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Research Article

METHODOLOGICAL INSIGHTS IN THE PREPARATION OF *NAGA BHASMA*

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ABSTRACT

In the present research paper an attempt has been made to introduce standard operating procedure (SOP) for preparation of Naga *Bhasma* described in Ayurvedic formulary of India (AFI) using traditional *Puta* method. A total 60 *Putas* were given, out which first 50 *Puta* were *Ardha gajaputa*, followed by last 10 *Puta* as *Gajaputa*. In this method *Manahshila* and *Kanji* were taken as media. *Arddha Gaja Puta* (burnt with 4 kg Cow dung cake) was given for first 50 *puta* and the last ten *Putas* was given *Gajaputa* (burnt with 8 kg cow dung cake). The percentage increase in the *Naga bhasma* prepared after 60 *Puta* was 12%. Upto 50 *Puta* the increase in weight of Naga was 208%, while in last 10 *Putas* the percentage of decrease in weight was 63.66%. The average percentage purity of *Naga* decreased from 93.18% to 81.44% after *Shodhana*. The percentage of (Pb) Lead in *Naga Bhasma* 50 *Puta* and 60 *Puta* were 14.118% and 14.872 % respectively. Chemically *Naga Bhasma* was found in the form of PbS form.

KEYWORDS: Methodological, Pharmaceutical, *Naga bhasma, Manahshila, Ardha gajaputa, Gaja puta.*

INTRODUCTION

Ayurveda, the science of healing is the oldest medical science. The various formula and their manufacturing procedures are very much practical and stands valid even today. Though these time tested remedies doesn't require further validation but still these principles and theories are needed to be explained on the basis of scientific terms not only to convince the present day scholars but also for its Global acceptance. Sushruta guessing well in advance such sort of situation will arise has advised that one should be well versed in his own branch and also to have knowledge in the other allied branches too. Ayurveda too adopted so many changes according with the change of time. The use of *Naga* is described in *Charaka Samhita*[1] in *Trapvadi lepa* for the treatment of *Kushtha*, *Pancha lauha*[2], *Kustha roga chikistha.*[3] The use of *Naga* in Sushruta samhita also in *Trapwadi lepa*[4] for the treatment of *Kustha*, a variety of *Shilajatu,*[5] used for *Kaphaja Arbuda.*[6] The use of *Naga* in different *Rasashastria* literature are grouped under in *Dhatu Varga*, *Putilouhas*, constituent of *Divya Ausadhi yoga*. The Ayurvedic application of *Naga Bhasma* is described in *Pandu*, *krimi*, *Prameha*, *Amavata*, *Raktapradara*, *Rakta arsa*, *Vrikka sopha*, *Hasatapadavikara*, *Pakshyaghata*. The Pharmacological activity of *Naga Bhasma* is used for Hyperglycemia, *Amavata*, *Gulma*, *Grahani*, *Atisaranasaka*, *Vajikarana*, *Vrisya*, *Balya*, Hypoglycemic activity, testicular regenerative capacity, good *Rasayana*. Toxicity of lead occurs commonly through manufacturing and ecological exposure. It affect almost all system in the body and gives rise to symptoms such as lead stomach pain, lead encephalopathy etc. So the present study was undertaken to develop SOP in the preparation of *Naga Bhasma* using method described by AFI method.

Materials and Methods

Raw *Naga*, *Tila Taila*, *Takra*, *Gomutra*, *Kanji*, *Kulattha* seeds, *Manahshila*, *Ashwattha Twaka* were used as raw materials. Lead was considered as *Naga* for their comparable uniqueness and was collected from Pharmacy, National institute of Ayurveda, Jaipur and was authenticated as per classical texts. In this study the following practical's were carried out viz., *Naga Shodhana* (Purification of Lead), *Naga Jarana* (Lead), *Manhashila Shodhana* (Purification of Realgar), *Naga Marana* (incineration of Lead).

Naga (Lead) *Shodhana*

Samanya Shodhana

Procedure

The *Naga* (Lead) was melted in a long handled ladle or a fat-thick iron pan. For *Samanya Shodhana,*[7] on melting it was immediately quenched in the liquid media, three times in each, successively. The *Samanya Shodhana* converts *Naga* (Lead) into a grayish granular form. Before and after every

quenching the weight of *Naga* (Lead) was recorded. The initial and final volume and weight of the liquid medium after every single quenching was recorded. The whole procedure was observed keenly for detailed behavioral patterns of the metal as well as the media.

Naga* (Lead) *Jarana

The gas burner was first starts and a big clean iron vessel, called 'kadhai', was placed over it. In accordance with the Good Laboratory Practices (GLP), the vessel was heated red hot to burn any remains from previous use. It was allowed to self-cool and then only put to use for *Jarana*. The *Aswatha* and *Chincha*, in the specified amount (1/4th part each), which was dried in shade was collected in an enamel tray, cleaned, weighed, substituted for the weight loss during cleaning and kept ready for use.

Procedure

The specified amount of *Sodhita Naga* (Lead)[8] was taken in the iron vessel and allowed to melt over the ignited gas burner. Weighed quantity of *Aswatha* and *Chincha* ranging from 10g to 15g was added to the molten *Naga* (Lead). The stirring is kept continuous with simultaneous imparting of pressure and friction. The *Aswatha* and *Chincha* was allowed to burn away completely, leaving no trace of unburnt material, and then only the next quantum of *Aswatha* and *Chincha* was added. In the end when the whole of the metal had been transformed into ash/powder form, and none of the metal remained in a visibly metallic form, the ash was collected in the center and covered with an earthen plate. The heat was increased to as much as possible till the bottom of the vessel was visibly red. The plate was slightly lifted intermittently to check the colour status of the ash. As soon as the colour changes to red-hot the heating is stopped and left for self-cooling. After 45 minutes fragmentation of *Naga* (Lead) occurs. Total assimilation of *Naga* (Lead) occurs after 6 hrs. The next day, after complete self-cooling, the *Jeerna Naga* (Lead) is collected in an already weighed container for weighing. *Prakhyalana* was done with *Ushna jala* and *Kanji* for three times to separate the *Kshara* added to this. Lastly the material obtained was subjected to washing with *Ushna jala* till it acquired neutral pH. The fumes released during the process, possibly contain lead oxide No fumes should be actively inhaled. Though only one-fourth part of both *Aswatha* and *chincha* has been advised to be used, very less amount than the one fourth does the job. Because it is specifically mentioned, the whole of the one fourth of *Aswatha* and *Chincha* was used for the process.

Manhashila Shodhan

Material

Ashuddha Manashila- 4000gm, *Ardraka swarasa* (*Zingiber officinale*)- 3600 ml

Procedure

Accurately weighed 4000 gm of *Ashuddha Manashila* was taken in *Khalvayantra.*[9] Fine powder was made. 5kg *Adraka* was properly cleaned. Pounded material was put into mixer cum grinder and smooth paste (*Kalka*) was prepared. The *Kalka* was expressed through the cotton cloth by manual method. Filtered juice (*Swarasa*) was then collected into a steel container. Obtained *Swarasa* was measured by measuring cylinder and then used for *Bhavana* process. For 1st *Bhavana* 600 ml of *Ardraka swarasa* was added into mortar. The mixture was subjected for trituration till mixture was dried. When the powder was totally dried up, it was consider as the completion of 1st *Bhavana*. Then again sufficient quantity of *Swarasa* was added and mixture was triturated. The same process was repeated for more 6 times. *Swarasa* which was prepared was stored in freeze.

Naga* (Lead) *Marana

The Medium used for *Naga Marana* were *Jeerna Naga* (Lead), *Shuddha Manhashila* and *Kanji.*

Procedure

A particular amount of the material to be calcined is taken in an iron mortar. A weighed and measured amount of *Shuddha Manhashila*[10] and *Kanji* is added to the material. The mixture is levigated with proper and constant pressure and frequency for 3 hrs. As the paste tightens due to loss of moisture, it is transferred to an already weighed *Sarava* and spread uniformly on it, with the help of spoon. Before transferring the levigated material onto the *Sarava, Sarava samputa* designated to the use of this particular calcinations batch is weighed and kept aside. The spread material is immediately caked to squares using a knife and weighed. Subtracting the weight of the *Sharava* already taken, from this weight gives us the weight of wet cakes. It is covered with another *Sarava* to form the calcination apparatus, the *Sarava samputa* which is kept on a shelf for complete drying. Just before exposing it to *Puta* (Calcination) the *Sarava samputa* is weighed, only the *Sarava* with dried cakes is weighed and the weight of empty *Sarava* is deducted from it to give the weight of dried levigated materials.

Table 1: Quantitative Status of Materials During Kanji Preparation

Batch No.	Weight of Raw Rice (Kg)	Volume of Water Added for Cooking (L)	Weight of Cooked Rice (Kg)	Volume of Water added for Kanji Preparation (L)	Final Yield of Kanji (L)	pH of Kanji	Colour of *Kanji*
K1 (Boiled Water) 24-04-04 to 2-05-04	2	10	8	24	22	3.5	Translucent like coconut water

Table 2: Depicting the Details of *Shodhana* (Samanya) Practicals

Batch Code	No. of *Dhalana* (Quenching)	Wt of *Naga* (Lead) after *Shodhana*		*pH*	*No.*
NS1	*Til Taila* ($T_1 - T_3$)	500	490	-	3
NS 2	*Takra* ($Tk_1 - Tk_3$)	490	480	3	3
NS 3	*Gomutrta* (Gm_1 - Gm_3)	480	470	7.5	3
NS 4	*Kanji* ($K_1 - K_3$)	470	460	3.5	3
NS 5	*Kulattha Kvatha* (KKw_1- KKw_3)	460	440	5	3

Table 3: Quantitative statuses of materials during *Naga* (Lead) *Jarana*

Batch Code	Time Required	Weight of Sodhita *Naga* (Lead) (g)	Weight of *Aswatha* & *Chincha* (g)	Yield of *Jeerna Naga* (Lead) Weight (g)	Yield of *Jeerna Naga (Lead)* (%)
JN	6 hr 00 min	440	220	490	111.36%

Table 4: Showing observation during *Bhavana* process in *Ardraka swarasa*

Bhavana	Trituration (hours)	Wt. of *Manashila* (gm)	*Ardraka swarasa* (ml)
1	2	4000	600
2	3	4118	500
3	2	4225	500
4	2	4300	500
5	2	4315	500
6	2	4325	500
7	2	4340	500

Table 5: Precalcination process physical gravitematroy

No of *Puta*	Amount of material taken in the iron mortar (J *Naga* (Lead) +S. *Manashila*) In (g)	Amount of *Kanji* juice added In (ml)	*Sarava* + Calcined Pellets (g)	Calcined Pellets (g)	Colour of calcinied pellets
1.	250+250	200	765	265	Blackish
2.	265+65	100	764	264	Blackish
3.	264+65	100	762	242	Blackish
4.	242+65	100	767	247	Blackish
5.	247+65	100	765	262	Blackish
6.	262+65	100	770	270	Blackish
7.	270+65	100	800	300	Blackish
8.	300+65	100	795	295	Blackish
9.	295+65	100	795	295	Blackish grey
10.	295+65	100	785	285	Blackish grey
11.	285+65	100	785	285	Blackish grey
12.	285+65	100	780	280	Blackish grey
13.	280+65	100	795	295	Blackish grey
14.	295+65	100	820	320	Blackish grey
15.	320+65	100	825	325	Blackish pinkish grey
16.	325+65	100	855	355	Blackish pink
17.	355+65	100	860	360	Blackish grey
18.	360+65	100	895	395	Blackish grey
19.	395+65	100	900	400	Blackish grey
20.	400+65	100	905	405	Blackish grey
21.	405+65	100	900	425	Blackish Grey

22.	425+65	100	920	420	Blackish grey
23.	420+65	100	920	420	Blackish grey
24.	420+65	100	915	415	Blackish grey
25.	415+65	100	930	430	Blackish grey
26.	430+65	100	935	435	Blackish grey
27.	435+65	100	965	465	Blackish yellow grey
28.	465+65	100	1007	507	Pinkish yellow black
29.	507+65	100	1015	515	Light brownish Black
30.	515+65	100	980	480	Light brownish black
31.	480+65	100	985	520	Light brownish black
32.	520+65	150	1060	560	Light brownish black
33.	560+65	150	1040	540	Light brownish black
34.	540+65	150	1050	550	Light yellowish black
35.	550+65	150	1100	600	Light brownish black
36.	600+65	150	1120	620	Light brownish black
37.	620+65	150	1140	640	Light brownish black
38.	640+65	150	1180	680	Light brownish black
39.	680+65	150	1190	690	Light brownish black
40.	690+65	150	1185	695	Light brownish black
41.	695+65	150	1200	700	Light brownish black
42.	700+65	150	1205	705	Light brownish black
43.	705+65	150	1212	712	Light brownish black
44.	712+65	150	1224	724	Light brownish Black
45.	724+65	150	1245	745	Light brownish Black
46.	745+65	150	1242	742	Light brownish black
47.	742+65	150	1254	754	Light brownish black
48.	754+65	150	1260	760	Light brownish black
49.	760+65	150	1270	770	Light brownish black
50.	770+65	150	1270	770	Light brownish black
51.	770+65	150	920	420	Light brownish black
52.	420+65	100	900	400	Light brownish black
53.	400+65	100	880	380	Light brownish black
54.	380+65	100	865	365	Light brownish black
55.	365+65	100	795	295	Light brownish black
56.	295+65	100	770	270	Light brownish black
57.	270+65	100	768	268	Light brownish black
58.	268+65	100	768	268	Light brownish black
59.	270+65	100	770	270	Light brownish black
60.	280+65	100	780	280	Light brownish black

Table 6: Showing the *Puta* (Temperature pattern) of *Naga (Lead) Bhasma*

During 1st 50 *Puta* (4 kg cow dung cake)			**During last 10 *Puta* (8 kg cow dung cake)**		
Time	**Temperature**	**Observation**	**Time**	**Temperature**	**Observation**
9.15	0-50		9.15	0-50	
9.30	50-100		9.30	50-100	
9.45	100-150		9.45	100-150	
10.00	150-200		10.00	150-200	
10.15	200-250	-	10.15	200-250	-
10.30	250-300	Fumes	10.30	250-300	Fumes
10.45	300-350	Fumes ↑↑	10.45	300-350	Fumes ↑↑
11	350-400	-	11	350-400	-
11.15	400-450	-	11.15	400-450	-
11.30	450-500	Burning Sound from inside the *Puta*	11.30	450-500	Burning Sound from inside the puta

12	500-550	Bursting and burning Sound from inside *Puta*	12	500-550	Bursting and burning Sound from inside *Puta*
12.15	550-600	Fumes ↑↑	12.15	550-600	Fumes ↑↑
12.30	600-650		12.30	600-650	
12.45	650-700		12.45	650-700	
1	700-750		1	700-750	
1.15	750-800		1.15	750-800	
1.30	800-850		1.30	800-850	
1.45	850-900		1.45	850-900	
2	900-950		2	900-950	
2.15	900-850		2.15	950-1000	
2.30	850-750		2.30	1050-1100	
2.45	750-650		2.45	1100-1150	
3	650-550		3	1150-1200	
3.15	550-450		3.15	1200-1250	
3.30	450-350		3.30	1300-1350	
3.45	350-250		3.45	1350-1250	
4	250-150		4	1250-1150	
4.15	150-50		4.15	1150-1050	
			4.30	10.50-950	
			4.45	950-850	
			5.00	850-750	
			5.15	1000-950	
			5.30	750-650	
			5.45	650-550	
			6.00	550-450	
			6.15	450-350	
			6.30	350-250	
			6.45	250-150	
			7.00	150-50	

DISCUSSION

The *Naga* (Lead), and *Manhashila* were subjected to *Shodhana* refining process. *Dhalana* method was followed for *Naga* (Lead) and *Bhavana* was the process adopted for *Manhashila* (traditional used arsenin metal). Heating up to the critical melting point, holding at that temperature and cooling suddenly in cold liquids as in case of *Dhalana* will bring about the brittleness in the metal, which was become evident by conversion of the metal proper to small pieces at the end of the procedure.[11] The metal *Naga* (Lead)were subjected to heat treatment in an open air that means in the presence of abundance of oxygen. The metal might have complexed with this oxygen and converted into a compound form. Similarly the contaminants that are present in association with the metal *Naga* (Lead) might have oxidized and either escaped into the air or might be dissolved on pouring into the liquids. Similarly the liquids that are used for sudden cooling induces oil/fat might have helped the metal to soften relatively from its original hardness.[12] The most aqueous liquids are acidic in reaction except cow's urine which is alkaline. Here the ph changes in the liquids will also helped in dissociation of contaminants/ impurities to the metal proper. Ayurveda too advocates the same that all alkaline media will help in disintegrating the impurities present while acidic media will assist in the purification/ refinement and also digestion of the purities. Another observation, which was common in all process of *Shodhana*, is the liquids lost their neutrality and become clear after quenching.[13] This is because the hot molten metal when comes into contact with the liquid the solids, especially proteineceous and fatty type, suspended in the liquid might have been coagulated and precipitated because of the heat. The loss observed in the metal at the end of the process in each liquid can be attributed to the handling. Similarly in case of *Manhashila* the yield of *Adraka swarasa* from fresh ginger was 72%. It was noticed that the colour of the *Manhashila* has gradually changed after every trituration the reason might be the colour will vary from aggregation state to powdered state. Trituration converts the aggregate *Manhashila* to fine powder form second reason as addition of starch present in the liquid media i.e.,

Ginger juice also might have helped in colour change. The addition of starch is indicated by the gain in weight after completing the purification process. This purified *Naga* (Lead) were subjected to an intermediary process *Jarana*, before proceeding for *Marana*. *Jarana* process a copy of polishing process employed in the refining process of Lead. In polishing process a fresh twig of *Neem* etc is used to rub the molten metal (Lead) in an open air while heating process is going on. It helps in release of the oxygen from the fresh twigs and the current of oxygen bubbles released will help in oxidizing the metal. Rasashastra advocates the barks of whole plant parts of some plants, especially of alkaline natured should be used for *Naga Jarana*. Rest of the procedure is identical to polishing. This helped in total conversion of the easy turning metal into powder from. An increase in the final yield was noticed which is again due to the addition of ash of plant material used in *Jarana* process.[14] The *Naga* (Lead) was incinerated in association with *Manahashila* (traditionally used arsenic mineral). *Naga Bhasma* (Lead) was subjected to 60 *Putas*. In initial 50 *Putas*, a remarkable increase in *Naga bhasma* (Incinerated Lead) was noticed and in last 10 *Putas,* the same was returned to normal weight. This was happened in last 10 *Putas* on increasing the quantum of heat. This indicates that the temperature received in initial 50 *Putas* was totally in sufficient to complete the reaction process. It is thus imperative from this experiment that the temperature must be optimum. The colour of the sublimed product is varied and may be due to different forms of arsenic deposition. *Naga Bhasma* samples on organoleptic parameters were smooth in touch indicating that the *Bhasma* is fine up to desired extent. This may be because of proper *Mardana* of the sample. On considering the P.S.A.F., in which *Naga Bhasma* is describing as a fine gray coloured, tasteless powder, it reveals that this variation in colour of *Bhasma* is may be due to the change in pattern of temperature given for incineration and due to the variation in *Bhavana Dravya* used. This probable cause is suggested on the basis of observations made during the preparation of *Naga Bhasma* in which temperature was gradually increased 4 kg for 1st 50 *Putas* 8 kg for last 10 *Putas*. In initial 50 *Putas*, a remarkable increase in *Naga* was noticed and in last 10 *Putas* the same was returned to normal weight. This was happened in last 10 *Putas* on increasing the quantum of heat. This indicates that the temperature received in initial 50 *Putas* was totally in sufficient to complete the reaction process. Maximum temperature for 4 kg was observed 900^0 C as per table no 6. It remained above 850^0 C for 30 min. followed by gradual decrease. It takes 6 hrs approximately to reach the highest temperature. Maximum temperature for 8 kg was observed 1350^0 C as per table no 6. It remained above 1250^0 C for 45 minutes followed by gradual decrease. It takes 9 hrs approximately to reach the maximum temperature. It is thus imperative from this experiment that the temperature must be optimum. The increase in weight of *Naga Bhasma* after *Marana* may be due to the ash of *Manahshila* addition every *Puta* [15]. Total 120 gm of Arsenic was seen as white powder stucked over upper *Sharava* and to the walls of the pit after 60 *Puta*.

CONCLUSION

For preparation of good quality *Naga Bhasma* processes like; *Shodhana*, *Jarana* and *Putapaka* are very important. *Ardha gajaputa* for 250gm *Naga,* is 4 kg and *Gajaputa* for 250 gm *Naga*, is 8 kg found enough in the *Marana* process. *Naga Bhasma* is found as lead sulphide (PbS), by this AFI methods and Lead in *Naga Bhasma* 50 *Puta* and 60 *Puta* was 14.118% and 14.872 % respectively.

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