Research Article

CONFIRMATORY PHARMACEUTICO-ANALYTICAL ESSAY IN THE PHARMACEUTICAL STAGES OF ABHRAKA BHASMA

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ABSTRACT

Abhraka (Mica) gets second place after Parada (Mercury) which shows its importance in Rasashastra. Acharyas have given various methods of Abhraka *Marana* (Incineration). Here in the selected *Marana* procedure, according to *Rasa Ratna Samucchaya* he claims of attaining Abhraka Bhasma Siddhi Lakshana (sign of appropriate quality of Abhraka Bhasma) by 3rd Puta (Heating grade). The present study aims at evaluation of *Abhraka Bhasma* which was prepared by selected Shodhana (Purification), Dhanyabhrakarana, Marana and Amruteekarana (Nectorization) process. In Pharmaceutical study, preparation of Abhraka Bhasma forms major part of the study which can be done by using Electrical Muffle Furnace by fixing standard Temperature pattern. On observation it shows only Nischandratva after 3rd Puta, Rekhapurnata and smoothness by 7th Puta and Brick red color attained by 15th Puta. Apurnabhavatva by 21st Puta, Uttamatva and Varitaratva by 23rd Puta. It was also characterized by using modern instrumental analysis like XRD, EDAX, SEM and FT-IR. The SEM analysis evaluated that prepared Abhraka Bhasma has particles in nano meters, least being 213.2 nm. EDAX study confirmed the presence of Al, Si, Fe, K, Mg, Na, O and K. XRD study confirmed the presence of Fe₂O₃, Al₂O₃, SiO₂, MgO, Na₂O₂ and K₂O. FT-IR analysis shows - Organic Compounds with functional groups like secondary Amines, Nitro, Alcohol, Carboxylic Acid, Alkenes, Esters, Bromide, iodide.

Keywords: Abhraka Bhasma, Shodhana, Marana, XRD, SEM, EDAX, FT-IR.

INTRODUCTION

Present day demand of Ayurveda formulations has been raised globally due to increased response toward Ayurveda system of medicine. Hence, commercialization of Ayurveda drug manufacturing has taken place. In this era of Globalization it is need of time to explore the scientific validation of medicaments of Ayurveda. It is the prime duty to establish the scientific standards for the preparation of the medicaments. Abhraka (Mica) keeps its importance in herbo-mineral preparations and highly useful mineral next to Parada (Mercury). In the present study, selective pharmaceutical procedures were adopted. Acharyas claimed Abhraka Bhasma Siddhi Lakshanas will be attained by minimum 3 Puta¹. The present study aims to evaluate the Abhraka Bhasma which was prepared by SOP and respective readings were noted both classical as well as modern parameters.

MATERIALS AND METHODS

Raw drugs: Krishna Vajra Abhraka was selected according to Grahya Lakshana (acceptable quality) as well as modern specifications.

Equipments: Khalva Yantra (pestle and mortar), Samdamsha Yantra (holder), Sharavas (saucers), Electric Muffle Furnace, weighing machine, steel vessels, Gas stove, Measuring jar, Ladle, Lids, Glass beaker, Steel vessels, Plastic sheets. These

includes knife, juice extractor, Multani Mitti (clay), kora cloth, lighter, spoon etc.

Methods

Abhraka Shodhana by Nirvapa (quenching) method with Godugdha (cow's milk)², Dhanyabhrakarana³, Abhraka Marana⁴ and Amruteekarana of Abhraka Bhasma⁵.

Procedures

Abhraka Shodhana

1000g of Abhraka in stratified form was taken in an iron ladle and subjected to fire, after heating to red hot it was immediately quenched in to Godugdha. The Abhraka was then separated by filtering it through iron sieve. Same method of Nirvapa was repeated for 6 more times. After 7th Nirvapa, wet Abhraka was obtained and it was put into the iron pan and subjected to mild fire to remove moisture contains. Then it was completely dried.

Dhanyabhraka

942 gm Sodhita Abhraka and 236gm paddy were mixed together and divided into 3 equal parts for easy rubbing and handling. The mixture was made into three equal sized Pottalis (cloth pouches) prepared by jute clothes and kept completely immersed in steel vessel containing Kanji for three days. Pottalis were taken out after 72 hours and dipped in large steel vessel containing water. It was rubbed between palms protected by

gloves. When the color of water changed to dark black, new vessel with water was taken to give fresh media for the faster extraction of Dhanyabhraka. This process was continued till complete extraction of Dhanyabhraka occurs. This was confirmed by unchangeable colour of water during Mardana (trituration) & chaffing the bag between hands and getting some hard particles inside. All the vessels were kept stable for overnight. Next day morning, the supernatant water was discarded through a plastic tube by suction. This method prevents the loss of fine particles of Abhraka while discarding supernatant liquid portion. Residue in all the vessels was collected in a steel vessel and kept for evaporation. At last a lustrous black colored coarse powder of Dhanyabhraka was obtained.

Abhraka Marana

775g Dhanyabhraka and 97g Guda (jaggery) were taken in a clean Khalva Yantra and subjected to trituration with Erandapatra Swarasa (juice of *Ricinus communis*) (1570ml). After 4 to 6h of trituration a slurry mixture was obtained. Later the Chakrikas (pellets) of desired size and shape were prepared, dried on plastic sheet under the shadow. The dried Chakrikas were arranged in between the Vatapatras (leaves of *Ficus bengalensis*) which were placed inside the *Shariava* (saucers) to prepare Vatapatra Samputa. Then it was subjected to Puta in electric muffle furnace. Then the furnace was closed and calcination was done by rising the temperature to 200°C for 15mins i.e. the temperature was allowed to raise up to 1000°C and then it was maintained at the peak for 45 minutes. Thereafter the furnace was shut off and subjected for self cooling. Next day when Puta becomes cool by itself the Sharava *Sampiuta* (sealed saucer) was taken out and Chakrikas were collected. The same procedure of *Marana* was repeated for 23 times. After 23rd Puta Abhraka Bhasma was collected, powdered and weighed.

Amruteekarana of Abhraka Bhasma

10 part of Abhraka Bhasma (125g) was taken in an iron pan and 16 part of decoction of Triphala (200 ml) along with 8 parts of Goghrita (Cow's ghee) (100 ml). It was mixed together and heated in low temperature till the liquid evaporates completely and dries.

Analytical study

Abhraka Bhasma was analyzed by using different Bhasma Pareeksha (examination of Bhasma) like Varna (colour), Rasa (taste), Nishchandrata (lustreless), Niswadu (tasteless), Rekhapurnata, Unnama, Varitara, Niruttha and Nirdhuma were performed. Modern sophisticated instrumental analytical techniques like SEM, EDAX, XRD and FT-IR were also performed.

OBSERVATIONS AND RESULTS

Shodhita Abhraka

After 1st Nirvapa, it became more soft and brittle, layers were easily separable, and the pieces were flooded with Godugdha. After each Nirvapa, the crammed structure of Abhraka was destroyed to form small pieces and particles due to increased

brittleness. The colour of Abhraka became black after each Nirvapa. Silver luster of Abhraka kept on increasing after each Nirvapa. After evaporation it became very light, soft, and puffy and looked like small paper chits. The colour changed to shining silver black. The process of single Nirvapa was divided in to three stages for observation based on previous study. Observation of the process has been presented in the Table 1-4.

Dhanyabhraka

While doing the chaffing of Pottali the pointed edge of Dhanya pokes the hands. Initially rate of extraction of Dhanyabhraka was more. But later it gradually tapers down which can be judged by the reduction in the size of Pottali. At this stage one must switch on to fresh media instantaneously, Fine particles of Dhanyabhraka also remain entangled in jute cloth. Slightest movement also causes disturbance in settled Dhanyabhraka. During evaporation, typical foul smell was produced. Observation of the process has been presented in the Table 5.

Abhrakia Bhasma

During each trituration the quantity of Erandapatra Swarasa was reduced gradually. The average drying time of Chakrikas was for 12-14h. During the stage of Marana between 250°C to 300°C temperature, Guda and Vatapatra burnt and create a typical smell and smoke which disappears later. Observation of each Puta throughout the process has been presented in the Table 6 & 7.

Amruteekarana

After 5 minutes of heating bubbles with sound started to appear, fumes started to appear after 10 minutes of heating. Vessel caught fire after 15 minutes of heating which stopped after 2 minutes. After 20 minutes the mixture was sticking to the vessel. After 40 minutes the mixture totally dried and attained powder form. Abhraka Bhasma lost its natural color and became brownish black. Bhasma particles were fine and smooth. Observation of the process has been presented in the Table 08, Table 9 & 10.

Analytical study

- XRD study of the sample Abhraka Bhasma had 14 peaks showing the angles (2θ), Heights, d-spacing and FWHM values. Comparison with standard values confirmed the presence of Fe₂O₃, Al₂O₃, SiO₂, MgO, Na₂O and K₂O.
- SEM analysis showed that Abhraka Bhasma is containing the smallest particle size of 213.2 nm confirming the presence of "Nano particles". EDX study confirmed the presence of elements in Abhraka Bhasma are O-49.78%, Si-19.94%, Al-11.74%, K-10.02%, Fe-4.81%, Ca-1.80%, Mg-1.18%, Na-0.72% in weight percentage.
- FT-IR Analysis of Abhraka Bhasma shows- Organic Compounds with functional groups like secondary Amines, Nitro, Alcohol, Carboxylic Acid, Alkenes, Esters, Bromide, iodide.

Table 1: Color changes and average temperature values at different 3 stages during Abhraka Nirvapa

Nirvapa		Stage: 1 (After 15 minutes)		Stage: 2 (After 35 minutes)		Stage: 3 (Red hot stage)	
		Colour	Temp.	Colour	Temp.	Colour	Temp.
Nirvapa 1		Silver black	518 ⁰ C	Silver black	934 ⁰ C	Reddish black	1152 ⁰ C
2 to 5	2 to 7	Golden black	260 ⁰ C	Silver black	446 ⁰ C	Reddish black	757 ⁰ C
6-7		Black		Silver black		Reddish black	

Table 2: Variation of weight before and after Nirvapa

Nirvapa	Weight of Abhraka (Before Nirvapa)(gms)	Weight of Abhraka (After Nirvapa) (gm)	Gain in wt (Wet Abhraka) (gm)
1	1000	1212	+ 212
2	1212	1298	+86
3	1298	1553	+255
4	1553	1792	+239
5	1792	1847	+55
6	1847	2202	+355
7	2202	2575	+373

(Weight was measured after 15 minutes of each Nirvapa)

Table 3: Volume of Godugdha before and after Nirvapa procedure

Nirvapa	Volume of Godugdha (Before Nirvapa)(ml)	Volume of Godugdha (After Nirvapa) (ml)	Loss in volume (ml)
1	1500	950	550
2	2500	2050	450
3	2500	1850	650
4	2500	1700	800
5	2500	1600	900
6	2500	1200	1300
7	3000	1300	1700

Table 4: Observation during Abhraka Nirvapa

Total weight of Krishna Vajra Abhraka	1000g	Average time duration for 1 Nirvapa	58 min
Sodhita Abhraka	942g	Total weight gain of wet Abhraka after 7 Nirvapa	1575 gm (before evaporation)
Yield of Sodhita Abhraka	94.2%	Average weight gain of Abhraka in wet stage per Nirvapa	225 gm
Loss of Abhraka after Sodhana Procedure	58 gm (5.8 %)	Total loss of Godugdha for 7 Nirvapa	6350 ml
Average quantity of Godugdha per Nirvapa	2428ml (2.428 liter)	Average loss of Godugdha per Nirvapa	907.14 ml
Total time duration for 7 Nirvapa	406 min	Total used Godugdha for 7Nirvapa	17,000 ml (17 liter)

Table 5: Results of Dhanyabhrakarana

Total quantity of used Shali	234g	duration of evaporation	1hr 25 min
Total quantity of used Sodhita Abhraka	942g	Dhanyabhraka	800g
Duration of soaking	3 days (72 h)	yield of Dhanyabhraka (from Shodhita Abhraka)	84.93%
Duration of sedimentation	20h	loss of Abhraka after Dhanyabhrakarana procedure	142g (15.07%)

Table 6: Observation of Abhraka Bhasma in different Putas

Putra	Colour	Touch	Putra	Colour	Touch
1	Shining orange	Rough	7 to11	Orange with pale black tinges	Smooth
2	Orange with black tinge	Rough	12	Light Orange	Smooth
3	Black with orange ting	Rough	13-14	Light brick red	Smooth
4	Black with Brown tinges	Less rough	15 to 23	Brick red	Smooth
5-6	Blackish brown with pale tinges	Less rough			

Table 7: Result of Abhraka Bhasma

Average duration of Putra	2h 40 min	Weight loss at the end of 23 Putra	216g (27.87%)
Weight of Abhraka Bhasma obtained at the end of 23 Putra	559g	Yield of Abhraka Bhasma	72.13% (from Dhanyabhraka) 55.9% (from Raw Abhraka).

Table 8: Bhasma Pareeksha of Abhraka Bhasma in different Putas

Putra	Chandrika	Varitara	Rekhapurnata	Apunarbhava	Uttama
1	+	-ve	-ve	-ve	-ve
3	-	+	-ve	-ve	-ve
7	-	+	+ve	-ve	-ve
10	-	++	+ve	-ve	-ve
15	-	+++	+ve	-ve	-ve
20	-	++++	+ve	-ve	-ve
21	-	++++	+ve	+ve	-ve
23	-	++++	+ve	+ve	+ve

Table 9: Lakshanas of Amruteekrita Abhraka Bhasma

Parameters	Observations	Parameters	Observations
Colour	Brownish black	Touch	Soft
Taste	Tasteless	Lusture	---
Odour	Odourless		

Table 10: Result of Amruteekarana

Weight of Abhraka Bhasma taken	125g	Weight loss	2g
Weight of Amruteekrita Abhraka Bhasma obtained	123g	Yield of Amruteekrita Abhraka Bhasma	98.4%

Table 11: XRD values of Abhraka Bhasma

Peak No	Pos. [°2Th.]	Height [cps]	FWHM [°2Th.]	d-spacing [Å]	Rel. Int. [%]
1	16.0666	730.83	0.2835	5.51202	371.06
2	25.5853	1672.3	0.2103	3.47884	463.74
3	26.8793	2198.14	0.2632	3.31423	691.41
4	27.6665	200.45	0.3357	3.22169	78.28
5	30.1643	553.57	0.3768	2.96036	231.72
6	31.0687	845.46	0.3629	2.87622	341.73
7	31.4803	479.15	0.2826	2.83954	149.76
8	32.8854	650.69	0.1721	2.72136	193.93
9	35.3732	395.14	0.229	2.53546	104.04
10	36.5355	450.38	0.3182	2.45742	170.61
11	37.6076	329.09	0.2721	2.38979	114.16
12	41.9718	52.72	1.0262	2.15084	61.04
13	49.2999	244.63	0.2545	1.84691	67.27
14	54.5731	103.61	1.1377	1.68025	125.49

(Totally 14 peaks were identified in sample of Naradiya Lakshminivilasa Rasa at different angels (2θ) from 16.0666 to 54.5731.)

Graph 1: EDAX Analysis of AB

Graph 2: FT-IR Analysis of AB

Picture 1: SEM Analysis of AB

DISCUSSION

Pharmaceutical study

The heat resistance properties and stratified structure of Abhraka persuaded the Acharyas to follow mainly Nirvapa for Abhraka Shodhana. So the main purpose of Shodhana of Abhraka is removal of both water soluble and fat soluble impurities and destruction of stratified structure of Abhraka by converting it to a granular form especially before Marana. Godugdha is known to be weak acid which plays an important role in the structural changes in Abhraka as well as impose their properties on it. During 1st Nirvapa, at 1st and 2nd stage Abhraka showed a colour change of silver black colour. During 2nd to 5th Nirvapa, at 1st stage Abhraka showed Golden black colour and at 2nd stage it showed silver black colour. During 6th and 7th Nirvapa, at 1st stage Abhraka showed black colour and at 2nd stage showed silver black colour. After each Nirvapa, the crammed structure of Abhraka was destroyed to form small pieces and particles due to increased brittleness. Colour became black and Silver luster of Abhraka kept on increasing. Yield of Shodhita Abhraka was 94.2%. Loss may be because of flying of particles immediately after Nirvapa, light weight of fine particles, loss during decantation, filtering and also during evaporation.

Dhanyabhrakarana is a unique intermediate procedure between Shodhana and Marana which is highly beneficial as there is

particle size reduction. Interaction between the solid and the liquid media is described by explaining the role of Amla rasa (sour taste) through Tikсна (penetrating), Jarana (digestive) and Kshalana (cleansing) properties. While Dhanya (paddy) due to its structural ability acts as a doer in this process; its external jagged surface grates the soft Abhraka into coarse powder form. The pressure of the hands enhances this process by increased friction and increased area of exposure by the movement of Pottali. The pores of jute bag prove to be a perfect sieve, yielding and expelling out the standard sized particles of Dhanyabhraka. Yield of Dhanyabhraka was 84.93%. Loss of Abhraka may be due to remaining impurities and hard particles of Abhraka in the Pottali, loss of particles during decantation of water and evaporation.

This is the one procedure where Acharyas claimed of attaining Abhraka Siddhi Lakshana by 3rd Puta, but on observation we get Nischandrata only after 3rd Puta. During 1st Puta, 1570ml Erandapatra Swarasa was needed. In 2nd Puta it decreased to 600ml. After each Puta, Erandapatra Swarasa quantity decreased and during last Puta it reached to 230 ml only. Rekhapurnata and smoothness observed after 7th Puta. Apurnabhavta observed after 21 Puta. Partial Varitaratva attained after 4th Puta and complete Varitaratva observed after 23rd Puta. After 23rd Puta, Bhasma was showing positive results for Uttamatwa. After 1st Puta, colour turned to Shining Orange. After 2nd Puta, it turned

to orange with a black tinge. After 3rd Puta to 6th Puta it was blackish brown in colour with black tinge. After 7th it turned to orange tinge. After 12th Puta, it attained light orange colour. After 13th and 14th Puta, turned to light brick red colour. After 15th Puta, attained brick red colour, which is described in classics for Abhraka Bhasma Varna.

Due to the heat endurance of Abhraka, very high temperature is provided several times during the Marana. The frequent exposure to this high temperature leads to the formation of some unwanted properties in it like Rukshata (roughness), Tikshnata. To subside this effect, it is subjected for 'Amruteekarana'. Colour change was observed in the Abhraka Bhasma from brick red to brownish black. This is possibly due to the tannin content of Triphala that got concentrated on solidification. There is also a possibility that a part of ferric oxide change its phase to ferrous forming ferrous ferric oxide complex which again contribute black colour.

Analytical study

The sample Abhraka Bhasma has particles in nano meters, least being 213.2 nm. Nano particles are better absorbed and assimilated due to small particle size. XRD study of the sample had 14 peaks showing the angels (2θ), Heights, d-spacing and FWHM values. Comparison with standard values confirmed the presence of Fe₂ O₃, Al₂ O₃, SiO₂, MgO, Na₂ O₂ and K₂ O. The EDX study confirmed the presence of Al, Si, Fe, K, Mg, Na, O and K in Abhraka Bhasma. FT-IR Analysis of Abhraka Bhasma shows - Organic Compounds with functional groups like secondary Amines, Nitro, Alcohol, Carboxylic Acid, Alkenes, Esters, Bromide, iodide⁶.

CONCLUSION

The process of Shodhana, Dhanyabhrakarana and Marana play a vital role in the conversion of raw Krishnavajra Abhraka in to absorbable Abhraka Bhasma. According to the classics, 3 Putas are sufficient to attain Bhasma Siddhi Lakshanas. But on observation only Nischandratva attained after 3rd Puta. The desired Bhasma Lakshanas with standard brick red colour were obtained after 23rd Puta only. The increase in number of Putas decreases the particle size. There is a notable difference found in the particle size of the final product. The sample Abhraka Bhasma has particles in nano meters, least being 213.2 nm. XRD study of the sample had 14 peaks showing the angels (2θ), Heights, d-spacing and FWHM values. Comparison with

standard values confirmed the presence of Fe₂ O₃, Al₂ O₃, SiO₂, MgO, Na₂ O₂ and K₂ O. EDX study confirmed the presence of elements in Abhraka Bhasma are O-49.78%, Si-19.94%, Al-11.74%, K-10.02%, Fe-4.81%, Ca-1.80%, Mg-1.18%, Na-0.72% in weight percentage. FT-IR Analysis of Abhraka Bhasma shows - Organic Compounds with functional groups like secondary Amines, Nitro, Alcohol, Carboxylic Acid, Alkenes, Esters, Bromide, iodide.

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