Research Article

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PREPARATION OF KANTALAUHA BHASMA BY TWO DIFFERENT METHODS AND ITS SINDOORA NIRMANA: A COMPARATIVE PHARMACEUTICO-ANALYTICAL STUDY

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ABSTRACT

According to Rasa Ratna Samucchaya, Kantalauha is considered as the best variety among Lauhas for Lauha Bhasma compared with Tikshna and Munda Lauha. The present study deals with the "Preparation of Kantalauha bhasma by two different methods and its Sindoor Nirmana- A Comparative Pharmaceutico-Analytical Study. Two different Kantalauha Bhasma and their Kanta Sindoor were prepared as per classical reference and the samples were subjected to Classical and Modern Analytical Parameters, XRD, EDX, SEM, FT-IR, and NPST. Pharmaceutically Kantalauha Bhasma 1 has attained Bhasma Siddhi Lakshanas in 16 Putas and Kantalauha Bhasma 2 in 3 Putas. Both the samples of Kanta Sindoor attained Sindoor Varna by 3 Putas. SEM analysis showed that Kantalauha Bhasma 1 and Kanta Sindoor 1 attained the smallest particle size. XRD showed the presence of compound Fe_2O_3 in all the samples. EDAX confirmed the presence of Fe, O, Mg, Al, Si, S, K and Ca. The FT-IR analysis of all the samples shows the presence of 10 Absorption Peak frequencies cm^{-1} . NPST proved the fineness and proper formation of Bhasma samples. Among the two different methods of Kantalauha Bhasma preparation, the 1st method is found better in yield wise and cost-wise. The second method saved the time as it attained Bhasma Siddhi Lakshanas within 3 puts. In the case of Kanta Sindoor, yield wise both the samples were found almost the same.

Keywords: Kantalauha, Kantalauha Bhasma, Kanta Sindoor, Puta, Parada

INTRODUCTION

The incinerated iron preparations of Ayurveda are known as Lauha Bhasma. In Samhita period Ayas was used in the form of powder. According to Rasa Ratna Samucchaya, Kantalauha is considered as the best variety among Lauhas compared with Tikshna and Munda Lauha¹. Kantalauha can be correlated to Magnetite mentioned in Contemporary Science. Pure magnetite contains 72.4% of iron, but, since this mineral never occurs alone, the metal content of real ores is lower. The raw material took for this study was having 68% of iron as per assay.

Kantalauha Bhasma can be carried out by adopting Marana karnas after proper Shodhana. Shodhana is a process of separation by which physical and chemical impurities get separated from the substances by treatment with various drugs and the process which converts the purified metals and minerals into Bhasma after subjecting them to levigation and incineration is called as Marana.

Regarding the preparation of Loha Bhasma, we have classical references with using Parada or without using Parada. In both methods, the final product obtained usually will resemble Pakwajambuphala Varna²; Where in the case of Kanta Sindoor, the colour of the end product is Sindoor varna³.

The conventional Puta using the Electric Muffle Furnace (EMF) method of heating is accurate and convenient to regulate the temperature in a closed atmosphere. To fix the standard end product it is very much necessary to understand various Physico-

chemical natures of drugs and its practical utility based on modern technology of analysis. For quality assurance and characterization, the qualitative and quantitative analysis is to be carried out. Because in the Global scenario, it is very important to understand the concept of Metallic drug; based on currently available methodologies; only a few research works have been carried out so far, hence this study was an attempt made to compare Kantalauha Bhasma prepared by two methods and Kanta Sindoor made out of these Bhasma along with the evaluation of their analytical findings.

Aim and objectives

Aim and Objectives of this study are:

- Preparation of Kantalauha Bhasma as per the text Basavarajeevam and Rasa Ratna Samucchaya.
- Preparation of Kanta Sindoor from two different Kantalauha Bhasma samples.
- To carry out Physico-Chemical and instrumental analysis of all the samples.

MATERIAL AND METHODS

Kantalauha (Magnetite), Gandhaka (Sulphur), Hingula (Cinnabar) are the major raw drugs in this study. These drugs were collected from the Geological department, Ballari, Karnataka, India. Herbal drugs needed for the study were collected from the GMP certified pharmacy.

Methodology

- Samanya⁴ and Vishesh⁵ Shodhana of Kantalauha
- Gandhaka Shodhana⁶
- Hingula Shodhana⁷
- Hingulottha Parada⁸
- Kantalauha Bhasma preparation (Trividha Paka) according to Basavarajeevam (Kantalauha Bhasma 1)⁹ and Rasa Ratna Samucchaya (Kantalauha Bhasma 2)¹⁰
- Kanta Sindoor¹¹ preparation with samples of KLB1 and KLB2.

Samanya Shodhana of Kantalauha

Samanya Shodhana was carried out by Nirvapa (Heating and Quenching) of Kantalauha in Liquid Medias such as Taila (Sesame oil), Takra (Buttermilk), Gomutra (Cow's urine), Aranala and Kulattha Kwatha (Decoction prepared using Horse gram). For this Kantalauha was taken in an iron pan and subjected to fire till it attains red hot. Immediately, this red hot Kantalauha was quenched in liquid media. After self-cooling it was taken out from the vessel and washed thoroughly in hot water. It was again heated and quenched in fresh Liquid media. This was repeated in each liquid media separately for 7 times.

Vishesh Shodhana of Kantalauha

Samanya Shodhita Kantalauha was taken in an iron pan and heated until it becomes red hot. After that, it was quenched in Triphala Kashaya. Then it was taken out and again subjected to fire. This procedure was repeated 7 times. Finally taken out and washed in warm water and dried.

Gandhaka Shodhana

Gandhaka Shodhana was done using Bhudhara Yantra wherein a pot was half-filled with milk and was buried in the ground up to its neck. A cloth was tied over the mouth of the pot and Gandhaka was spread over the cloth. A Sharava was placed inverted over it on which Charcoal was spread and the fire was set with the help of camphor. After self-cooling, Shuddha Gandhaka in beads shape was found at the bottom of the pot which was washed thoroughly with hot water and dried under shade. Later on, it was powdered. This procedure was repeated 2 more times.

Shodhana of Hingula

Hingula was taken in a Khalva Yantra, powdered finely, to this Nimbu Swarasa (Lemon Juice) was added till whole mass get wet. It was triturated with the help of a granite mortar and pestle continuously until it gets dries up. The obtained Bhavita Hingula was added with quantity sufficient Nimbu Swarasa and triturated well till it attains Subhavita Lakshana. Likewise, the same procedure was repeated for 7 times.

Hingulottha Parada

Shodhita Hingula was taken in a cleaned and dried Khalva Yantra; Nimbu Swarasa was added to powdered Hingula and triturated uniformly at a rate of 30 strokes/minutes for 3 hours. Then it is placed on Urdhva Patanayantra and after 7 layers of Sandhi bandhana it was kept over the fire source, Madhyam Agni was given for 4 hours and then Tivragni was given for 4 hours. On self-cooling, the next day Sandhi bandhana was carefully removed. 2 pots were separated; soot with mercury globules was collected from the upper pot by scraping with a spoon and brush and was filtered through double-fold cloth to get clear mercury.

Kajjali Nirmana

1 part of finely powdered Shodhita Gandhaka was taken in Khalva and 1 part of Hingulottha Parada was added and triturated. Trituration was done slowly with uniform speed till all the Kajjali Lakshanas were observed, after that again 1 part of Shodhita Gandhaka was added to it and was triturated in the same manner till the whole mixture converts into a fine, black, smooth, lustreless powder i.e. Kajjali.¹²

Bhanupaka of Kantalauha

Shuddha Kantalauha was added to Triphala Kwatha kept in a vessel and was mixed well. This was exposed to intense sunlight continuously and left it until the liquid portion was completely evaporated. The decoction was added repeatedly at frequent intervals and the procedure was completed by 7 days. Kantalauha attains a coarse powder (Choorana) form after Bhanupaka.¹³

Sthalipaka of Kantalauha

Triphala Kwatha was taken in a vessel in which Kantalauha Choorana was added. It was subjected to Tivragni. Continuous stirring was carried out throughout the heating process. The heat was given continuously until the whole liquid gets evaporated. The obtained Kantalauha Choorana was collected and preserved.¹⁴

Kantalauha Bhasma 1 (KLB 1) preparation

1 part of Shuddha Kantalauha Choorana and ¼ part of Shuddha Gandhaka were taken and mixed in a Khalva Yantra. It was levigated continuously for 9 hours by adding quantity sufficient Bhavana dravyas such as Arka ksheera (latex of *Calotropis gigantea*), Pashanabhedi Swarasa (juice of *Bergenia ligulata*) and Palasha twak Swarasa (Bark juice of *Butea monosperma*) one by one. Then pellets were prepared and kept on a plate and were allowed to dry. After proper drying, the pellets were taken in an earthen saucer which was covered by another earthen saucer and the junction was sealed by a total of 7 layers of mud smeared cloth, after drying the previous one. Once the sealing was completely dried it was subjected to Putapaka in EMF. Initially, the temperature was fixed at 200°C and maintained for 15 min. Then it was increased to 400°C and maintained for another 30 min. Later the temperature was fixed to 650°C as peak temperature. It was maintained for 1 hour. Hence the total duration for 1 Puta was 370 min. The material was collected after self-cooling and grounded. The same pattern of procedure was repeated using the end product for a total of 16 times for the preparation of KLB1.

Kantalauha Bhasma 2 (KLB 2) preparation

1 part of Kantalauha Choorana and 1 part of Kajjali were taken in a Khalva Yantra and mixed to form Kajjali. To this added sufficient quantity of Kumari Swarasa (juice of *Aloe vera*) and levigated continuously for 6 hours. Then made it into a ball and kept in a Tamra Patra (Copper Vessel) covered with Eranda Patra (leaf of *Ricinus communis*) and subjected for Putapaka in EMF. Initially, the temperature was fixed at 200°C and maintained for 15 min duration. Then it was increased to 400°C and maintained for another 30 min. Later the temperature was fixed to 650°C as peak temperature. It was maintained for 90 min. Hence the total duration for 1 Puta was 400 min. The material was collected after self-cooling and grounded. The same pattern of procedure was repeated using the end product for a total of 03 times for the preparation of KLB2.

Kanta Sindoor 1 (KS 1) preparation

1 part of KLB 1 and ½ part Shuddha Hingula were taken and mixed in Khalva Yantra. It was levigated continuously for 3 days by adding quantity sufficient Kapikachhu moolaswarasa (root juice of *Mucuna pruriens*). Then it was kept in Vajra Moosha and sealed properly with cloth smeared with mud. After drying it was subjected to Putapaka in EMF. Initially, the temperature was fixed at 200°C and maintained for 10 min duration. Then it was increased to 400°C and maintained for another 10 min. Later the temperature was fixed to 650°C as peak temperature. It was

maintained for 90 min. Hence the total duration for 1 Puta was 375 min. The same pattern of procedure was repeated using the end product for a total of 03 times for the preparation of KS1.

Kanta Sindoor 2 (KS 2) preparation

The same method of preparation of KS 1 was followed for the preparation of KS 2, except the sample KLB 2 was taken instead of KLB 1. All the 4 samples (KLB 1, KLB 2, KS 1 and KS 2) were collected and stored in separate airtight containers and subjected for Physico-chemical and instrumental analysis.

Table 1: Methods used for the analysis

Classical Analytical parameters		Modern Analytical Parameters	Instrumental Analysis
a) Organoleptic characters:	b) Bhasma Pariksha:		
<ul style="list-style-type: none"> Shabda Sparsha Roopa Rasa Gandha 	<ul style="list-style-type: none"> Sookshmatva Shlakshnatva Rekhapumatva Varitaratva Unnama Nishchandaratva Nirdhoomatva Gatra satva Niruttha Apunarbhavatva Vishishtavarnotpatti 	<ul style="list-style-type: none"> pH value Loss on drying Total Ash Acid in soluble ash Water-soluble ash Water-soluble Extractive value Alcohol soluble Extractive value 	<ul style="list-style-type: none"> XRD (X-ray diffraction) EDX (Energy dispersive x-ray spectroscopy) SEM (Scanning electron microscopy) FT-IR (Fourier transform infrared spectrometry) NPST (Namburi's phased spottest)

Physicochemical study

This part of the study was carried out at the Analytical lab of Nagarjuna Herbal concentrates, Kalayanthani, Thodupuzha and Kerala, India.

Instrumental Analysis

- X-ray diffraction method for the crystallographic study of KLB 1, KLB 2, KS 1 and KS 2 was done at Dept. of Nanotechnology, VTU CPGS Muddenhalli, Chikballapur and Karnataka, India.
- Study of SEM – EDX, was done at NITK, Dept of Metallurgy and Material Science, Surathkal, Karnataka, India.
- NPST was done at Dept. of Chemistry, Alva's Degree College, Moodbidri and Karnataka, India.

X-Ray Diffraction (XRD)

In XRD the 2-theta value and intensity of the peak (counts) are represented on X and Y-axis respectively. Higher the value of counts represents higher the crystalline of the phase. For

identification of each phase, peaks were chosen and compared with standard Joint Committee Powder Diffraction File (JCPDF). The standard JCPDF number, identified phase and composition are also given.

Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDAX)

It is used for the Quantitative analysis of elements in a given sample. The EDAX detector is attached along with the SEM instrument. When the electron beam bombards with the sample it emits x-rays, which will be picked up by the EDAX detector probe and this analyzes the elements present in the surface by comparing with the standards. This will give the mass% and Atomic% of the elements present in the sample.

RESULT**Pharmaceutical study**

Results of preparation of KLB 1, KLB 2, KS 1 and KS 2 have been tabulated in Table 2.

Table 2: Results of KLB 1, KLB 2 prepared in two different methods and its respective Sindooras

Final products	Weight has taken	Weight obtained	Bhasma Pariksha	Colour
KLB 1	250 g (KL: G = 200:50)	184 g	All passed	Dark brown
KLB 2	240 g (KL: G:P = 120+80+40)	118 g	All passed	Brown
KS 1	150 g (KLB 1: H = 100+50)	112 g	All passed	Deepred
KS 2	60 g (KLB 2: H = 40+20)	46 g	All passed	Darkred

KLB 1: Kantalauha Bhasma Sample 1, KL: Kantalauha, G: Gandhaka, P: Parada, H: Hingula

Analytical Study

Physico-Chemical Tests

Table 3: Results of Physico-Chemical Tests

Parameters	KLB 1	KLB 2	KS 1	KS 2
Total ash% by mass	98.32%	97.82%	98.10%	96.88%
Acid in soluble ash% by mass	97.14%	96.33%	97.28%	96.08%
pH (5% aqueous solution)	3.57	3.20	3.12	3.02
Loss on drying at 105°C % by mass	0.40%	0.44%	0.32%	0.38%
Water-soluble ash% by mass	0.75%	0.67%	0.74%	0.80%
Assay for Iron	47.68%	46.12%	48.92%	42.24%

Figure 1: X-Ray Diffraction (XRD) of KLB 1

Figure 7: Scanning Electron Microscope (SEM) of KS 1

Figure 8: Scanning Electron Microscope (SEM) of KS 2

Figure 9: Energy Dispersive X-Ray Spectroscopy (EDAX) of KLB 1

Element Line	Weight %	Weight % Error	Atom %
O K	45.93	±0.88	69.33
Mg K	0.94	±0.16	0.94
Al K	0.93	±0.16	0.83
Si K	13.10	±0.37	11.27
Si L	---	---	---
S K	1.52	±0.15	1.15
S L	---	---	---
K K	0.61	±0.12	0.38
K L	---	---	---
Ca K	0.75	±0.14	0.45
Ca L	---	---	---
Fe K	36.21	±1.38	15.66
Fe L	---	---	---
Total	100.00	---	100.00

Figure 10: Energy Dispersive X-Ray Spectroscopy (EDAX) of KLB 2

Element Line	Weight %	Weight % Error	Atom %
O K	40.44	±0.88	64.49
Mg K	1.21	±0.17	1.27
Al K	1.39	±0.17	1.32
Si K	12.55	±0.38	11.40
Si L	---	---	---
S K	2.47	±0.28	1.97
S L	---	---	---
K K	1.32	±0.15	0.86
K L	---	---	---
Ca K	0.79	±0.15	0.50
Ca L	---	---	---
Fe K	39.82	±1.52	18.19
Fe L	---	---	---
Total	100.00	---	100.00

Figure 11: Energy Dispersive X-Ray Spectroscopy (EDAX) of KS 1

Element Line	Weight %	Weight % Error	Atom %
O K	40.34	±0.90	63.62
Mg K	3.71	±0.36	3.85
Al K	0.72	±0.19	0.67
Si K	11.83	±0.37	10.63
Si L	---	---	---
S K	3.28	±0.30	2.58
S L	---	---	---
K K	1.91	±0.16	1.23
K L	---	---	---
Ca K	0.83	±0.15	0.52
Ca L	---	---	---
Fe K	37.38	±1.41	16.89
Fe L	---	---	---
Total	100.00	---	100.00

Figure 12: Energy Dispersive X-Ray Spectroscopy (EDAX) of KS 2

Element Line	Weight %	Weight % Error	Atom %
O K	38.78	± 0.73	64.26
Mg K	1.25	± 0.16	1.36
Al K	0.95	± 0.15	0.94
Si K	9.26	± 0.31	8.74
Si L	---	---	---
SK	1.79	± 0.24	1.48
SL	---	---	---
KK	1.38	± 0.12	0.93
KL	---	---	---
Ca K	0.92	± 0.14	0.61
Ca L	---	---	---
Fe K	45.67	± 1.37	21.68
Fe L	---	---	---
Total	100.00		100.00

Figure 13: FT-IR (Fourier Transform Infrared Spectrometry) of KLB 1

Figure 14: FT-IR (Fourier Transform Infrared Spectrometry) of KLB 2

Figure 15: FT-IR (Fourier Transform Infrared Spectrometry) of KS 1

Figure 16: FT-IR (Fourier Transform Infrared Spectrometry) of KS 2

Figure 17: Namburi's phased spottest (NPST) of KLB 1

Figure 18: Namburi's phased spot test (NPST) of KLB 2

Figure 19: KLB 1

Figure 20: KLB 2

Figure 21: KS 1

Figure 22: KS 2

Instrumental Analysis

X-Ray Diffraction (XRD)

XRD results of KLB1, KLB2, KS1 and KS2 are shown in Figure 1, Figure 2, Figure 3 and Figure 4 respectively.

Scanning Electron Microscope (SEM) and Energy Dispersive X-Ray Spectroscopy (EDAX)

SEM results of KLB1, KLB2, KS1 and KS2 are shown in Figure 5, Figure 6, Figure 7 and Figure 8 respectively.

EDAX results of KLB1, KLB2, KS1 and KS2 are shown in Figure 9, Figure 10, Figure 11 and Figure 12 respectively.

FT-IR (Fourier Transform Infrared Spectrometry)

A total of 10 peaks were selected from each sample for identification and compared with standard Peaks Frequency. FT-IR results of KLB1, KLB2, KS1 and KS2 are shown in Figure 13, Figure 14, Figure 15 and Figure 16 respectively.

Namburi's phased spottest (NPST) of Kantalauha Bhasma - Figure 17 and Figure 18.

Table 4: SNPST observations of KLB

Phases	Observation timing	Changes noted in KLB1	Changes noted in KLB2
I.	5 th minute	Deep blue circles around the Bhasma with light blue, white colour and brown thin circles in the periphery	Same changes were noticed
II.	20 th minute	Expanded blue circle	
III.	Up to 24 hours and above	No other changes are noted	

DISCUSSION

Rasa Ratna Samucchaya explained Kantalauha Bhasma preparation in Loha varga Adhyaya which is said as Sarvarogajarapaham; and if it is administered along with Triphala and Madhu will act as Sarvaroga nashaka. According to Basavarajeeyam, Kantalauha Bhasma cures Kushta and Rajayakshma. It is Tridosahara, Sarva vyadhi hara and is superior among Rasayana. Though both are Kantalauha Bhasma, in the method of preparation, the Maraka Dravya told were different. Parada and Gandhaka are the Maraka Dravyas told by Rasaratna Samucchaya while Basavarajeeyam told only Gandhaka as Maraka Dravya. Both the samples of KLB were used to prepare Kanta Sindoor according to Basavarajeeyam text explained in the chapter 'Rasagandhakadidravayashuddhiniropanam'.

Shodhana of Kantalauha

Shodhana of Kantalauha was carried out as Samanya Shodhana followed by Vishesh Shodhana. For Samanya Shodhana, Tilataila, Takra, Gomutra, Aranala, and Kulattha Kwatha have been taken which may have particular functions in purification and detoxification of Kantalauha. The red hot Kantalauha was quenched into each liquid media and was repeated for seven times to reduce the particle size and to acquire desired benefits. All these liquid media acts as cooling media during the process of Nirvapa, these may serve a favorable atmosphere to the material for the occurrence of a particular chemical reaction and compound formation. For Vishesh Shodhana the same procedure was followed using Triphala Kwatha.

In this process of Nirvapa, the changes occur at two stages; Phase of heating and Phase of quenching. Both help to cause brittleness, breaking and size reduction in metals and minerals. The phase of heating: In this phase, the changes that take place are called linear expansion. By the application of force in the form of heat, the

tension in the matter is increased and they expand. Causing an increase in inter-atomic distance and intermolecular spaces leading to weakening of electrostatic forces and crystal lattice of the metals deform. The phase of quenching: Heating and immediate cooling in liquid media leads to a decrease in tension and an increase in the compression force. Disruption in compression tension equilibrium leads to increased brittleness, reduction in hardness and finally reduction in the particle size. Thus, the repeated heating and quenching reduces the particle size.

The brittleness of Kantalauha increased gradually after Samanya and Vishesh Shodhana with each media. The ultimate heating and quenching in these acidic and basic liquid media may lead to corrosive changes in the metal and also may cause the removal of acid and alkaline soluble impurities from the metal.

Gandhaka Shodhana

It was carried out by the Dhalana method. Dugdha was selected as Shodhana Dravya as it is an antidote for Gandhaka and milk is the commonly recommended antidote for poisoning, it might help in neutralizing the sulphur poisoning.

Hingula Shodhana

It was carried out by doing Bhavana in Nimbu Swarasa. At the end of the procedure, the shiny red colour of Hingula turned to bright red. At the same time, the lustrous shiny particles were disappeared. It may be due to the continuous trituration with the juice and reduction of the particle size.

Preparation of Hingulottha Parada

Urdhvatapana Yantra method was selected for the extraction of Parada from Hingula because many experienced Rasacharyas explained that by this method the yield of Parada will be more

(i.e. about 60%) and Parada will be devoid of Saptakanchuka Doshas and Yougika Doshas and will have the qualities of Samaguna Gandhaka Jirna Parada but in the present study the yield of Parada was 47.3%.

Kajjali

It was prepared using one part of Shodhita Parada and two-part of Shodhita Gandhaka. For the formation of Kajjali, Dridha Mardana was required. After 36 hours all the parameters like Rekhpurnata, Shlakshnatva, Kajjalabhasa and Varitaratva were observed to be positive and the colour was black. These tests confirm the reduction in particle size of the ingredients and homogeneity of the mixture. As the triturating continues; the Kajjali becomes fine and tends to be spilled out of the Khalva Yantra.

Bhanupaka and Sthalipaka

On the pharmaceutical point of view the process of Bhanupaka and Sthalipaka helps in the disintegration of Iron molecules and there by eases the process of Bhasmikanarana. These are the processes that utilize the Triphala Kwatha and natural condition which brings about transformation to the Lauha. It has been established that the metallic Iron is toxic. Hence, it should contain Iron in the form of mofa complex. The UV radiation present in the sunlight may reduce the oxidation state of iron in the presence of vitamin C present in the Triphala Kwatha thereby improving bioavailability.

Process of Putapaka (KLB 1 and KLB 2)

In this study, Marana of Kantalaucha was done by the Putapaka method for 2 samples of Kantalaucha. After the process of Sthalipaka, obtained Kantalaucha churna was divided into 2 parts and used for the preparation of Kantalaucha Bhasma for 2 samples i.e. first sample with ¼ part of Shodhita Gandhaka and second sample with 1/3rd of Hingulottha Parada and ½ part Shodhita Gandhaka. KLB 1 was given Bhavana with Arkaksheera, Pashanabhedi Swarasa, and Palasha twak Swarasa. The standard procedure of Putapaka was followed. It was repeated for 16 times. At the end of 16th Puta, the sample of Kantalaucha turned to a completely Bhasma form. It was confirmed by subjecting to various Dhatu Bhasma Parikshas. During the first few Putas metallic luster was observed on the surface of the pellets, and gradually disappeared in successive Putas. The appearance of luster after the first few Puta indicates Kantalaucha was persisted in metallic form, later which was completely transformed into a lusterless compound.

KLB 2 was given Bhavana with Kumari Swarasa. The standard procedure of Putapaka was followed. It was repeated for 3 times. At the end of 3rd Puta, the sample of Kantalaucha turned to a completely Bhasma form. It was also confirmed by subjecting to various Dhatu Bhasma Parikshas. During the first Puta metallic lustre was observed on the surface of the pellets; then it disappeared in the next Puta. As lustre is the physical character of metal when the metal transforms to compound form then its lustre is lost. In the present procedure, the weight of Bhasma was reduced much in each Puta as compare to the 1st method, which may result due to the presence of a larger proportion of Gandhaka which may react with metallic iron and the remaining part gets vaporized. The early disintegration of Iron molecules in Bhanupaka and Sthalipaka processes may also result in a weight reduction of the obtained product.

In KLB 2 the sample has passed all Bhasma Pariksha in 3rd Puta. But in KLB1 it has taken 16 Putas to pass all Bhasma Pariksha. It suggests that, if Parada is using for Marana Karma, it needs a minimum number of Puta to obtain Bhasma. It justifies the concept of materials used for Marana Karma told by RRS, which tells that the best process is with the help of Rasa Bhasma (Shreshta) and the least is with the help of Sulphur and Sulphur containing materials (Kanishtha).

Preparation of Kanta Sindoor

Here two samples of Kanta Sindura were prepared by using KLB 1 and KLB 2. The methodology and ingredients were the same except the Kantalaucha Bhasma samples which were prepared by two different methods. Kapikachhu Moolaswarasa was the Bhavana Dravya for both the samples. In the present procedure, the percentage-wise yield of Sindoor was almost the same in both the samples, i.e. 74.6% in KS1 and 76.6% in KS2. This may be due to adopting the same procedure for Sindoor preparation. Both the samples have attained Sindoor Varna after Puta.

Analytical study

EDAX confirmed that the concentration of Iron increased in KS1 after Puta and the same was found to be decreased in KS2 than Bhasma samples. Phase identification of different samples of Kantalaucha Bhasma by XRD reveals Iron as the major phase. The substance identified as Fe₂O₃ in KLB1, KLB2, KS1 and KS2. The FT-IR analysis of KLB1, KLB2, KS1, and KS2 shows the presence of 10 Absorption Peak frequencies cm⁻¹. This reveals the presence of Organic functional groups in all the samples. SEM analysis shows that the smallest particle size of KLB1 and KS1 is 119 nm and 91.6 nm respectively and that of KLB2 and KS2 are 136 nm and 93.5 nm respectively. Thus, SEM analysis of KLB1 and KS1 samples shows that it contains lesser particle size as compared to the particle size of KLB2 and KS2. In the NPST study for both the samples of Kantalaucha Bhasma, the formation of deep blue colour in the potassium ferricyanide paper was obtained; it indicates the fineness and proper formation of the Bhasma which was prepared according to the classical method.

CONCLUSION

The sample KLB1 has attained the Bhasma in 16th Puta and KLB2 in 3rd Puta which resulted due to the presence of Parada in the 2nd sample. After subjecting both samples of KLB into 3 Gaja Puta, the end product Kanta Sindoor obtained with Lakshana 'Balodayasamam' as explained in classics. In the case of Kantalaucha Bhasma, yield wise KLB 1 was found better, as loss of end product was 26.4% in KLB 1 and 50.84% in KLB 2. In the case of Kanta Sindoor, yield wise both the samples were found almost the same (loss of end product in KS 1 was 25.4% and in KS 2 was 23.4%). In expense wise also KLB 1 was better, as it doesn't contain Parada. SEM analysis shows the sample KLB 1 contains comparatively least particle size than KLB 2, due to more number of Putas. EDAX confirmed that the concentration of Iron is comparatively more in KLB 2. The other minor elements present in all the samples were Oxygen, Magnesium, Aluminium, Silicon, Sulphur, Potassium and Calcium. The present study emphasizes the comparison of both Bhasma; i.e. presence of Parada helps to reduce the number of Putas while adding more Putas the particle size become less.

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