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PHARMACEUTICO ANALYTICAL STUDY OF LOHAGARBHA POTTALI

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ABSTRACT

LohagarbhaPottali is a unique formulation beneficial in disorders like *Sangrahani, Pandu, Kaamala, Raktakshobha, Prameha & Pradara*. Even though it is an effective & unique formulation till date no research work has been carried out. The aim of this study was Preparation of *Loha Garbha Pottali* & Physico-chemical Analysis of *Loha Garbha Pottali*. ***Lohagarbha Pottali*** was prepared using *Loha Bhasma-10 Karsha, VishudhaKajjali- 1 Karsha, Shuddha Gandhaka - 1 Tanka, Shuddha Swarnata-nutantukanda- 6 rattika*. The above ingredients were mixed to get a homogenous mixture of *Loha-garbhaPottaliKajjali*, which was given *Bhavana* with *Kumariswarasa* for 7 days. Preparation of *Lo-hagarbha Pottali* was done by *Gandhakapaka* method using *Valukayantra*.

Keywords: *Loha Garbha Pottali; Loha bhasma*; XRD; SEM-EDAX; FTIR.

INTRODUCTION

Rasa Shastra was developed to achieve two main aims *Lohavada & Dehavada. Rasou-shadhis* became popular day by day due to their unique assimilatory organo-metallic con-stitution. Newer methods and techniques were evolved so as to provide effective & safe treatment namely *Sindoora, Bhasma, Pottali, Parpati* etc. Among them *Pottali Kalpana* is a treasure of peculiar but prodigious pharma-ceutical formulation. It is very potent, concise and of all the formulations in *Ayurveda*, it has carved a niche for itself.

Lohagarbha Pottali[1] is one such formulation, mentioned in classics, which is prepared by *Gandhakadrava* method i.e the prepared *loha-garbha Pottali* is subjected to *paka* in a pot containing molten Sulphur which is given in-direct heat through *valukayantra.*

MATERIALS & METHODS

Pharmaceutical steps involved in preparation of *Lohagarbha Pottali*[1]

1. *Dhatupisti* is prepared using *Hingulottha-Parada* and *Shuddha Swarnatantu* then *PishtiPrakshalana* was carried out.

2. *ShuddhaGandhaka & Loha bhasma* was added and as per the procedure *Kajjali* was prepared.
3. *Bhavana* was given with *Kumari Swarasa* for 7 times, and *Shikhararambhakara* was given & dried under shade.
4. It was wrapped in four layered silk cloth containing *shodhitaGandhaka* and subjected to *Gandhakapaka* till *Pottali siddhi lakshanas* appeared.

Preparation of *Lohagarbha Pottali Kajjali*

Materials : *DhatuPisti Kajjali*[2]

ShodhitaSwarna Patra	*- 2.25g.*
ShodhitaHingulotthaParada	*- 18g and*
Nimbuswarasa	*- 50 ml*
SaindhavaLavana	*- 1pinch*
Luke warm Water	- Sufficient quantity
ShuddhaGandhaka	*- 18g*

DhatuPistiKajjali - 38.25 g
ShuddhaGandhaka- 9 g
Loha Bhasma -360g

Equipments: *Khalvayantra*, Steel Vessel, Steel Spoon, Clean Cora cloth

Procedure: [Fig 1&2]

The procedure told in the classics for the preparation of *Dhatupisti Kajjali* is same as that of preparation of normal *samaguna Kajjali.* Here *swarna*etc metals are amalgamated into *parada* without the addition of any liquids. Trituration is carried out till a fine homogenous mixture of *kajjala* consistency is obtained.

The method of preparation followed in the study is as follows:

- *ShodhitaSwarnapatra* was cut into tiny pieces and added slowly into *Khalvayantra* containing *ShodhitaParada*. Continuous *mardana* (trituration) was carried out.
- As *mardana* continued within 10min the pieces of *Swarna* turned into Silver colour.
- After 6 hrs of *mardana* complete amalgamation of *Swarna*in *Parada* had taken place. *Mardana* was done for a total period of 24 hrs.
- After complete formation of *Pisti, SaindhavaLavana* and *NimbuSwarasa* was added and triturated well for 4 hours again. Then washed with lukewarm water, until the water stopped turning into black colour and all the acid content disappeared.
- Fine powder of *ShodhitaGandhaka* was added tothe prepared *DhatuPistiKajjali* and triturated with uniform speed till all the *Kajjali Lakshanas* were observed, i.e. the whole mixture converted into a fine, smooth, lusterless powder.
- Totally 150 Hrs of *KajjaliMardana* was done.

Mixing of *Loha bhasma*to *Kajjali*.

- *Loha bhasma* was added to the prepared *Kajjali*, initially the mixture was Bluish black in colour.
- After 5 hrs, *peshani* the mixture had become homogeneous.
- After 10 i.e. totally 160 hours the mixture had attained *Rekhapurnatva* and *Slakshnatva*, emission of dust particles observed during *mardana*, *Varitara* test was positive.
- *Kajjali* was taken between wet thumb and index finger rubbed and seen it in sunlight few shining particles were counted.

***KajjaliBhavana* (Levigation) with *Kumari Swarasa* (Juice of Kumari Pulp)[Fig 3 &4]**

Drugs used:
Lohagarbha Pottali Kajjali- 407 g,
KumariSwarasa -200ml.

Procedure: 407 g of *Kajjali* was taken in a clean *Khalwayantra*. To this 200 ml *Kumariswarasa* (Juice of Kumari Pulp) was added, and *bhavana* (levigation) was done. This procedure was repeated for 7 days with fresh *KumariSwarasa* (Juice of Kumari Pulp) everyday. On 8th day *bhavana* (levigation) was continued till minimum quantity of moisture content required to give shape remained. It was then formed into *'Shikararamba' akara* i.e shape of the mountain tip& dried [Fig 5]

Table 1: Observations during *Bhavana*with *KumariSwarasa*

Day	Qty of *Kumari*	Durationof *Bhavana*	Observation
1	200 ml	6 ½ hr	Colour of *Kajjali* became darker.
2	130 ml	6 hrs	Colour was black.
3	140 ml	6 hrs	Colour was black with persistent irritant odour. *Kajjali* became softer in texture.
4	140 ml	7 hrs	Colour was black.
5	145 ml	7 hrs	Colour was black with slight irritant odour. During *bhavana* movement of *peshani* became little difficult as *Kajjali* had become stickier.
6	130 ml	7 hrs	Colour was black. During *bhavana* movement of *peshani* became little difficult as *Kajjali* had become stickier.
7	130 ml	7 hrs	Colour was black with irritant odour reduced. Stickiness & oily texture observed during *bhavana.*

Results:

- Quantity of *Lohagarbha Pottali Kajjali* taken : 407 g
- Quantity of *Lohagarbha Pottali Kajjali* after *bhavana* : 433 g
- Gain in weight : 26 g

***Pottali* Preparation- *Gandhakapaka* Method: [3](Fig 6, 7 & 8)**

The procedure has been divided under 3 **headings** as follows**:**

1. ***Purva Karma*:**
a. Preparation of *Pottali* for *GandhakaPaka*
b. Placing of *Ghata* in *ValukaYantra*.
2. ***Pradhana Karma*:**
a. Uniform Heating Pattern
b. Observation and Recording of Temperature
c. Maintaining the *Gandhaka* Level
3. ***Paschat Karma* :**
a. Removal of *Pottali* from *Gandhaka* media
b. Removal of debris around the *Pottali*
c. Collection of Final product.

The Study was carried out in 2 phases as pilot study & main study. Based on the results of pilot study main study was done. 2 batches of main study were conducted.

Pilot Study (Fig 9, 10& 11)

Drug used: 8 *LohagarbhaPottalis*, 12g *ShuddhaGandhaka* for each *pottali*

Table 2: observations of *Gandhaka* Pilot Study

Pottali	Time of Removal	Observations	Colour	Weight		
				Before Drying	After Drying	After *paka*
1st*Pottali*	48 mins	-	Greyish black	15.5g	13.5 g	13.5g
2nd*Pottali*	1 ½ hrs	-	Dull black	16 g	13.5 g	14
3rd*Pottali*	3 hrs	-	Black	16 g	13.5 g	15
4th*Pottali*	6 hrs	Metallic sound Clearly heard	Black	16 g	13.5 g	15.5
5th*Pottali*	8 hrs	Metallic sound heard	Jet black	17 g	14.5 g	17
6th*Pottali*	9 hrs	Metallic sound heard	Jet black	16 g	14 g	16
7th*Pottali*	10hrs	Metallic sound heard	Jet black	17 g	14 g	17.5
8th *Pottali*	12hrs	Metallic sound heard	Jet black	17 g	14.5 g	17.5

So by above the practical, based on classically laid criteria the *LohagarbhaPottaliPaka* should be carried out upto8 hours i.e 6 hours is enough for *Pottali Paka* after the melting of sulfur.

Main Study

Drug Used: *Lohagarbha Pottali*-47g.

***Purva Karma*[Fig 6,7&8]**

- Thin layer of *ShodhitaGandhaka* was spread uniformly on silk cloth. Another silk cloth was placed over the previous silk cloth upon which *shodhitaGandhaka* was spread again. *Lohagarbha Pottali* dried in shade was tied in 4 layers of silk cloth smeared with *Gandhaka* powder.
- Quantity of *ShodhitaGandhaka* was equal quantity to the total weight of *Pottali* i.e 12g on each layer.
- *Pottali* was wrapped with silk cloth and tied with catgut thread tightly and was suspended from crossbars made from an Iron rod.

Placement of *Ghata* in *Valukayantra*

Materials: *LohaBhanda* (Iron pan) with handle, *loha shalaka* with *Pottali* (Iron rod), *MritGhata* (mud pot) filled with *Sh.Gandhaka*-4000g

Procedure:

- *Loha Bhanda* (Iron pan) was first filled with a thin layer of sand (4cm), over this *ShodhitaGandhaka* filled *Ghata* was placed at the exact center.

- Pyrometer was placed 5 cm away from the *Ghata* and 4 cm from the bottom of *ValukaYantra.*
- Remaining portion of the *Yantra* was filled with sand (35.kg) upto the neck of the *Ghata*

***Pradhana Karma: Gandhakapaka of Pottali*[Fig 12]**

1. The *ValukaYantra* was subjected to *mridu-vagni*i.e150^{0}C – 250^{0}C.Temperature reading was carried out with the help of pyrometer with thermocouple at every fifteen minutes interval.
2. After the complete melting of *Gandhaka, Pottali* was suspended in the molten Sulfur.
3. *ShodhitaGandhaka* was added whenever Sulfur quantity reduced below the knot tied to the *pottali.*

Paschat Karma:

a) Removal of *pottali* from *Gandhaka* media

b) Removal of debris around the *pottali*

c) Collection of Final product.

Method:[Fig 13 &14]

- After the attainment of complete *pakalakshanai.e vyoma varna* (Bluish-black)of *Gandhaka*, Burning of Silk cloth and Metallic sound, the *pottali* was removed and collected in separate container and allowed to cool down a bit.
- Debris attached to the *pottali* like burnt silk cloth, sulfur was scraped till smooth surface was attained.

Table 3: Showing Temperature record during*LohagarbhaPottaliPaka* (Batch I)

Time	Temp (°c)	Observation
5.30am	19	4000 g of *shuddhaGandhaka* taken, *Agni* is ignited.
5.45am	50	
6.00am	100	
6.15	160	*Gandhaka* started to melt.
6.30am	200	
6.45am	220	
7-00am	250	
7.15	270	
7.30	240	
7.45	250	Complete melting of *Gandhaka. Pottali* suspended in molten Sulfur
8-00am	250	Golden yellow colour of Sulfur is observed
8.15	250	
8.30	250	Sulfur turned to dark yellow
8.45	270	
9-00am	272	Scum collected at the surface of *paka* removed
9.15	272	
9.30	271	Slight increase in viscosity of Sulfur observed.
9.45	260	
10-00am	258	Sulfur turns brownish red in colour
10.15	254	Sulfur fumes became denser
10.30	237	

10.45	231	Colour of Sulfur was dark brown with red tinge
11-00am	235	
11.15	235	Dark brown colour of *Gandhaka* is observed
11.30	250	
11.45	250	
12-00pm	240	
12.15	244	*Gandhaka* attained Dark brown colour
12.30	246	
12.45	248	
1-00pm	248	
1.15	248	Dense fumes of Sulfur seen
1.30	248	
1.45	248	*Gandhaka* appeared Brown with bluish tinge
2-00pm	248	
2.15	248	*Pottali* fell into *Gandhakapaka* due to burning of silk cloth.

Graph 1: showing the temperature pattern of Batch I - L.G.P

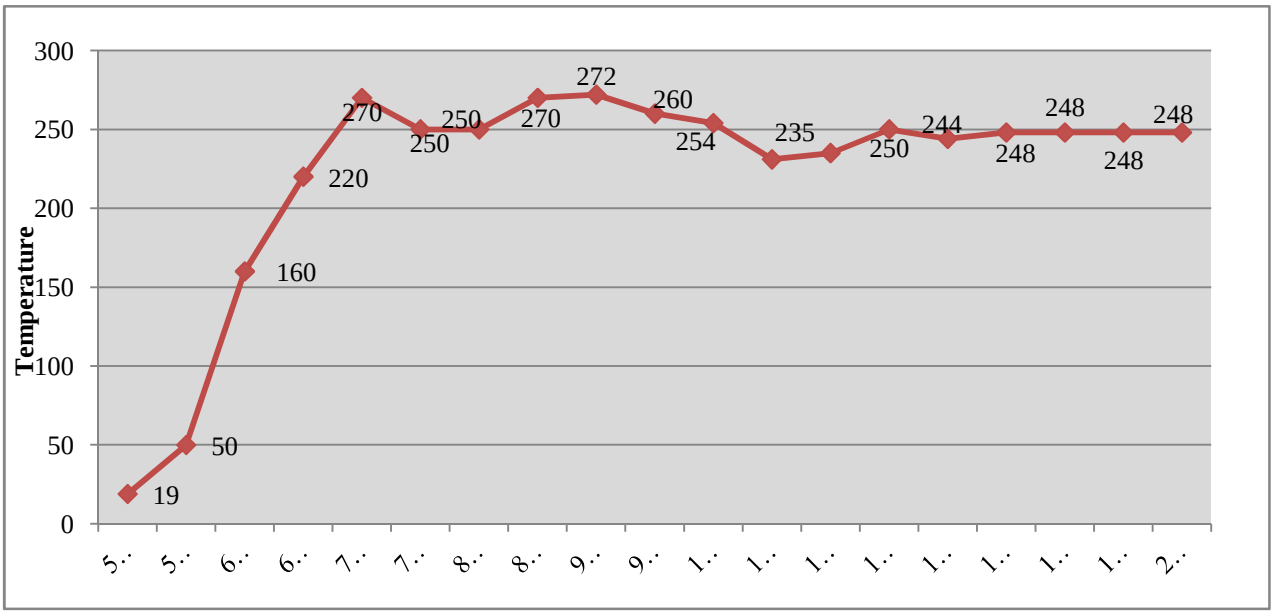


Table 4: Results of batch *Lohagarbha Pottali*

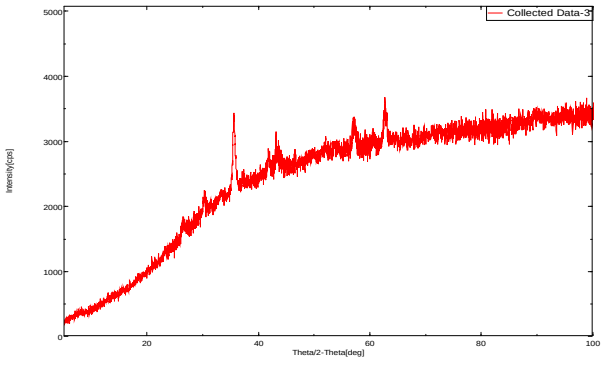
Result	Batch I	Batch II
Initial weight of *Lohagarbha Pottali* before *paka*	47g	48g
Weight of *Lohagarbha Pottali*after *paka*	47 g	51g
loss of weight after *paka*	Nil	3 g
Total *ShuddhaGandhaka* required for *paka*	4000g	3800g
Total duration of heat given	8 hours 45 mins i.e 6 hr 30 mins after *Gandhaka-paka*	6 hours 30 mins i.e 4 hours 30 mins after *Gand-hakapaka*

Table 5: Organoleptic &Physico-Chemical characters of *Lohagarbha PottaliKajjali* & *Lohagarbha Pottali*

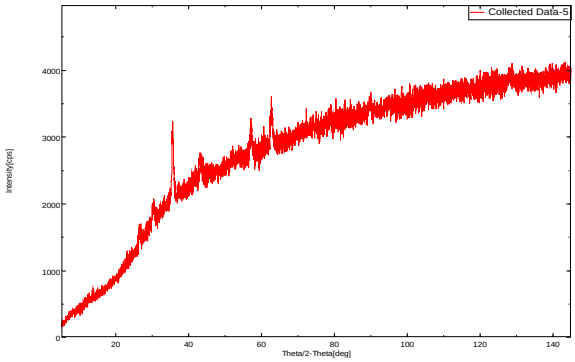
Parameters	*Lohagarbha Pottali Kajjali*	*Lohagarbha Pottali*
Colour	Black	Black
Taste	Astringent	Astringent
Odour	Odourless	Odourless
Touch	Amorphous	Amorphous
Total Ash, w/w	87.00%	80.55%
Acid insoluble ash, w/w	4.80%	5.10%
Water soluble ash, w/w	5.15%	4.50%
Loss on drying at 110^0C, w/w	0.50%	0.90%
pH	7.60	6.62
Total Iron	21.55%	20.83%
Ferric	7.59%	8.21%
Ferrous	13.96%	12.62%
Mercury	8.50%	7.20%
Sulfur	13.35%	22.44%
Gold	0.25%	0.35%

XRD Results of *Lohagarbha Pottali Kajjali&Lohagarbha Pottali*

- XRD peaks of the *LohagarbhaPottalikajjali* sample which were compared with standard D-space JCPDF values confirmed that the presence of Hematite (Fe2O3)- Trigonal, Magnetite (Fe3O4) – Cubic crystal System, Cinnabar (HgS) in Hexagonal crystal system and Auric Oxide (AuO) in Orthorhombic crystal system.
- XRD peaks of the *LohagarbhaPottali* sample which were compared with standard D-space JCPDF values confirmed that the presence of Hematite (Fe_2O_3). Trigonal, Magnetite (Fe_3O_4) –Cubic crystal System, Mercury Sulphide (HgS) in Cubic crystal system and Auric Oxide (AuO) in Orthorhombic crystal system.



Graph 1: Peaks of *Lohagarbha Pottali KajjaliXRD*

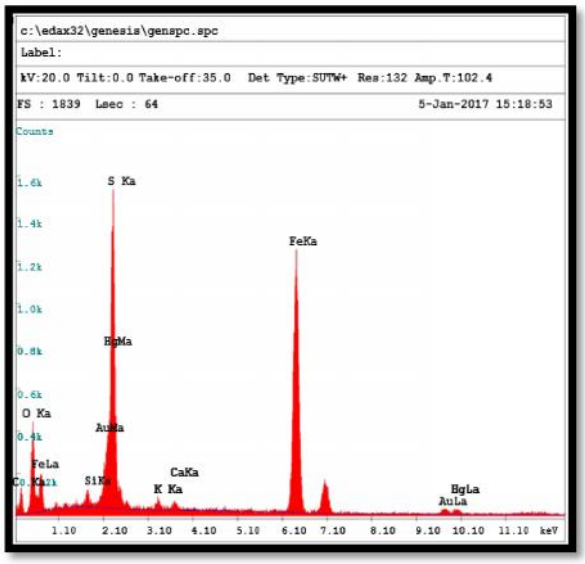


Graph 2: Peaks of *Lohagarbha Pottali* XRD

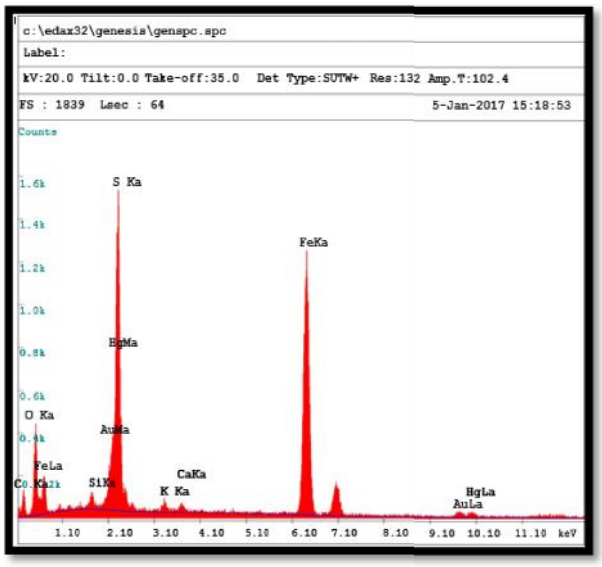
Table 6: Showing Comparative SEM EDX results of *Lohagarbha PottaliKajjali, Lohagarbha Pottali*

LohagarbhaPottaliKajjali [Fig 15&16]				*LohagarbhaPottali* [Fig17 &18]			
Element	Mass %	Element	Mass %	Element	Mass %	Element	Mass %
C	13.26	Ca	0.78	C	11.08	Ca	0.56
O	9.62	Fe	50.31	O	9.33	Fe	42.63
Mg	-	K	1.33	Mg	-	K	0.68
Si	0.61	Hg	13.25	Si	0.73	Hg	11.43
S	6.20	Au	4.66	S	13.72	Au	9.85

Graph 3:Depicting EDAX of Lohagarbha Pottali Kajjali

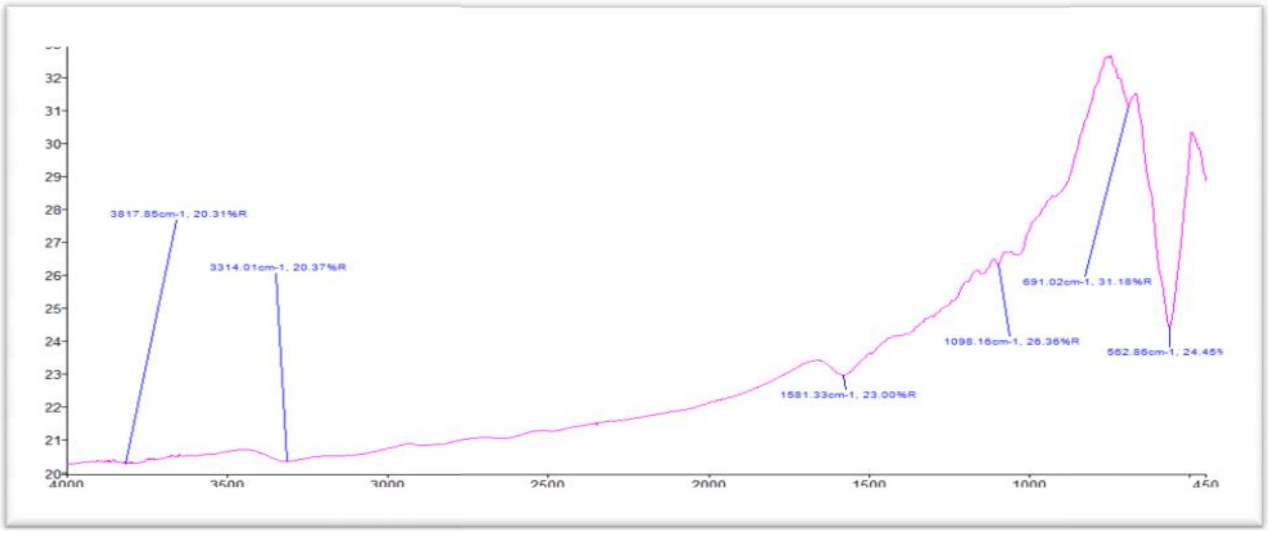


Graph 4:Depicting EDAX of Lohagarbha Pottali



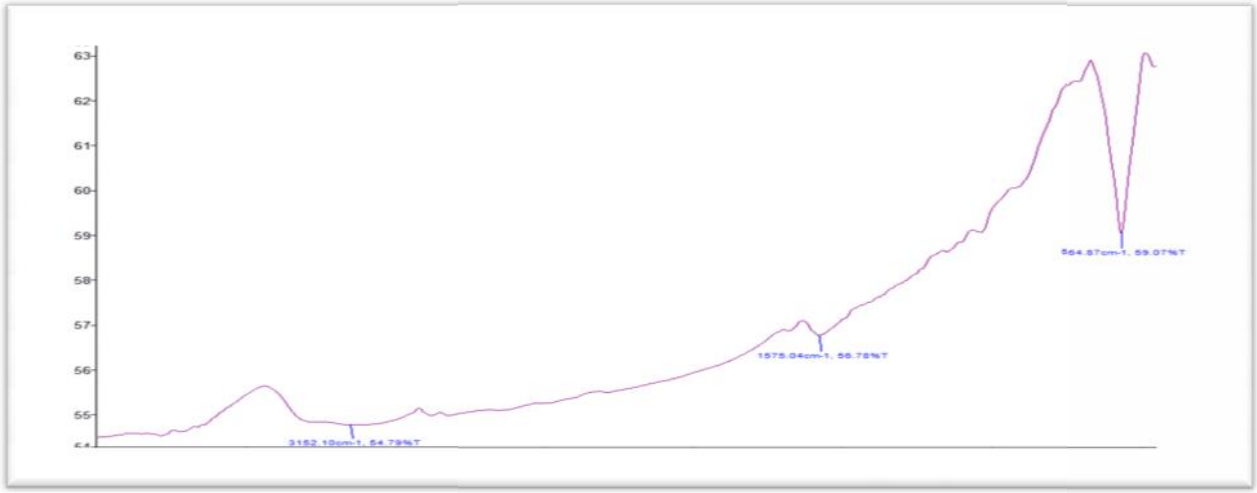
FTIR:

- FTIR analysis of *LohagarbhaPottali Kajjali* shows it contains Organic compounds with functional groups like alcohols, phenols, Amines, amides, Alcohols, carboxylic acids, esters, ethers, Alkenes, Aromatics, Alkyl halides, Alkynes.
- FTIR analysis of *Lohagarbha Pottali*- shows it contains Organic compounds with functional groups like carboxylic acids, Primary and secondary amines and amides, cyclic alkene, Amide, Alkyl halides



Graph 5: Lohagarbha Pottali Kajjali Graph & Peaks

Peak Number	X (cm-1)	Y (%R)
1	3817.85	20.31
2	3314.01	20.37
3	1581.33	23.00
4	1098.16	26.36
5	691.02	31.18
6	562.86	24.45



Graph 6: *Lohagarbha Pottali* Graph & Peaks

Peak Number	X (cm-1)	Y (%R)
1	3152.10	54.79
2	1575.04	56.78
3	564.87	59.07

Table 7: Showing Particle Size Results of *Lohagarbha PottaliKajjali & Lohagarbha Pottali*

	Effective Diameter(nm)		
Sample	Mean diameter (nm)	Standard error	Effective diameter (nm)
Lohagarbha PottaliKajjali	578.1 nm	11.5	575.9 nm
Lohagarbha Pottali	360 nm	9.6	362.1 nm

DISCUSSION

Preparation of *Kajjali* for *Lohagarbha Pottali*: By taking cross reference of *Kupipakwa Rasayana*, in this context first *dhatupisti* was prepared, later *Gandhaka & Loha bhasma* was added to prepare *Lohagarbha Pottali Kajjali*i.e

If *Kajjali* is to be prepared by adding *Dhatus* (Metals) such as *Svarna* (gold), *Tamra* (Copper) etc, then, *parada* should be first triturated with the *Dhatu* (Metal) till it becomes a homogeneous mixture. Later *Gandhaka* is to be added and *Mardana* has to be done till it becomes *'Anjanasadrushasukshmachurna'* i.e as fine as collyrium.

Bhavana with *KumariSwarasa* helps in particle size reduction, uniform mixing of *Kajjali*and potentiating of the product and to bring compactness. It may also add some organic and inorganic trace element into the final compound along with enhancement of therapeutic qualities of the compound. During *Pottali paka* some organic matter will be burnt in to carbon form and this carbon has a major role to play in reducing loss of mercury along with Sulfur.

Giving pyramid shape to the *Kajjali* might be to keep the ingredients of *Lohagarbha Pottali Kajjali* in compact form to prepare condensed compact medicine.

Pilot study of *LohagarbhaPottali*: This practical was carried out to assess the duration of heat required for *Loha Garbha Pottali Paka*. During the entire procedure *mriduvagni*was maintained i.e 160^0- 240^0C.

By the observations of Pilot study, the time duration required for the clear appreciation of *Pottali pakalakshana i.e vyoma varna* (Bluish-black) of *Gandhaka*, Burning of Silk cloth and Metallic sound, was fixed to be at 6 Hrs.

Analytical study:

- The Total Ash of *Lohagarbha Pottali Kajjali & Lohagarbha Pottali* was found to be 87.00%, 80.55% respectively indicating that the samples have very less impurities.
- Acid insoluble ash of the *LohagarbhaPottali Kajjali & Lohagarbha Pottali* was 4.80% and 5.10% respectively indicating that the drug is easily soluble in the gastric environment.
- The water soluble ash of *LohagarbhaPottali Kajjali & Lohagarbha Pottali*5.15% and 4.50%. As the values are less it indicates that water is not soluble media for it.

CONCLUSION

Lohagarbha Pottali Kajjali, was given *KumariSwarasaBhavana* daily 3hrs for 7 days, and then shaped into *shikararambhaakara*, dried under shade & subjected to *Gandhaka-*

paka in an earthen pot which was placed in *Valukayantra. Mridvagni* (150ºC- 250ºC) plays an important role for proper preparation of *Lohagarbha Pottali*, black colour yield was obtained and the average yield of *Lohagarbha Pottali*, was 103.3% after *Pottali paka.*

All the *lakshanas* were seen in all batches of *Lohagarbha Pottali*. By taking the average of I & II study conclusion can be drawn that 5 to 5 hrs 3o mins (based on the appearance of *siddhi lakshana*) might be sufficient for the *paka* of *Lohagarbha Pottali*.

Chemically *LohagarbhaPottali* is considered as a complex compound of Fe_2O_3, Fe_3O_4, S, HgS & AuOalong with the organic compounds with their functional groups like carboxylic acids, Primary and secondary amines and amides, cyclic alkene, Amide, Alkyl halides. Hence *Lohagarbha Pottali* can be considered as an Organo-Metallic complex compound.

PHOTOS:

Fig 1 Fig 2 Fig 3

DhatupistiKajjali LGP Kajjali Adding *KumariSwarasa*

Fig 4 Fig 5 Fig 6

KumariSwarasaBhavana *ShikarambhaAkara* of LGPK *Gandhaka* smeared Silk cloth

Fig 7 Fig 8 Fig9



Pottali *ValukaYantra* Pilot Study

Fig 10 Fig 11

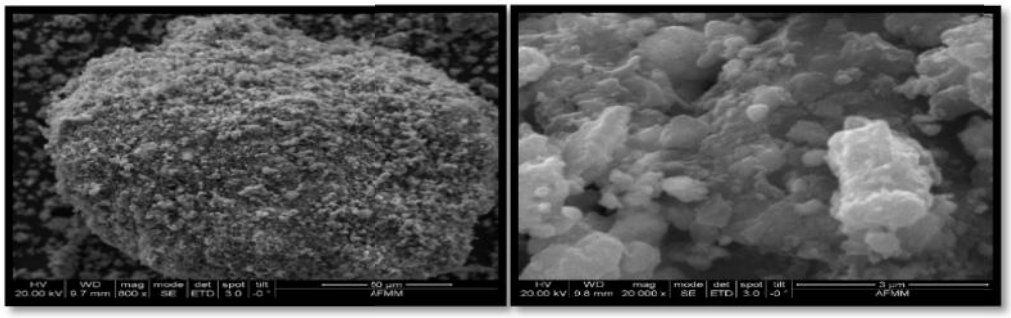

After 8hours Pilot Study- 8 Pottalis'

Fig 12 Fig 13 Fig 14



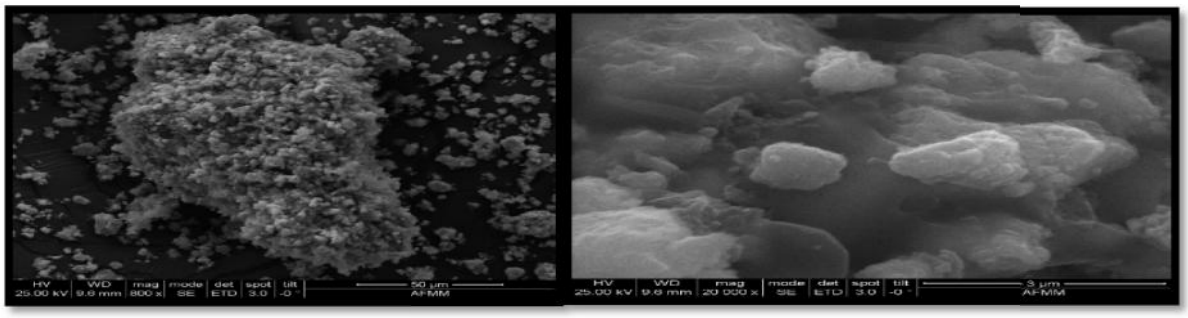
First Main Study 1st Main Study *Pottali* 1st *Pottali* &*Gandhaka paka* colour

Fig 15 Fig 16



Lohagarbha Pottali Kajjali SEM Images at 800 & 20k Magnification

Fig 17 Fig 18



Lohagarbha Pottali SEM Images at 800 & 20k Magnification

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