native *Parada* (Mercury) and there compound have many toxic effects like severe gastrointestinal irritations, peripheral circulatory collapse, metallic taste in mouth, excessive salivation, inflammation of gums etc^[4] if it is not used in proper manner. After proper processing of *Shodhana*, *Samskara*, *Murchhana*, *Jarana* etc. and with herbo-mineral drugs it acts like nectar in the body.^[5] Though *Hingula* is the main source of *Parada* but it is included under *Sadharana Rasa Varga*^[6] in majority of books. It is reddish brown in colour^[7] and heavy mineral of the *Parada* and *Gandhaka*.^[8] It has *Tikta*, *Kashaya*, *Katu Rasa*; *Laghu*, *Ruksha Gunas*; *Ushna Virya*, *Katu Vipaka*, *Tridoshashamaka Doshaghnata*.^[9] It is insoluble in water and when burnt in air liberate mercury vapor, on sublimation which converted into mercury metal. There are so many methods with same principles which are found for the extraction of *Parada* from *Hingula*. But most of the methods are not convenient to procure *Parada* from *Hingula*. Most of the methods are found very difficult while easier ones are not much suitable for present era due to air pollution & higher cost of the process. The 73% *Hingulottha Parada* was obtained by *Nada Yantra* and Standard Manufacturing Procedure (S.M.P.) of the same has been developed by *Neky Mehta et al.*^[10] in department of *Rasashastra* and *Bhaishajya Kalpana*, IPGT & RA, GAyU, Jamnagar.

According to classics of *Rasashastra*, *Parada* extracted from *Hingula* is free from various types of *doshas*, hence the same does not need any further *Samskara* and could be used even without subjecting it to the eight *Samskaras*. Moreover according to *Rasendra Chudamani*^[11] and *Rasa Prakash Sudhakar*^[12] mercury extracted from *Hingula* may possess all those properties which are seen in *Sadguna Bali Jarita* (six times *Gandhak* burnt) *Parada*.

It is considered highly superior to ordinary mercury from the purity as well as potency point of view. Therefore whole process is validated with following aim, to develop the Quality control parameter of Mercury.

MATERIALS AND METHODS

Collection of raw materials

Hingula was procured from Pharmacy, Gujarat Ayurved University, Jamnagar. *Nimbu* (*Citrus medica* Linn.) was collected from local market of Jamnagar. The whole procedure was divided into two steps i.e.

- (a) Steps I: *Shodhana* of *Hingula*.^[13] by *Nada Yantra*.
- (b) Steps II: *Parada Niskashana*.^[14] (sublimation of mercury).

In present study *Hingulottha Parada* was carried out as per the reference of *Siddha Bhaishajya Manimala* by applying principle of *Urdhva Patana* (upward distillation) and it was subjected to various organoleptic and physicochemical analyses such as texture, color, taste, odor, pH^[15], loss on drying^[16], percentages of mercury and^[17] percentages free sulfur^[18] as per standard method designed in API .

a. Steps I: Hingula Shodhana

Procedure

3.5kg *Hingula* (Cinnabar) was divided into 7 batches i.e. 500g each. All equipments are washed properly with acidic media (Lemon Juice) & hot water and then dried properly on gas burner for sterilization. *Ashuddha Hingula* (unpurified Cinnabar) was made into powder form and passed through sieve 60. *Nimbu Swarasa* (Lemon juice) was extracted manually. Each 500g of *Hingula* powder was given one *Bhavana* (levitation) with 80 ml of lemon juice continuously for three hours and then allowed to dry in same *mortar*. The same procedure was followed in other 7 batches.

Table 1: Data of *Hingula Shodhana*.

Batch code	Wt. of Ashuddha Hingula(g)	Wt. of Nimbu Swarasa(ml)	Wt. of Sh. Hingula(g)	% gain
HP1	500	80	503	0.6
HP2	500	80	507	1.4
HP3	500	80	506	1.2
HP4	500	80	505	1
HP5	500	80	504	0.8
HP6	500	80	506	1.2

HP7	500	80	505	1
Avg.	500	80	505.14	1.02

b. Step II: *Parada Niskashana* (extraction of mercury)

Procedure

All equipments are washed properly with acidic water & hot water then dried on gas burner properly for sterilization. Cotton cloth are washed properly with soap water and hot water then dried in sun light. Equal weight of cotton cloth was taken and fine powder of *Shuddha Hingula* was spread over it uniformly. After that, cotton cloth was rolled from both side in opposite direction to make a bolus like structure and it was tied up loosely by a cotton thread. The cotton cloth bolus was kept in an earthen pot (*Sharava*) properly and *Sharava* was placed at center of a large enamel tray. The bolus was ignited by match stick and it was explored to air for few minutes to catch fire. The *Sharava* was covered by an earthen pot (*Nada*) fully. On the 3 small pieces of tiles which were put around the *Sharava* till the whole cotton bolus was burnt completely. On next day after self cooling, the *Nada* was carefully removed and *Parada* was procured from inner side of it with the use of small pieces of cotton cloth by rubbing. The ash of cotton cloth washed with hot water and *Parada* was collected from it also. Finally all collected *Parada* was filtered through double folded cotton cloth. It was collected in a sterile glass bottle.

Table 2: Results obtained during extraction of *Hingulotha Parada*.

Batch code	Wt. of <i>Hingula</i> (g)	Wt. of cotton cloth(g)	Wt. of obtained <i>Parada</i> (g)	% of obtained <i>Parada</i>
HP 1	500	500	359	71.8
HP 2	500	500	368	73.6
HP 3	500	500	372	74.4
HP 4	500	500	376	75.2
HP 5	500	500	373	74.6
HP 6	500	500	369	73.8
Avg.	500	500	369.5	73.9

Table 3: Organoleptic properties.

Character	Lemon juice	As. <i>Hingula</i>	Sh. <i>Hingula</i>	<i>Hingullotha Parada</i>
Texture	liquid	stony	fine powder	liquid
Colour	pale yellow	shiny red	reddish brown	dull white
Taste	acidic	NA	acidic	NA
Odour	acidic	odorless	acidic	NA

Table 4: Physiochemical parameter of *Nimbu Swarasa*.

Character	Lemon juice			
	Batch I	Batch II	Batch III	Avg.
pH	2	1.8	2.1	1.9

Table 5: Physiochemical parameters of *Ashuddha Hingula*.

Parameter	<i>Ashuddha Hingula</i>			
	Batch I	Batch II	Batch III	Avg.
pH				
Loss on drying at 110°C	0.86	0.81	0.85	0.84
% of mercury	86.9	87.4	87.3	87.2
% of free sulfur	0.26	0.29	0.29	0.28

Table 6: Physiochemical parameters of *Shuddha Hingula*.

Parameters	<i>Sh. Hingula</i>			
	Batch I	Batch II	Batch III	Avg.
pH	2.1	1.9	2	2.0
Loss on drying at 110°C	0.31	0.25	0.33	0.29
% of mercury	84.7	83.9	84.1	84.2
% of Free Sulfur	0.89	0.84	0.85	0.86

Table 7: Physiochemical parameters of *Hingulottha Parada*.

Parameter	Lemon juice			
	Batch I	Batch II	Batch III	Av.
% of mercury	98.2	99.2	98.4	98.6
Specific gravity	13.57	13.58	13.56	13.57

DISCUSSION

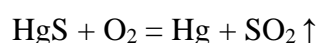
Mercury occasionally occurs in native form but it's one of the chief source is cinnabar.^[19] The extraction of *Parada* from *Hingula* (cinnabar) can be carried out by three methods i.e. *Adhah Patana* (downward sublimation), *Urdhva Patana*^[20] (upward sublimation) or *Tiryanka Patana*.^[21]

(Transverse sublimation). The different *Yantras* (instrument) were used for extraction of *Parada* like *Damaruyantra*, *Vidhyadharayantra* and *Patanayantra* etc. The application of *Nadayantra* for extraction *Parada* was first time described by *Siddha Bhaishajya Manimala*.^[22] Around 29 references^[23] are found for *Hingulottha Parada* in which 18 principle methods are described in classics. Majority of the references for extractions of *Parada* are belonging to *Patana* method among most frequently mentioned method for *Hingulottha Parada* is *Urdhva Patana* method. *Amla rasa Bhavana* is advised to be done before the *Patana* procedure. As *Bhavana* with *Amla rasa*^[24], *Nimbu Swarasa*^[25], *Jambir*

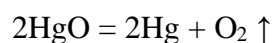
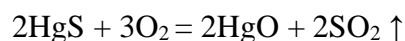
Nimbu (*Citrus limon* (Linn.) Burm. F.) *Swarasa*^[26] and *Changeri* (*Oxalis corniculata* Linn.) *Bhavana*^[25] references are available in the classical texts.

The SMP for the extraction of *Parada* with *Nada Yantra* method for 500g *Hingula* has been developed by Neki Mehta^[26] *et al.*

In present study, Validate the process (SOP) of mercury extraction and to develop their organoleptic and physicochemical profile. In this process *Nada Yantra* was used for extraction of *Parada*. Boiling point of *Parada* is 357⁰C at normal room temperature and pressure, but when it is extracted from *Hingula* it needs 600 – 650⁰C temperature, because *Hingula* dissociate at this higher temperature only in following manner. The Sulfur burns and liberate mercury.



Mercury is readily obtained by roasting the mineral cinnabar in air. Cinnabar is oxidized to mercury oxide which decomposes at the temperature of 356⁰C, yielding mercury, which distils off^[27] i.e. extraction.



Ashuddha Hingula (Native form) was made into powder form of 60 mesh size and levigated with *Nimbu Swarasa*. 80 ml of *Nimbu Swarasa* was found sufficient for 500 g of *Hingula* to make as *Rasapankvat* (slurry mass). Total 3 hours levitation was done. Then *Hingula* was allowed to complete dry at room temperature. *Hingula* became soft and fine powder after drying. After processing of *Bhavana* with *Nimbu Swarasa* the reddish brownish shining Crystalline raw of *Hingula* convert into reddish color in color. Average 1.02% increase in weight of *Hingula* was observed after *Shodhana*. This may be due to addition of total solid content of *Nimbu Swarasa*. The pH of *Nimbu Swarasa* was 1.9 and is an acidic media. Dried *Shuddha Hingula* was spread over four folded cotton cloth which was equal to *Hingula* by weight. Equal quantity of cotton cloth is sufficient for complete extraction of *Parada*. *Nada* was put in such a way that it covers *Sharava* in the base of tile pieces so that there will be some space to provide oxygen to burn the cotton bolus. A huge *Nada* should be needed to collect and for proper cooling of *Parada* vapor. *Parada* was adhered on the inner surface of *Nada*, when vapor became cool. Due to toxicity of mercurial vapor, the procedure should be done in open air only by using mask and gloves. *Parada* globules were collected from the

inner side of the *Nada Yantra* by rubbing with cotton cloth. The remaining *Parada* was procured from the ash of cloth through careful washing with hot water. Average 73.9% *Parada* was obtained from *Hingula*. 86.20% of mercury should be present in *Hingula* theoretically. The reason of loss of *Parada* may be due to vapor coming out from the space in between *Sharava* and *Nada*, *Jala Gati* of *Parada* during washing and some amount of *Parada* was remained in pores of the *Nada*. Dr. Suhas Nayak^[28] et. al, March 2005 and Dr. Neky Mehta et. al. March 2007.^[29] Dr. Sanjay Khedekar^[30] et al., March 2009, Dr. Rohit Ajith Gokarn^[31] et al, March 2014 has found 72.7%, 73.00% and 73.97%, 73.96 of *Parada* from the *Hingula* in his respective work. Dr. Suhas Nayak^[32] et al, has collected 73.2% of *Parada* in his work by the same method but he didn't give the *Bhavana* of *Nimbu Swarasa* to the *Hingula* prior to the extraction. The percentage of Hg is decreases in *shudha Hingula* in comparison to *Ashudh Hingula*, it may be due to addition of solid content or it may be the process of levitation which dissociate the HgS into free Hg. The percentage of Hg in *Ashudh Hingula*, *Shudha Hingula* and *Hingullotha Parada* are found 87.2%, 84.2% and 98.6% respectively in these samples which support the classical reference. The purity of Hg in *Hingullotha Parada* is 98.6% which is highly supportive to further research work. The percentages of mercury obtained in different studies are negligible. It may be due to the possible variation in quantity of mercury present in the raw *Hingula* or due to variation in loss during manual processing.

CONCLUSION

Hingullotha Parada is extracted by *Urdhva Patana* (upward sublimation), *Adhah Patana* (downwards sublimation) and *Tiryanka Patana* (transverse sublimation) method. Among them *Urdhva*.

Patana (upward distillation) by *Nada Yantra* is very convenient and economic to procure approx 73.9% *Parada* from the *Hingula*. This method is revalidated for 500 g of *Hingula* with all given specifications of equipments & materials. The percentage of Hg in *Ashudh Hingula*, *Shudha Hingula* and *Hingullotha Parada* are found 87.2%, 84.2% and 98.6% respectively which shows the purity of Hg.

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