WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 11, Issue 5, 1847-1858. Research Article ISSN 2277– 7105

PRELIMINARY ANALYTICAL STUDY OF *TAARAGARBHA POTTALI*

Aishwarya Nair*[1] and M. S. Krishnamurthy[2]

[1]PG Scholar, Department of PG Studies in Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College, Moodbidri, Karnataka, India.

[2]Professor and HOD, Department of PG Studies in Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College, Moodbidri, Karnataka, India.

Article Received on
14 March 2022,

Revised on 03 April 2022,
Accepted on 24 April 2022

DOI: 10.20959/wjpr20225-23979

***Corresponding Author**
Dr. Aishwarya Nair
PG Scholar, Department of PG Studies in Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College, Moodbidri, Karnataka, India.

ABSTARCT

Pottali Kalpana is a consolidated form of mercurial preparation which incorporates the *Pota Bandha* of *Parada. Pottali* is a type of preparation which is emerged as a result of *Parada Murchana. Murchana* is a procedure in which mercury is ground thoroughly with other herbo-mineral drugs to make it therapeutically efficient. Here a research work is carried out on *Taaragarbha Pottali* by molten sulphur method for about 3 hours *Paka* and analyzed with classical and modern parameters. Here the particle size is found to be 296.6nm. In SEM-EDAX there is presence of C, Au, Al, Si, Ag, S, and Hg. XRD showed compounds with crystalline structure and split pseudo peaks. Along with these other Physico-chemical tests, NPST were carried out to show the standard values of the final product. Overall, a remarkable difference was observed in the sample of *Taaragarbha Pottali.*

KEYWORDS: *Pottali Kalpana, Pota Bandha, Taaragarbha Pottali*, SEM-EDAX, XRD.

INTRODUCTION

Pottali Rasayana is superior and innovative dosage form in Rasashastra, in the method of preparation, administration and has showed its remarkable excellence in unique dosage than other *Rasakalpas*. *Rasashastra* was developed to achieve two main aims *Lohavada* and *Dehavada*. *Rasaushadhis* became popular day by day due to their unique assimilatory organo- metallic constitution.

As per *Rasayoga Sagara*, *Taaragarbha Pottali* is being explained, and is selected for preparation, which is *Sagandha*, *Sagni*, *Bahirdhooma*, and *Gandhaka Jarita Pottali Kalpana*.[1] It consists of *Rajata Bhasma* 10 *Karsha*, *Swarna Bhasma* 6 *Rattika*, *Hingulottha Parada* 10 *Karsha* and *Shodhita Gandhaka* 1 *Tanka*. Here *Gandhaka Drava Paka* method has been carried out and analyzed for *Pottali Siddhi Lakshana* on ancient and modern parameters. After attaining all the *Siddhi Lakshanas*, it was analyzed for Physico-chemical analysis and all other instrumental techniques to check for genuinity and aiding towards the standardization of the final product of *Taaragarbha Pottali*.[2] The analytical methods reveal out the chemical composition of the formulation as well as their concentration. By this it helps to ensure safety limits and accuracy of the drug. In such a case for analysing the finished product as well as pharmaceutical procedures analytical study of Taaragarbha Pottali was carried out.

OBJECTIVES OF THE STUDY

To carry out analytical study of *Taaragarbha Pottali.*

MATERIALS AND METHODS

Materials

Classical organoleptic parameters were done in Laboratory of Department of Rasashastra and Bhaishajya Kalpana, Alva's Ayurveda Medical College, Moodubidire, Karnataka.

Other Qualitative and Quantitative chemical tests were done at quality control lab, Shree Dhoothapapeshwar Pvt.Ltd Mumbai.

X-ray Diffraction, SEM-EDAX was done at University of Mysore, Chamarajanagara.

NPST was done at Laboratory of Atma Research Center, Alva's Ayurveda Medical College, Moodubidire, Karnataka.

Method of Preparation of *Taaragarbha Pottali*

Firstly *Rajata Bhasma* is triturated with *Swarna Bhasma* till *Dhatu Pishti* is formed, then *Samaguna Kajjali* of required quantity is prepared separately and added to the above *Dhatu Gata Kajjali*, trituration is continued till *Kajjali Lakshanas* appears, then it is subjected to *Bhavana* with *Kumari Swarasa* for 7 times and made into *Sikarakara* shape. After drying this *Pottali* it is placed in the center of four folded silk cloth.[3] Then *Pottali* is subjected to *Gandhaka Drava Paka* where the entire procedure was carried out for 3 hours with *Mrudu Agni*, till *Pottali Siddhi Lakshanas* appears.

The *Pottali* after *Paka* has been analyzed on classical and modern parameters, Physico-chemical parameters, Quantitative and Qualitative modern parameters like XRD, SEM-EDAX and NPST.

OBSERVATIONS AND RESULTS

Analysis using classical parameters

Pottali Siddhi Lakshana like *Vyoma Varna* of *Gandhaka,* metallic sound when banged against *Bhanda* and with burning silk cloth. Different views are mentioned in *Rasashastra* texts regarding the duration of *Paka* of *Pottali*. They are *Yamardha, Yamaka, Chiram, and Dwighatika* or up to the attainment of *Vyoma Varna* of *Gandhaka*, considering all these it was concluded that 3 hours of processing is needed to attain all these *Siddhi Lakshanas*.[2] Other classical parameters like *Rekhapurnatva, Varitaratva, Nischandratva* and *Unnama Pareeksha* for *Taaragarbha Pottali* is tabulated in the below table.

Table 1: Classical Parameters for Analysis of *Taaragarbha Pottali.*

Test	Observation
Rekhapurnatva	When *Taaragarbha Pottali* was rubbed between the thumb and index finger it entered the furrows of the fingers
Varitaratva	When finely powdered *Taaragarbha Pottali* was carefully sprinkled into glass beaker containing water, it was floating on the water.
Nischandratva	There are no shining particle in the finely powdered *Taaragarbha Pottali* even when it was rubbed between thumb and index finger and made wet, observed in the bright sun light.
Unnama/Uttama Pareeksha	On placing a food grain over the floating *Taaragarbha Pottali*, the food grain also floats over *Bhasma* without sinking into the water.

Namboori Phased Spot Test (NPST)[4]

In NPST sensitivity of reaction at different time intervals is measured unlike the chromatography of chemistry. The continuous chemical reactions taking place gradually between 2 chemical substances on a static media at a fraction of second are easily detected by their distinct color changes and the pattern of spot which is specific to each *Rasa* formulation.

Table 2: Observations during NPST of *Taaragarbha Pottali.*

Phases	Observation timing	Changes noted
I	0-5th minute	Immediate drop developed creamy white area at the centre, surrounded by light coffee thin ring. Intermediate greyish-black ring followed by reddish brown periphery.
II	5-20th minute	Central creamy white with thick grey coloured ring, followed by reddish brown periphery was seen.
III	Up to 24hrs and above	Central creamy spot surrounded by light brown area followed by black ring surrounded by reddish brown periphery. Further there was no change noted for the whole day.

ANALYTICAL STUDY[5]

Organoleptic Characteristics

The specific characters that are mentioned in our classics for evaluating the qualities of preparation by color, touch, fineness, taste, odor etc. were noted through *Gnyanendriya* in the sample of *Taaragarbha Pottali.*

Table 3: Organoleptic characters of *Taaragarbha Pottali.*

Parameters	*Taaragarbha Pottali*
Colour	Dark black colour
Taste	Characteristic
Odour	Odourless
Touch	Fine powder which is smooth and soft
Shape	Solid mass present with definite shape

Physico- chemical Parameters[6]

The physical tests are carried out as per Pharmacopoeial standard techniques which helps is measuring the physical property that is characteristically related to the component. Then the convectional chemical analysis was carried out by Volumetric and Gravimetric method analysis.

Table 4: Physico-chemical characters of *Taaragarbha Pottali.*

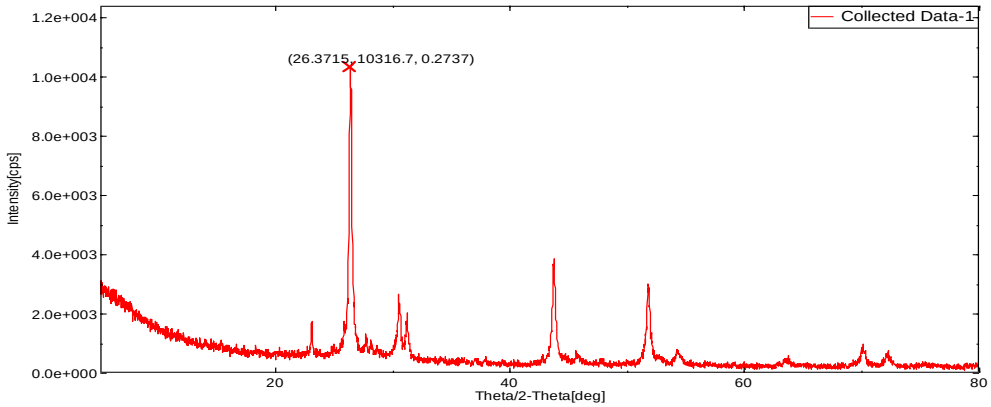
Sl. No.	Chemical analysis	Results
1	Total ash value	1.15% w/w
2	Acid insoluble ash	0.82% w/w
3	pH value (1% aqueous solution)	4.81
4	Loss on drying by 110^0 C	4.41% w/w
5	Water soluble ash	0.14% w/w
6	Loss on ignition	99% w/w

7	TLC Solvent system – Toluene: Ethyl acetate - 9:1	

Instrumental methods of analysis

X-Ray diffraction analysis[7]

XRD method determines the arrangement of atoms within a crystal with the help of X-rays. On analysis XRD peaks in this study were identified and is having pseudo split structure.



XRD graph of *Taaragarbha Pottali* sample.

Scan speed- 1.0000

Scan width- 0.0200 deg

Scan axis- 2 Theta

Scan range- 10.0000- 70.0000 deg

Peak shape- Split pseudo

Results of XRD

Angle 2θ	d space	Intensity
26.0526	3.37876	819.54
43.6921	2.07006	297
45.6343	1.98637	17.75

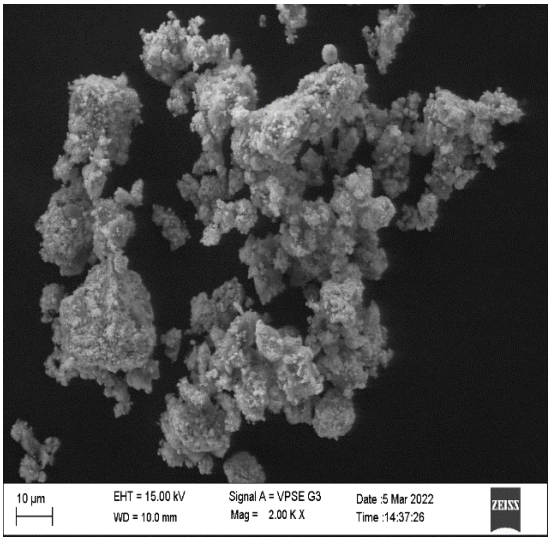
Total 16 peaks were identified, among that only 10 peaks are clearly visible from angle (2θ) 23.0526 to 72.0943. 3 strong peaks were chosen as strong with their relative intensity and compared to standard X-ray diffraction values. Peak with relative intensity of 8 was significant at angle 26.3566 having d space value 3.37876 and d space value of standard intensity percentage of *Taaragarbha Pottali* is nearer to the standard value.

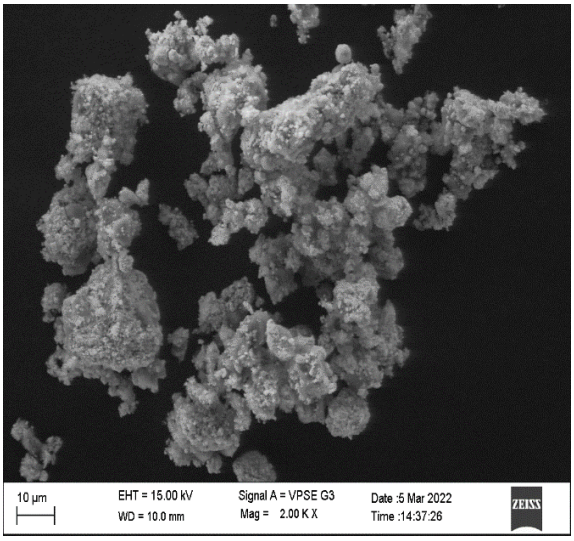
SEM-EDAX[8,9]

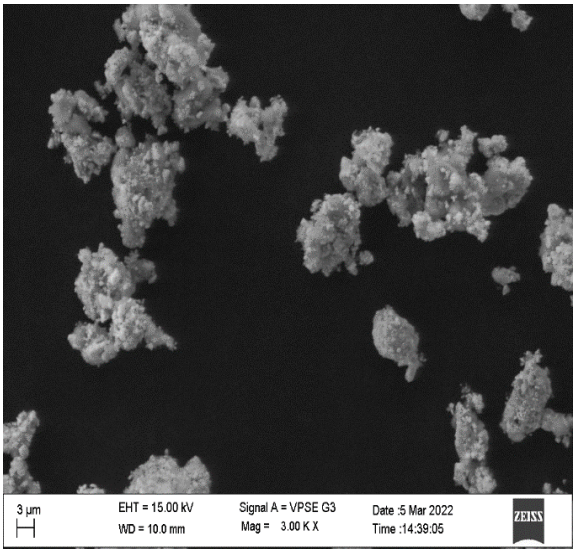
These were carried out in the sample of *Taaragarbha Pottali* and the elements present in those is tabulated in the following table.

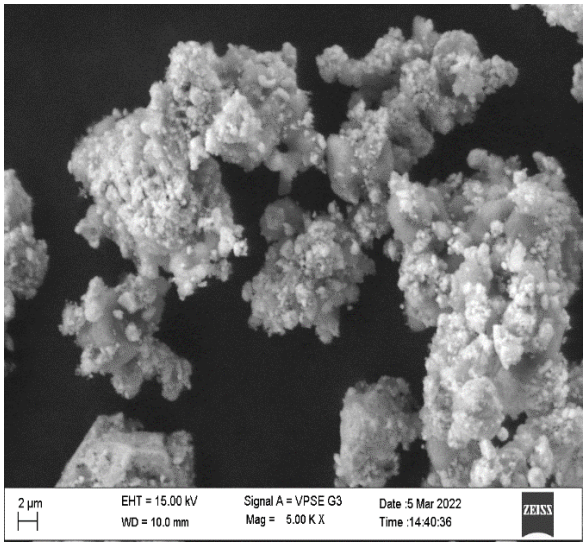
Particle size analysis by SEM has been calculated considering its length density, volume density and area density. In the present study Volume density mean is considered for determining the actual particle size of the sample as it covers length and area of the particle.

SEM images of *Taaragarbha Pottali* taken at different magnifications









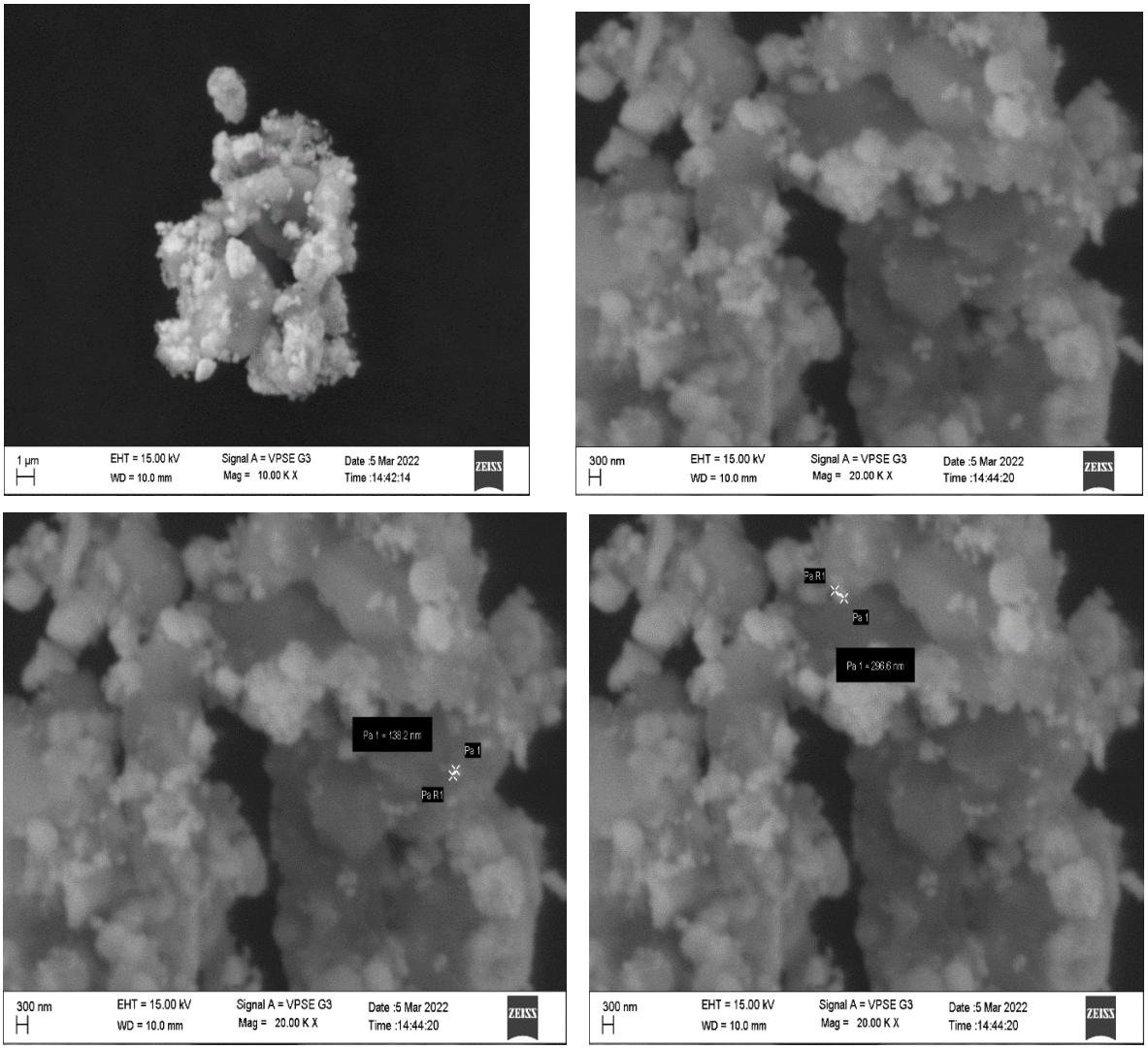
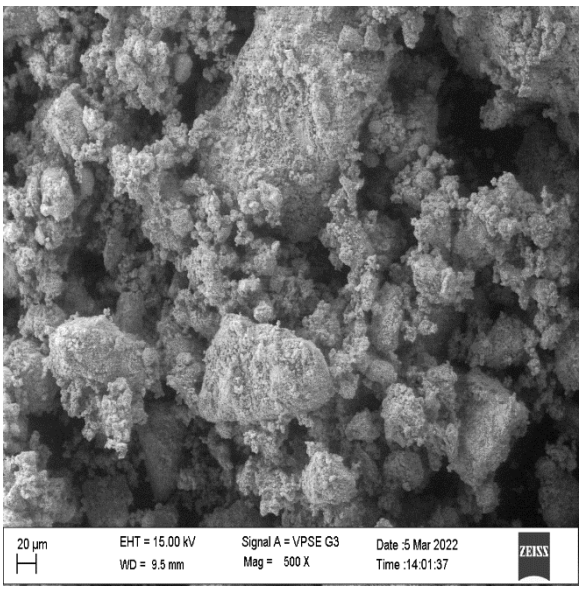
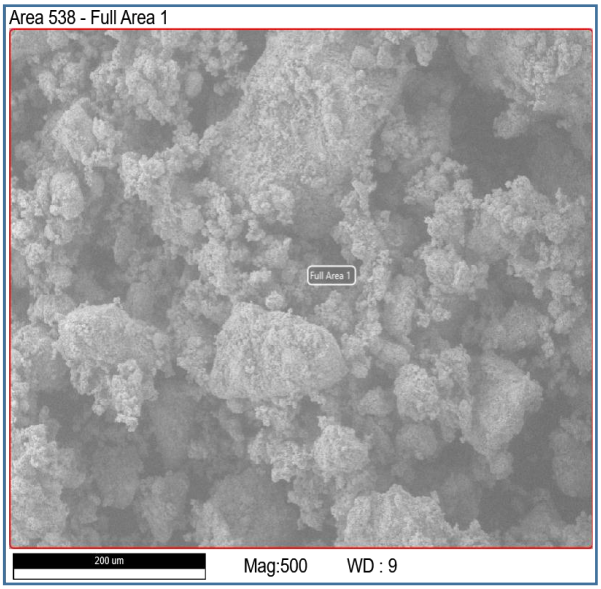


Table 5: Results of SEM in *Taaragarbha Pottali.*

Magnification	Particle size visibility range
200KX	10µm
100KX	10µm
300KX	3µm
500KX	2µm
1000KX	1µm
2000KX	300nm
2000 KX	138.2nm

EDAX images of *Taaragarbha Pottali* taken at different magnifications





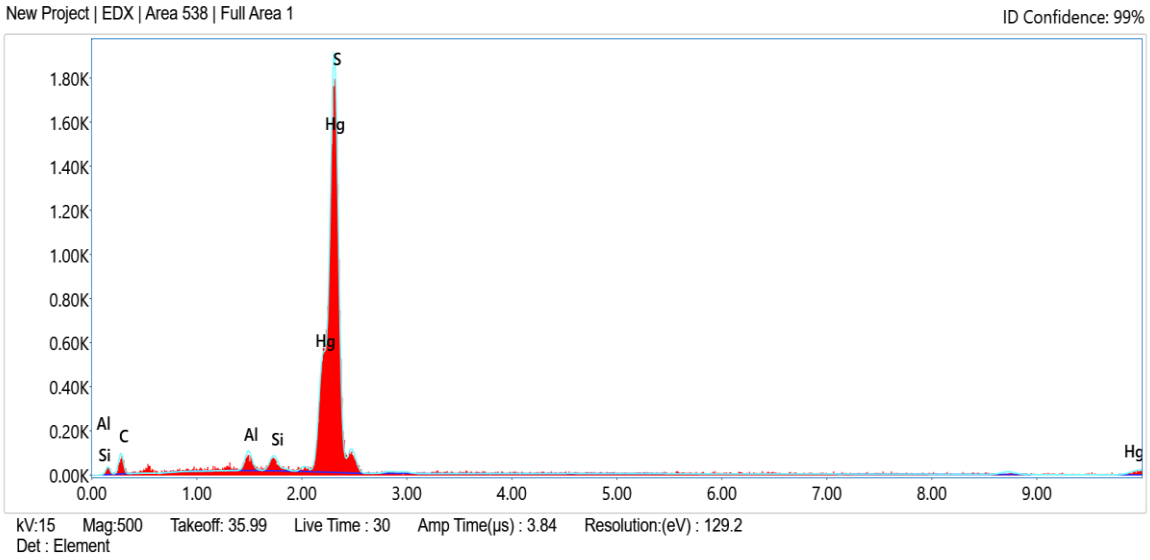


Table 6: Results of EDAX in *Taaragarbha Pottali.*

Element line	Mass (%)	Atomic (%)	Error %
C K	12.7	37.1	22.3
Al K	1.8	2.3	11.7
Si K	0.9	1.1	22.1
S K	48.4	53.1	4.2
Hg K	36.2	6.4	7.1
Au K	8.8	8.45	5.6

DISCUSSION

The *Gandhaka Drava Paka* used here has brought up a desired changes in the *Pottali* like critical analysis can be done in different steps.

Paka Lakshanas

As per the colour of the *Gandhaka* the *Paka* of *Pottali* was considered perfect or complete when the color of the sulphur became *Vyoma Varna* or *Neelashyama* (Bluish black). Upon heating, sulphur melts to provide a yellow liquid that flows readily. As the temperature increases the color of sulphur changes to red and eventually darkens further. The color is caused by the presence of a small amount of red S_3 and S_4 molecules. At about higher temperature, *Gandhaka* becomes dark red and its viscosity sharply increases. Here *Vyoma Varna* of *Gandhaka* at 3rd hour showed the completion of *Paka*.

Metallic sound

It is produced by the *Pottali* when banged against the container. This may be due to long polymerization of sulphur to give hardness to *Pottali*.

Burning of silk cloth

During the process of *Pottali Paka*, the cloth containing the *Taaragarbha Pottali* was burnt and this is a sign of *Paka Lakshana* of *Pottali*. Silk cloth was burnt due to prolong maintenance of heat and varied viscosity of sulphur and constant heat through sulphur media.

Organoleptic characters

The black color of the *Pottali* is due to major percentage of *Kajjali* in the final product. The tests like *Varitaratva*, *Nischandratva*, *Rekhapurnatva* and *Unnama Pareeksha* were positive, and this showed reduced particle size and lusterless parameter after long duration of trituration of the *Kajjali* with other ingredients.

Analysis of Physico- chemical parameters

Discussion on pH: pH is the negative logarithm of the hydrogen. pH of *Taaragarbha Pottali* was found to be 4.81, means it is acidic (weaker acid nature) and the formulation can be easily absorbed by passive diffusion. According to pH- partition concept, weak acids are better absorbed from the stomach and weak bases from the intestine. Hence *Taaragarbha Pottali* is biocompatible in nature.

Discussion on Acid Insoluble ash: *Taaragarbha Pottali* has acid insoluble ash of 0.82%. It is the residue obtained after boiling the total ash with dilute hydrochloric acid, and igniting the remaining insoluble matter. This measures the amount of siliceous matter present in the sample, and it is seen that it is comparatively less. Which signifies the genuinity of the

product and suggests it is best in terms of solubility and absorption. Means higher bio-active drug components is soluble.

Discussion on total ash value: The total ash value of the sample is 1.15% w/w. This indicates the presence of organic materials used in *Shodhana, Bhavana* which means that the product has bio availability. *Taaragarbha Pottali* has permissible amount of ash value because it was heated up to 600^0C. Thus total ash value helps to know about inorganic constituents in the test drug, organic substances are burned in the presence of oxygen. Most of the minerals are converted into oxides, sulphates, phosphates, chlorides. Here in Taaragarbha Pottali lesser values of ash indicating presence of less impurity.

Discussion on water soluble ash: Water soluble ash for the sample *Taaragarbha Pottali* was 0.14% w/w, which denotes the standard quality of the sample. It determines the amount of the water soluble contents of the given sample. Here the salivary secretions, gastric enzymes play an important role in its dissolution.

Discussion on Loss on drying at 110^0C: It is a physical test to detect the percentage of least moisture content and hence the shelf life of the samples. The least loss on drying at 110^0C the better will be the drug. In the present study *Taaragarbha Pottali* possessed 4.41% of loss of drying at 110^0C. Hence it can be stated that it has least amount of moisture content and very rare chance of bacterial and fungal growth. The drug is having least hydroscopic activity with less chances of contamination of the drug. Concurrently it can be stated that the shelf life of the drug will be more.

Discussion on Loss on ignition: The loss on ignition of *Taaragarbha Pottali* is 99%.

Discussion on XRD: Total 16 peaks were identified, among that only 10 peaks are clearly visible from angle (2θ) 23.0526 to 72.0943. 3 strong peaks were chosen as strong with their relative intensity and compared to standard X-ray diffraction values. Peak with relative intensity of 8 was significant at angle 26.3566 having d space value 3.37876 and d space value of standard intensity percentage of *Taaragarbha Pottali* is nearer to the standard value. Graph shows the identified compound is HgS in Hexagonal crystal structure, Gold oxide in orthorhombic crystal structure, Silver oxide in cubic crystal structure and Silver Sulphide in monoclinic crystal structure.

Discussion on SEM-EDX: EDX study reveals the accurate elemental analysis of the sample, this study of elements enable us to explore major and minor elements. The percentage of elements present in *Taaragarbha Pottali* are Ag- 1.8%, Si -0.9%, S – 48.4%, Hg -36.2%, Au – 8.8% and C – 12.7%.Silver, Oxygen, Sulphur, Mercury, Gold and Carbon are the major elements and Silica found in minor portion. The presence of carbon may be due to the organic matters present in the sample. The presence of Silver % which may be due to heat treatment given by *Gandhaka Paka*, which may increase the bio-availability of Silver. The reduction in oxygen % in *Taaragarbha Pottali* may be due to oxidation process during *Pottali Paka*. The increase in % of Sulphur is because of *Gandhaka paka*. The above result, may be due to the heat treatment on an average 3 hours. This heat treatment causes breaking of bond and the formation of new bond with the evaporation of certain gases like SO_2 in a substance resulting in increased and decreased % of an element and occurrence of oxidation reduction reaction which may result into change in percentage of some of the elements.

Discussion on NPST: There is no mentioning of standard method of preparation for NPST. Henceforth here an attempt made in the guidelines of *Rajata* group of drugs as the above product contains *Rajata Bhasma* as a main ingredient. Changes in the colour is due to reaction between 10% Potassium iodide paper and solution prepared out of 0.5g of *Taaragarbha Pottali* with 1ml conc.HNO_3. This test confirms the proper formation of *Taaragarbha Pottali.*

CONCLUSION

Taaragarbha Pottali is black colored, tasteless, amorphous in touch and with characteristic Odour. All relevant analytical data of sample of *Taaragarbha Pottali* are having less difference in their physical and chemical values. *Pottali* with Nano particle size of 295.6nm reveal the drug is easily transported into cells and nuclei and specificity to the target can be achieved as desired. Here *Taaragarbha Pottali* can be considered as an organo- metallic complex compound.

REFERENCES

1. Vaidya Pandit Hariprapannaji, Rasayoga sagara, 1st edition, Varanasi, Chowkhambha Krishnadas Academy publication, Reprinted 2004, volume-2, 581pp.
2. Anonymous, Yogaratnakara, Hindi commentary by Vaidya Lakshmipathi Shastri, edited by Brahmashankara Shastri, 6th edition, Varanasi, Chowkhambha Sanskrit Sansthan, 1997, Kasa Chikitsa, Verse 3, 420pp.

3. Rao Namburi Hanumanth, Manual of Namburi phased Spot test. Vijayawada: Namburi Inventions and Publication, May 1997, 35pp.
4. Protocol of testing. Govt. of India. Dept of AYUSH. Ghaziabad: Pharmacopeia laboratory for Indian Medicine.
5. Ayurvedic Pharmacopoeia of India, Part 1, Volume- 1,2, 3. Published by govt. of India, Ministry of Health and Family welfare.
6. www.unm.edu/xrd/xrdbasics.pdf.
7. www.ipdlabservices.co
8. www.Zetapotential,analysier.pdf.
9. www.wcaslab.com, mmrc.caltech,edu/FTIR/FTI Rintro.pdf