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PHARMACEUTICO-ANALYTICAL STUDY OF BABBULA NIRYASA BHAVITA RASA GARBHA POTTALI

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ABSTRACT

Pharmacopoeia of 'Ayurveda' comprises of drug derived not only from herbs but also from minerals, metals and animal products. Rasashastra is a specialized branch of Ayurveda dealing mainly with Minerals which are known as 'Rasa dravyas', Pottali Kalpana is one among the mercurial compound processed with the help of sulphur. This is based on its compactness. i.e. "the medicine of large magnitude is compacted into a small pottali like structure". Rasagarbha pottali is a unique rasa preparation. It is one among various Kajjali bandha perpetrations. Various bhavana dravyas for preparation of pottali like Kumari swarasa, Tulasi swarasa, Ardraka swarasa etc... are mentioned in classics. In the current study, Babbula Niryasa is used as a bhavana dravya to prepare Rasagarbha Pottali by Gandhaka paka method. Its pharmaceutical processing and Analytical evaluation is undertaken.

KEYWORDS: Rasagarbha pottali, Babbula Niryasa.

INTRODUCTION

Among various murchita Parada yogas Pottali kalpana has been given greater significance by the author Pandith Hariprapannaji in his text Rasayoga sagara. It is the effective form of mercurial formulation as it is made into a single compound structure constituting various ingredients into a compact shape.

Many Pottalis has been described in the text books of Rasashastra. Rasagarbha Pottali is a classical Pottali rasayana containing Hingulottha Parada, Kajjali, Shodhita Gandhaka and Swarnatanutantu Khanda [1], which is Unique, Potent, and fast effective, novel molecule with highly promising therapeutic application.

The gum resin of the plant Babbula is mentioned as one of the bhavana dravya for preparation of Pottali. The gum resin of the plant contains *Galactose, L-rhamnose, L-Arabinose* and some traces of *calcium* and *magnesium* [2]. Moreover it is considered as a good binding agent for the pottali.

Preparation of Rasagarbha pottali (RGP) by using Babbula Niryasa (RGP-B) as a bhavana dravya and evaluating its Pharmaceutical and analytical results are the main purpose of this study.

AIM

To prepare Babbula Niryasa bhavita Rasa garbha Pottali (RGP-B) by Gandhaka drava paka method and evaluating its pharmaceutico-analytical results.

OBJECTIVES

- To Carry out Visesha Shodhana of Swarna.[3]
- To prepare Samaguna Kajjali.[4]
- To Prepare RGP by Bhavana dravya 'Babbula Niryasa.[5]
- To carry out Pharmaceutical and Analytical study of RGP-K

MATERIALS AND METHODS

Materials

Major raw materials
Swarna, Hingula, Gandhaka

Associated Drug
Kanchanara Patra Swarasa, Nimbu swarasa, Saindhava Lavana, Go-dugdha, Babbula Niryasa, Silk cloth.

Equipments
Khalwa Yantra,Urdhwa patana Yantra, Kurma puta, Valuka yantra, Gas stove, Vessel, Kora Cloth, Knife, Spoon, Utensils, Multani mitti, Loha sharava, Valuka,

Loha shalaka, Thread, Cow dung cakes, Match stick, Glass beaker, Scissor etc.

Method
The whole method of preparation includes.

Extraction of Parada from Hingula [6]
Parada is extracted from Hingula by the Hingulottha Parada method mentioned in Rasa Tarangini.

From 860 g of Hingula 507 g of parada obtained. It is taken into a porcelain mortar and 31.68 g of Haridra churna added and triturated for 3 days and filtered and 480g of Parada was collected with the loss of 27 g.

Gandhaka Shodhana[7]
Gandhaka Shodhana is carried out in Godugdha by subjecting it to Kurma Puta by Bhoodhara Yantra method as mentioned in Ayurveda Prakasha. 710-730g of Gandhaka is taken for Shodhana each time. Totally: 45.770 kg gandhaka Shodhana done.

Shodhita Gandhaka is of pale Yellow Colour with greenish tinge & shiny.

It is in granular form and few were streak like, fully immersed in the milk.

Visesha Shodhana of Swarna[8]
The method mentioned in Yogaratnakara is followed. 2.587g of Swarna Patras are cut into small layer like pieces and heated to red hot in a mild flame and suddenly quenched into Kanchanara patra swarasa and washed in warm water. Same procedure is repeated for 2 more times. For each time Nirvapa fresh sample of Kanchanara patra Swarasa was used.

Preparation of Swarna Pisti[9]
2.587g of Shodhita Swarna was cut into small pieces and added slowly into Khalva yantra containing 41g of Shodhita Parada and triturated. Amalgamation of Swarna and Parada was taken place After 6 hrs of mardana.

After complete formation of Pisti, Nimbu swarasa and Saindhava Lavana was added and triturated well. After 3 hrs of trituration swarasa colour turned into greyish black. The Pisti was then washed with lukewarm water, until the water stopped turning into black colour and all the acid content disappeared.

Then this Swarna Pisti was collected and weighed. The final product of prepared Swarna Pisti weighs 43.587g.

Preparation of Kajjali[10]
331 g of Parada and 331 g of Gandhaka were taken in a clean Khalva Yantra. Then gently triturated with uniform speed till all the Kajjali Lakshanas were observed, i.e. the whole mixture converts into a fine, smooth, lustreless powder.

Average to and fro movements of Peshani was 14-15 times/minute.

After 72 hrs, Kajjali was taken between thumb and index finger made wet then rubbed and was exposed to sunlight, minute particles were observed in furrows of finger confirming Rekhapurnatva test. Nischandra, Varitara, uttama test was confirmed. Obtained kajjali is 662 g.

Preparation of Final Kajjali for RGP
In a Khalva Yantra 43.587 g of prepared Swarna Pisti is taken. To this 10.35g of Gandhaka is added and triturated properly till it is properly mixed.

Later the above mixture is mixed with 662 g of prepared kajjali and again trituration continued. After 72 hrs Kajjali appeared Smooth and Rekhapornata test found positive. For better fineness and smoothness of kajjali, mardana was continued up to 280 hrs.

Distribution of RGP Kajjali For Babbula Niryasa bhavana[11]
238.6 g of kajjali triturated by 200ml Babbula Niryasa for 7 days.

Distribution of kajjali for Pilot study and Main study

Kajjali for	Wt. before bhavana	Wt. after bhavana	Wt. gain	For pilot study	kajjali for main study
RGP-B	238.6 g	295 g	56.4 g	100g	145g

50g of kajjali is taken for Analytical study.

Pilot Study

	Kajjali	7 days Bhavana	Poogakara Pottali
RGP-B	96 g	60 ml Babbula niryasa	8 pottali: 9.5g, 10g, 10.5g, 10.5g, 10.5g, 11.5g, 12 g & 12 g

Result after Gandhaka paka of RGP-B.

Pottali	Paka kala	Weight [g]	
		Before paka	After paka
1	45 min	9.5	9.5g
2	1:30 hrs	10	10.5g
3	3 hrs	10.5	10 g
4	5 hrs	10.5	9 g
5	6 hrs	10.5	9 g
6	7 hrs	11.5	8.5g
7	8 hrs	12	8g
8	9 hrs	12	8g

So by above Pilot study, the Paka kala of RGP-B known is:

"09 hours. I.e. 07 hours after the melting of sulphur**"**

	Dried Poogakara Pottali
RGPB	3 pottalis of 44g, 44.5g, 32 g

Main study

Purva Karma

Equal quantity of Shuddha Gandhaka to that of dried RGP was taken and made into four parts. Four layers of Silk cloth were taken. Each part of Shuddha Gandhaka was spread on every layer of silk cloth. Then the layers were arranged one above the other.

After this the well dried RGP was placed in the center of the top layer silk cloth.

Then the four layered silk cloth wrapped around the Pottali and tied with cotton thread at the centre and perpendicular to iron rod for the convenience in the Pottali paka.

A Loha patra (iron vessel) of wide mouthed vessel with the measurement of 20cm x 55cm (height x diameter) was taken. 3-4 cm height of Valuka was spread evenly in the loha patra. Then the pot which was 10x12x13 cm (height x top width x middle width) was placed at the center. Then the rest portion of the Loha patra covered by Valuka so that the pot was immersed up to the neck portion. Total Valuka was taken: 13 kg.

Pradhana Karma

Shodhita Gandhaka was filled in the pot and kept in the Valuka Yantra. Then the arrangement was placed on the gas stove. Thermocouple was properly placed i.e., 5-6 cm away from the pot in Valuka Yantra and 4 cm above the bottom of Valuka Yantra.

Pooja done by chanting of "Aghora Mantra". Fire was set and temperature reading was carried out with the help of pyrometer with thermocouple for every fifteen minutes. Mrudu agni tapa was maintained according to classical reference.

As soon as Gandhaka melts Rasa garbha Pottali was immersed in it. Heating continued throughout the process till the appearance of Pottali paka lakshanas Mrudvagni was given i.e., temperature was maintained between 190^{o} C to 215^{o}C.

Observed for accomplishment of Pottali Siddha Lakshana like Vyoma Varna for molten Gandhaka, Metallic sound was heard when banged against pot.

Burning of silk cloth

After attaining these features the Pottali was then removed and placed in an empty pot and was allowed for self-cooling.

Paschat Karma

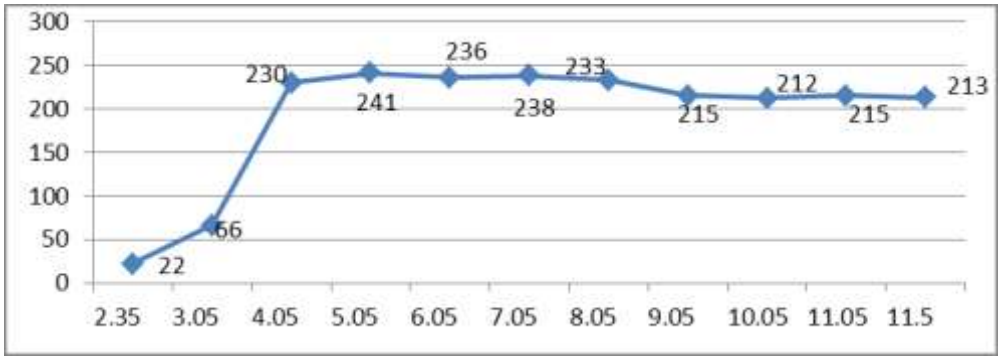
After self-cooling of the Pottali. Burnt silk cloth and Sulphur which was adhered to the Pottali was removed. Then the Pottali surface was cleaned and polished with the help of sharp blade and sand paper. Then the final product was collected in an air tight container.

Temperature pattern and Observation of RGP-B.

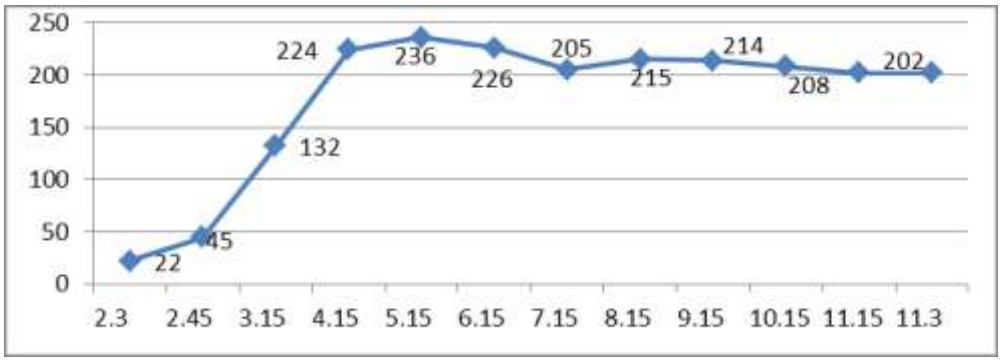
Time	Temp (^{0}c)	Observation
2.35 am	20^{0} C	Fire ignited
2.50 am	27^{0} C	
3.05 am	66^{0}C	
3.20 am	125^{o}C	
3.35 am	170^{0}C	Gandhaka started to melt
3.50 am	214^{0}C	Scum removed
4.05 am	230^{0}C	Gandhaka melted completely, Pottali was immersed.
4.20 am	238^{0}C	
4.35 am	244^{0}C	
4.50 am	242^{0}C	
5.05 am	241^{0}C	Golden yellow of sulphur is observed
5.20 am	240^{0}C	Thin layer scum started to appear and they are removed
5.35 am	240^{0}C	
5.50 am	238^{0}C	
6.05 am	236^{0}C	yellow colour of sulphur is observed
6.20 am	237^{0}C	

6.35 am	238^{0}C	Scum collected at the surface of paka removed
6.50 am	236^{0}C	
7.05 am	238^{0}C	
7.20 am	237^{0}C	Thin layer scum started to appear and they are removed
7.35 am	235^{0}C	
7.50 am	234^{0}C	
8.05 am	233^{0}C	
8.20 am	230^{0}C	
8.35 am	220^{0}C	Vyoma varna of Gandhaka appeared
8.50 am	215^{0}C	Pottali siddhi lakshanas appeared so pottali removed
9.05 am	215^{0}C	
9.20 am	210^{0}C	Dark Brown colour of sulphur is observed
9.35 am	209^{0}C	
9.50 am	210^{0}C	Thin layer scum started to appear and they are removed
10.05 am	212^{0}C	
10.20 am	216^{0}C	
10.35 am	216^{0}C	
10.50 am	216^{0}C	
11.05 am	215^{0}C	Vyoma varna of gandhaka appeared
11.20 am	215^{0}C	Golden yellow of sulphur is observed
11.35 am	214^{0}C	Thin layer scum started to appear and they are removed
11.50 am	213^{0}C	Vyomavarna observed, pottali removed.

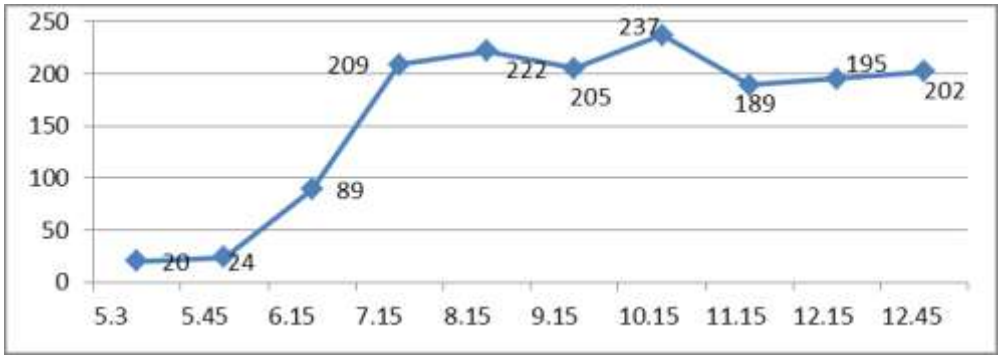
Time & Temp graph during Preparation of RGP-B 3 pottalis.



RGP-B 1.



RGP-B 2.



RGP-B 3.

RESULTS

Pharmaceutical Study

Yield of Preparation of Hingulottha parade.

Extraction of Parada from Hingula	Initial wt. of Hingula (860g)	Wt. of parada extracted	Loss	parada Obtained in %	Total Yield in
1st Batch	230g	135 g	95g	58.69	507g 59.05 %
2nd Batch	200g	120 g	80g	60	
3rd Batch	230g	130 g	100g	56.52	
4th Batch	200g	122 g	78g	61	

Yield of Gandhaka after Shodhana:
Total Gandhaka taken: 48.210 kg
Total loss: 2.440kg
Total yield: 45.770 kg

Observations made during Swarna Pisti.

Swarna Pisti	Shuddha Swarna Patra	Hingulottha Parada	Nimbu Swarasa	Saindhava Lavana	Swarna Pisti after Prakshalana	Loss during Pisti
1	2.587g	41g	60 ml	1 pinch	43.587g	0

Pilot Studies

The Paka kala known by Pilot study is
RGP-B: 09 hrs. I.e. 07 hours after the melting of sulphur

Main Study

Observations of RGP-B: (3- Batches).

RGP-B	Duration Hrs	Wt. Before Gandhaka paka	Wt. After Gandhaka paka	Loss	Total Before Paka	Total After Paka	Total Yield
1	7:45	44 g	34 g	10	140.5g	110g	30.5 g Loss (21.7%)
2	7	44.5 g	33 g	11.5			
3	7:15	52 g	43g	9			

Analytical Results
Classical parameters

Sl. No.	Test	RGP-B
1	Sparsha	Smooth and soft
2	Gandha	Characteristic Smell.
3	Rekhapurnatva	Fine powder of RGP-B entered the furrows of the fingers.
4	Varitaratva	Fine powder of RGP-B was floating on the surface of water in a test tube.
5	Nischandratva	There was no shining particle in the finely powdered RGP-B even when it was rubbed between thumb and index finger and made wet, observed in the bright Sunlight.

Organoleptic characters

Sample	Colour	Odour	Appearance	Taste
RGP-B	Black	Charecterstic	Amorphous	NO

Qualitative and Quantitative Study
Physical Tests

Sample	P^H Value	Ash Value	Acid insoluble ash	Water soluble ash	Loss on drying
RGP-B	4.30	14.55%	1.21%	0.85%	0.00%

Chemical Tests
Percentage of Mercury and Gold

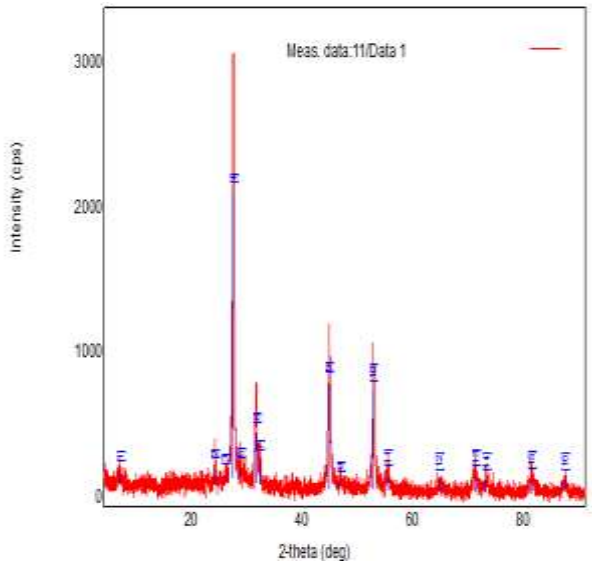
Sample	Total Mercury	Mercurous Mercury	Mercuric Mercury	Free Mercury	Gold
RGP-B	14.1 %	2.71 %	11.39 %	0.00%	0.38 %

Estimation of Sulphur by Eschka Method

Sample	Total Sulphur	Sulphide	Sulphate	Free Sulphur
RGP-B	6.50 %	5.90 %	0.60 %	Nil

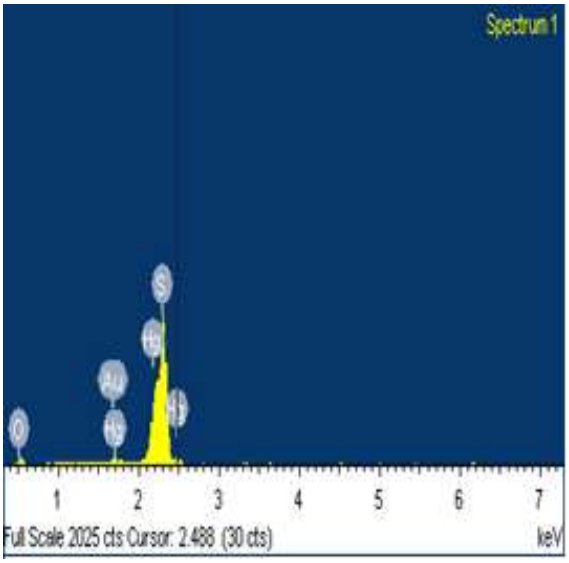
Showing FT-IR Peak values of RGP-B

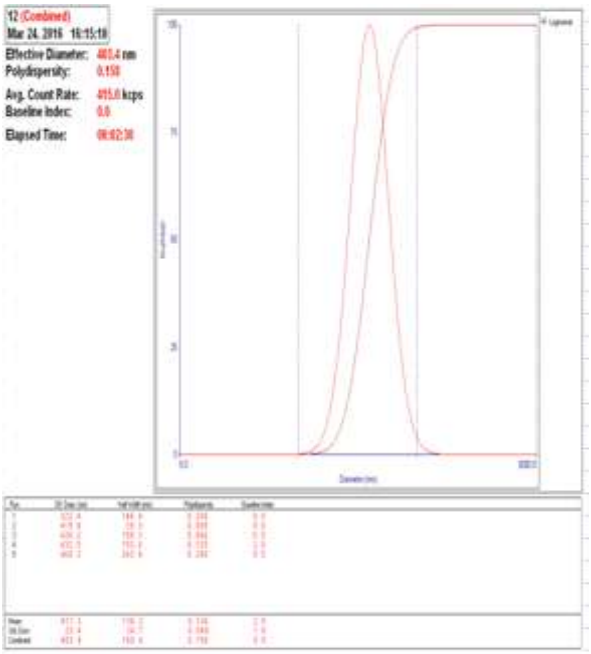
Sample	Functional Group
RGP-B	Amides, Primary & secondary Amines, Alcohol/Phenol, Alkenyl, Carboxylic acids, Ketone, Aromatic, Nitro, Esters, Alkenes, Bromides, Iodides



X-Ray Diffraction Results

Sample	RGP-B
Compound Name	Meta-cinnabar
	Gold Sulphide
Chemical Formula	Hg
	Au_2S
Crystal Structure	Cubic
	Cubic





SEM-EDX

	RGP-B	
Elements	**Wt. %**	**At %**
C	34.22	58.85
O_2	15.81	20.61
S	26.56	17.47
Hg M	22.85	2.37
Au M	0.56	0.70

Practical Size

Sample	Effective diameter	Half width diameter
RGP-B	Mean diameter- 411.3nm Std error-23.4nm Combined- 403.4nm	Mean diameter- 136.3nm Std error-34.7 nm Combined- 160.4nm

DISCUSSION

R.G.P. is a Sagandha, Sagni, Bahirdhooma, Gandhaka jaarita, Kajjali bandha Pottali Kalpana containing Parada, Shuddha Gandhaka churna, Swarnatantu Khanda.

It is explained by Pandith Hariprapannaji in Rasa yoga sagara along with other Pottali Kalpanas. It can be used in Shwasa, Kaasa, Rajayakshma, Jeernajwara & Sannipathaavastha along with Rogochitha Pathya.

Kajjali Mardana: After 72 hrs Kajjali appeared Smooth and Rekhapornata test found positive. For better fineness and smoothness of kajjali, mardana was continued up to 280 hrs.

Bhavana dravyas

Babbula Niryasa

Gum Arabic's mixture of polysaccharides and glycoprotein gives it the properties of glue and thus acts as a binding agent in RGP-B. Parts of Babbula tree are having Kashaya rasa, Sheeta veerya, Guru and Ruksha guna, Katu vipaka, Kapha hara. Its Niryasa is having Pitta-Vata hara property.

Shape of Pottali after paka: Round / Bolus & crispy, because of early melting of gum and loosening of bonds between the molecules.

Paka kala and Compactness of Pottali

RGP-B's Pakakala is estimated as 7 hrs. The Pottali reduces its hardness and became Round / Bolus & crispy, because of early melting of gum and loosening of bonds between the molecules; the property attributed by Gum Acacia.

PH is slightly acidic in Nature.

RGP-B possess least amount of 'Acid insoluble ash' and on par with standards, which signifies that, a considerable amount of drug is soluble in the acidic media of stomach.

It also has least 'water soluble ash value', indicating that water is not soluble media for it. So salivary secretions, gastric enzymes play an important role in its dissolution.

'Loss on drying at 110^0C' is 0.00% hence it is having least amount of moisture content and very rare chance of bacterial and fungal growth. The drug is having least hygroscopic activity with less chances of contamination.

Concurrently it can be stated that the shelf life of the drug in the present study is more.

As the number of trituration period increased and by the effect of Gandhaka paka it is observed that there is increase in percentage of *Mercuric mercury* i.e. 11.39 % and decrease in percentage of *Mercurous mercury* i.e.. 2.71%. "Means after subjecting to Gandhaka paka *Mercurous mercury* is less compared to the *Mercuric mercury*" This clearly indicates that RGP-B is more *mercuric mercury* form rather than the *Mercurous form.*

'Percentage of Free Sulphur' is Nil. This clearly indicates by doing Kajjali and Gandhaka paka there is a reduction in free sulphur and it forms more bondage with mercury.

There is no drastic change in the percentage of Gold in before Gandhaka paka and after Gandhaka paka. RGP-B: 0.38%.

XRD: The d-space and 2 theta values of the sample RGP-B when compared with the standards, confirmed the presence of cubic crystal of Meta-cinnabar (Hg) and Gold sulphide (Au_2S).

EDAX: RGP-B Shows Presence of C, O_2, S, Hg and Au elements in slight difference in their percentage.

The change percentage of elements may be due to the heat treatment, which causes breaking of bond and the formation of new bond with the evaporation of certain gases like SO_2 resulting in the increase and decrease of other elements.

FTIR: Analysis of RGP-B shows *Amides, Primary & secondary Amines, Alcohol/Phenol, Alkenyl, Carboxylic acids, Ketone, Aromatic, Nitro, Esters, Alkenes, Bromides, Iodides*

This shows the presence of organic compounds in the drug. *Here* milk and ghee may be the source for *Amines, Iodides,* and *Esters.* Nimbu swarasa is the source for *Carboxylic acids*. Babbula Niryasa may be the source of *amines, Carboxylic acids.*

Particles Size: Mean particle size of: RGP-B is 411.3nm.

CONCLUSION

Pottali Kalpana can be understood as a specific Pharmaceutical technique which is intended for keeping different constituents in their processed, purified, incinerated, sindhoora form into unique complex formula.
As per the classical reference the Rasagarbha pottalis is prepared by bhavana dravya "Babbula Niryasa".

By analyzing the comparative pharmaceutical points one can conclude that,

RGP-B pottalis can be prepared in 7hrs of Paka kala. Paka kala should be optimum. Giving more heat may break the pottali into cracks and its hardness will reduce. Babbula is a gum, due to intense heat exposure the RGP-B attained a round shape and crispy in consistency.

By the Loss on drying at 110^0 C it can be stated that the drug is having least hygroscopic activity with less chances of contamination.

A considerable amount of drug is soluble in the acidic media of stomach since it possess least amount of 'Acid insoluble ash'

The drug is composed of cubic crystal of Meta-cinnabar (Hg) and Gold sulphide (Au_2S) and Presence of C, O_2, S, Hg and Au elements.

It also contains *Amines, Iodides, Esters* and Carboxylic acids. It is having least hygroscopic activity with less chances of contamination of drug.

411.3nm is the particle size of Babbula Niryasa bhavita Rasa garbha Pottali.

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