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Research article

Standard operating procedure of Hingulottha Parada

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Abstract

Parada (mercury) is an important ingredient of Ayurvedic drugs particularly of the Rasayogas 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. 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. Considering this, a pharmaceutical study has been taken up on extraction of Parada from Hingula by Nadayantra method. Average yield of 73.00% Hingulottha Parada was obtained in this study.

Keywords: Hingula, Nada Yantra, Parada.

Introduction:

Rasachikitsa is considered as the best among all other treatment modalities due to their qualities like quicker action, effectiveness in smaller doses, longer stability period and augmenting effect. The drug formulations are found to be more potent and effective in terms of disease curing (1). But these should be used pre-cautiously 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 Parada (Mercury) has many toxic effects like severe gastrointestinal irritations, peripheral circulatory collapse, metallic taste in mouth, excessive salivation, inflammation of gums etc. (2) if it is not used in proper manner. After proper processing of Shodhana, Samskara, Murchchna, Jarana etc. and with herbomineral drugs it acts like nectar in the body (3).

Though Hingula is the main source of Parada but it is included under Sadharana Rasa Varga (3) in majority books. It is reddish brown in colour (3) and heavy mineral of the Parada and Gandhaka (4). It has Tikta, Kashaya, Katu Rasa; Laghu, Ruksha Gunas; Ushna Virya; Katu Vipaka; Tridoshashamaka Doshaghnata (4). It is insoluble in water and when burnt in air liberate mercury vapor, on sublimation which converted into mercury metal. 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

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Operating Procedure (S.O.P.) of the same has been developed by repeated processes for more than 13 times.

Table 1: Showing the references and methods of Hingulottha Parada along with materials used

No.	References	Media use in process	Ingredients for Bhavana	Principle of method	Yantra used
1	Rasanrav (5) 7/48	Hingula + Gomansa (meat of cow,) Mahisha Mutra (Buffalo urine),Tila Tail (Sesame oil), Dadhi Amla (Sour curd) → agni for 3days in each dravya	Shikhipitta	Patana	Patana Yantra
2	R.S.S (1).1/58; Rasa Paddhati (6) 18 R.T. (7). 5/38;	Hingula	Paribhadra (Erythrina variegate Linn. Var.orientalis (Linn) Merrill) Swarasa	Urdhva Patana	-
3	R.S.S. (1)1/58; Rasa Paddhati (6) 18; R.T.S. (8). Paribhasa; R.T. (7) 5/38	Hingula	Jambir Nimbu (*Citrus limon* (Linn.) Burm.f.) Swarasa	Urdhva Patana	-
4	R.S.S. (1)1/55; Rasendra Vigyan (9) 1 R.T. (7) 5/38	Hingula	Changeri (*Oxalis corniculata* Linn.) Swarasa	Urdhva Patana	-
5	R.R.S. (3)1; Anand Kanda Kriyakaran Vishranti (10) 2/193 R.J.N. (11) Part 2, chap 3	Hingula	-	Patana	Patana Yantra
6	Rasa Paddhati (6) 18	Hingula (Pottali) + Snuhikshira (Latex of Euphorbia neriifolia Linn.), Tila Tail, Kanji (sour gruel) → Swedana for 3 hr	Uccha prachalaki (bile of peacock) 7 Bhavana	Urdhva Patana	
7	Rasendra	Hingula	Adaraka (dry	Urdhva	Vidyadhara

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	Chudamani (12) 4/42		Zingiber officinale Rosc.) Swarasa	Patana	Yantra
8	Rasa Ratnakar Rhuddhi Khanda (13) 2/48	Hingula + Gomutra (cowurine),Mahisha Mutra, Tila Tail, Sura, Amla → Kramagni for 7 days in each dravya	Mayurpitta (bile of peacock)	Patana	
9	Rasa Ratnakar Rhuddhi Khanda (13) 2/53	Hingula	Amlarasa (Acidic meidia)	Patana	-
10	S.B.M.M. (14) 5/3	Hingula + Siktha make Varti	-	Patana	-
11	S.B.M.M. (14) 5/4	Hingula + Vastra in Sharav	-	Patana	-
12	S.B.M.M. (14) 5/5	Hingula + Haridra (Curuma) in Vastra	-	Patana	Sthalika
13	S.B.M.M. (14) 5/6	Hingula in Chaturguna Vastra	-	Patana	Nada Yantra
14	A.P. (4) 2/83	Hingula	-	Patana	Damaru Yantra
15	A.P. (4) 2/84; Rasendra Vigyan (9) 1	Hingula	Nimbu Swarasa	Urdhva Patana	
16	A.P. (4) 2/84; R.T.S. (8) Paribhasa;	Hingula	Nimba patra Swarasa	Urdhva Patana	
17	Rasamrit (15) 1	Hingula	Nimbu Swarasa	Tiryanka Patana	
18	Rasa Chikitsa part (16) 1	Hingula	Amaruk Shak Bhavana + 1 Day Sthapan	Patana	

Abbrevations:

R.R.S. – Rasa Ratna Samuchchaya,
R.S.S. - Rasendra Sara Samgraha,
S.B.M.M- Siddha Bhaishajya Manimala,
R.T.S. – Rasa Tantra Sara
R.T. - Rasa Tarangini,
R.J.N - Rasa Jala Nidhi,
A.P. - Ayurved Prakash,

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 (12) and Rasa Prakash Sudhakar (17) mercury extracted from Hingula may possess all those properties which are seen in Sadguna Bali Jarita (six times Gandhak burnt) Parada. Thus it is considered highly superior to ordinary mercury from the purity as well as potency point of view.

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 parts i.e. (a) Shodhana of Hingula (4) (Ayurved Prakash 2/77) and (b) Parada Niskasana (sublimation of mercury). In present study Hingulottha Parada was carried out as per the reference of Siddha Bhaishajya Manimala (14) (5/6) by applying principle of Urdhva Patana (upward distillation).

a. Hingula Shodhana:

Ingredient:

Hingula – 6.5 kg

Nimbu *(Citrus medica Linn.)* Swarasa – 1040 ml

Procedure:

- 6.5kg Hingula (Cinnabar) was divided into separate 13 batches i.e. 500g each batch.
- All equipments are washed properly with acidic media (Lemon Juice) & hot water, 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.
- Hingula powder was given Bhavana (levigation) with lemon juice continuously for three hours and then allowed to dry in same mortar.
- The same process was followed in all the 13 batches.

Observations:

- After processing of Bhavana with Nimbu Swarasa the reddish brownish shining of Hingula convert into reddish colour.
- pH of Nimbu Swarasa was 2.
- Hingula became reddish brown and soaked after drying.
- The shining of crystals lost after Bhavana.
- Crystalline raw Hingula converted into soft consistency after Bhavana (levigation).

Results:

Table 2: Data of Hingula Shodhana;

Batch Code	Ashuddha Hingula (g)	Nimbu Swarasa (ml)	Duration of Mardana (h)	Weight of Hingula obtained after Shodhana (g)
H_1	500	80	3	507
H_2	500	80	3	510
H_3	500	80	3	507
H_4	500	80	3	508
H_5	500	80	3	505
H_6	500	80	3	510
H_7	500	80	3	508
H_8	500	80	3	510
H_9	500	80	3	507
H_{10}	500	80	3	508
H_{11}	500	80	3	503
H_{12}	500	80	3	504
H_{13}	500	80	3	504
Avg.	**500**	**80**	**3**	**507**

Approximately 10 g sample of Bhavit Hingula has been preserved as reference sample.

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b. Parada Niskasana (extraction of mercury):

Ingredients:

Nimbu Swarasa Bhavit Hingula - 6434 g
Cotton cloth - 6434 g

Procedure:

- All equipments (Table 4) are washed properly with soap 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 basis of 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.

Observation:

- The bolus of cotton cloth was burnt very slowly.
- A little amount of fumes were coming out from the space between the outer border of Sharava and lower border of Nada, which was accumulated to liquid Parada on rubbing by cotton cloth at the time of collection.

Results:

Table 3: showing the results obtained during processing of Hingulottha Parada

Sr. No.	Batch code	Shuddha Hingula (g)	Cotton Cloth (g)	Obtained Parada (g)	Obtained Parada %
1.	HP_1	497.0	497.0	343.0	69.01
2.	HP_2	510.0	510.0	373.0	73.14
3.	HP_3	497.0	497.0	353.0	71.03
4.	HP_4	500.0	500.0	380.0	76.00
5.	HP_5	490.0	490.0	348.0	71.02
6.	HP_6	500.0	500.0	365.0	73.00
7.	HP_7	500.0	500.0	367.0	73.40
8.	HP_8	500.0	500.0	380.0	76.00
9.	HP_9	500.0	500.0	365.0	73.00
10.	HP_{10}	500.0	500.0	366.0	73.20
11.	HP_{11}	480.0	480.0	366.0	76.25
12.	HP_{12}	480.0	480.0	334.0	69.58
13.	HP_{13}	480.0	480.0	363.0	75.62
Average		**494.92**	**494.92**	**361.8**	**73.10**

Discussion:

Mercury occasionally occurs in native form but its chief source is the ore, cinnabar (18). The extraction of Parada from Hingula (cinnabar) can be carried out by three methods i.e. Adhah Patana (downward sublimation), Urdhva Patana (upward sublimation) or Tiryanka Patana (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 (5/6). Around 29 references 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. Amlarasa Bhavana is advised to be done before the Patana procedure. As Bhavana with Amla rasa (02), Nimbu Swarasa (03), Jambir Nimbu (*Citrus limon (*Linn.) Burm. F.) Swarasa (03) and Changeri (*Oxalis corniculata* Linn.) Bhavana (03) references are available in the classical texts.

In present study Nadayantra (Plate - 1) was used for extraction of Parada. The SOP for the extraction of Parada with Nada yantra method for 500g Hingula has been developed by department of Rasashastra & Bhaishajya Kalpana, Institute for Post Graduate Teaching and Research in Ayurveda, Jamnagar.

Boiling point of Parada is 357^0C at normal room temperature and pressure, but when it is extracted from Hingula it needs 600 – 650^0C temperature, because Hingula dissociate at this higher temperature only.

$$HgS + O_2 \xrightarrow{\text{Heat}} Hg + SO_2 \uparrow$$

Mercury is readily obtained by roasting the mineral cinnabar in air. Cinnabar is oxidized to mercury oxide which decomposes at the temperature of 356^0C, yielding mercury, which distils off (18) i.e. extraction.

$$2HgS + 3O_2 \rightarrow 2HgO + 2SO_2 \uparrow$$
$$2HgO \rightarrow 2Hg + O_2 \uparrow$$

Ashuddha Hingula 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 levigation was done. Then Hingula was allowed to complete dry at room temperature. Hingula became soft and fine powder after drying. Average 1.4% 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 2.0 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 73.10% 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 (19) et. al, MD (Ayu.), Jamnagar, March 2005, has found 72.7% of Parada from the Hingula in his work. He has collected 73.2% of Parada in his PhD (20) work by the same method but he didn't give the Bhavana of Nimbu Swarasa to the Hingula prior to the extraction.

Dr Sanjay Khedekar (21)et. al, MD (Ayu), Jamnagar, March 2009, has collected 73.97% of Parada from Hingula by using same method.

The percentages of mercury obtained in different studies are negligible. It may due to the possible variation in quantity of mercury present in the raw Hingula or due to variation in loss during manual processing.

Conclusion:

Hingulottha Parada is extracted by Urdhva Patana (upward sublimation), Adhah Patana (down wards sublimation) and Tiryanka Patana (transverse sublimation) method. Among them Urdhva Patana (upward distillation) by Nada Yantra is very convenient to procure approx 73.00 % Parada from the Hingula. Thus this method is validated for 500 g of Hingula with all given specifications of equipments & materials.

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Table 4: Showing the specifications of the Equipment used:

- Porcelain mortar : Diameter Inner : 24.0 cm
  Outer : 26.0 cm
  Height : 14.0 cm
  Depth : 13.0 cm
  Thickness : 1.0 cm
- Porcelain pestle : Length : 18.0 cm
  Diameter of lower surface: 6.0 cm
- Nada Yantra (earthen pot)
  - Upper surface : 23 cm
  - Body middle surface : 34 cm
  - Brim : 17 cm
  - Height : 34 cm
- Earthen Sharava
  - Base diameter : 7 cm
  - Upper side diameter : 21 cm
  - Depth : 5 cm
- Cotton cloth : 60 x 45 cm four layers
  - Weight : 500 g
- Enamel Tray : 40 cm x 50 cm x 8 cm

Plate -1

Detail processing of Hingulottha Parada

Process of Hingula Shodhana

Making a roll of Hingula Powder in the cloth

Bolus of cloth in Earthen Pot

Covering of Pot with Nada

Sublimated mercury inside the Nada

Filtration of procured Mercury

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