



eISSN - 2348-0173

Vol-2, Issue-1 - Jan-Feb -2014

www.ijaam.org



INTERNATIONAL JOURNAL OF AYURVEDA & ALTERNATIVE MEDICINE

RESEARCH ARTICLE

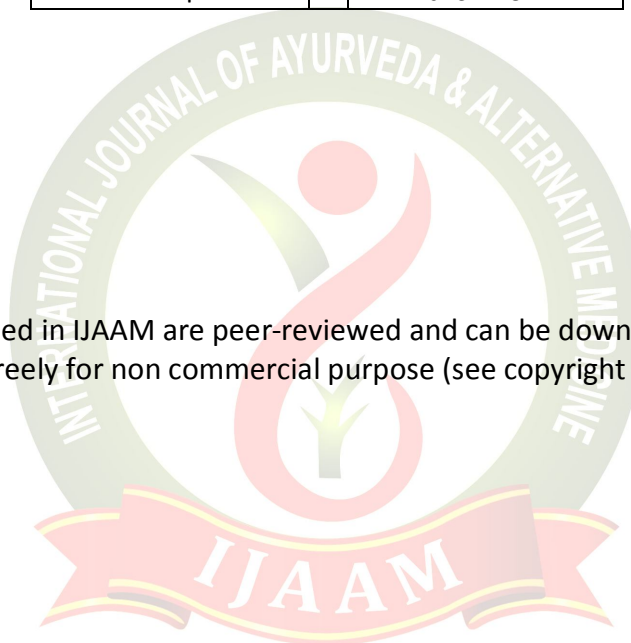
eISSN 2348- 0173

**COMPARATIVE PHARMACEUTICAL STANDARDIZATION OF NAGA
BHASMA (INCINERATED LEAD) PREPARED BY TWO DIFFERENT
METHODS****Dhirajsingh Rajput^{1*}, Shobhanath Yadav¹, Ashish Varma¹, B.J. Patgiri²**

1. PhD Scholar, Department of RS & BK, IPGT & RA, Gujarat Ayurved University, Jamnagar, Gujarat- 361008
2. Associate Professor, Department of RS & BK, IPGT & RA, Gujarat Ayurved University, Jamnagar, Gujarat- 361008

Article Received on	-	7 th February 2014
Article Revised on	-	25 th February 2014
Article Accepted on	-	1 st March 2014

All articles published in IJAAM are peer-reviewed and can be downloaded, printed and distributed freely for non commercial purpose (see copyright notice below).



© 2013 IJAAM

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by-nc-nd/3.0/deed.en_US), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

RESEARCH ARTICLE

eISSN 2348- 0173

COMPARATIVE PHARMACEUTICAL STANDARDIZATION OF NAGA BHASMA (INCINERATED LEAD) PREPARED BY TWO DIFFERENT METHODS**ABSTRACT**

Bhasma preparation is complex process which involves several steps. These steps are considerably differs based on the herbal, metallic and mineral media utilized for incineration cycles. In the context of *Naga Bhasma*, it is observed that, *Bhasma* preparation from herbal media require *Jarana* process; *lepa*(application of layer over metal) procedure is required when one utilizes mineral media and *Pishti* (amalgam) preparation is required while utilizing *Parada* (mercury) media. Some research works has been published on pharmaceutical standardization of *Naga Bhasma* but till date no work has been published on comparative pharmaceutical standardization of *Naga Bhasma* prepared by two different methods. Aim of the present study was to establish comparative pharmaceutical standardization of *Naga Bhasma* prepared by two different methods. *Samanya shodhana* of *Naga* was done by three times quenching in *Tila taila*, *Takra*, *Gomutra*, *Kanji* and *Kulattha kwatha*. *Vishesh shodhana* was done by seven times quenching of melted *Naga* in *Churnodaka*. *Naga Bhasma* was prepared in six batches, three batches with *Vasa* (*Adhatoda vasaica* Niss.) as herbal media and three batches with *Parada* as media.

Maximum 650°C temperature and seven incineration cycles were found sufficient for *Naga Bhasma* prepared by both methods. Average 69.4 % and 30.11 % *Naga Bhasma* was obtained from *Vasa* and *Parada* media respectively. *Bhasma* prepared from *Vasa* media was red while from *Parada* media was dark black.

KEY-WORDS- *Naga Bhasma*, Pharmaceutical standardization, *Vasa*, *Parada*.

INTRODUCTION:

Preparative procedure of *Bhasma* (incinerated metal) is bit complicated, tedious and require some cautions to maintain batch to batch consistency which is also necessary for reproducibility and large scale manufacturing. It is too much expensive to test the metals and minerals after each processing to confirm whether similar effect of processing is occurred in all batches. Hence standardization of each steps step in terms of time, temperature, duration of processing, quantity, loss and some observations are necessary. In classical texts various methods incineration are mentioned for every metal. These methods can be divided into some categories based on the principle procedure such as incinerated metal prepared after *Jarana* (open pan frying) process, prepared from *Pishti* (amalgam), prepared by *Lepa* (application of layer over metal) method and prepared after open pan frying process followed by *bhavana* (levigation) and *Puti* (incineration cycles) etc. Many times ancient seers of *Rasashastra* (a branch of *Ayurveda* deals with metals and minerals) utilized more than one principle procedures. Detail understanding of incinerated preparation of any metal by a principle process helps to understand preparative procedure of other metals.

Address for Correspondence

* Dhirajsingh Sumersingh Rajput
PhD Scholar, Department of RS & BK,
IPGT & RA, GAU, Jamnagar-361008
Mobile-08460286952
Email-dhiraj.ayu@gmail.com

Pharmaceutical standardization of *Rasaushadhis* (herbo-metallic and herbo-mineral preparations) can be defined with the number of processes, involved in the production of a drug. The standard protocols mentioned in the classics,^[1] which may be applied to the present manufacturing scientific pharmaceutical ambience, such as quality of raw materials^[2] to be taken for the process. The process standardization protocols are like temperature, time space, instruments and heating devices etc. along with purification protocols like number of levigation,^[3] *Swedana* (steam heating)^[4] etc. and the finished drug protocol^[5] viz. colour, fineness etc. Validation^[8] of the method of preparation is to be done by manufacturing the same product by similar method and instrumentation, for any number of times, with standard raw material getting output of same product with specification of parameters. Comparative pharmaceutical standardization supports in understanding the difference between two manufacturing process. It also helps to know the reason behind different preparative process of single formulation.

Some research works has been published on standardization and characterization of *Naga Bhasma* (incinerated lead by *Ayurvedic* method) but till date no work has been done on comparative level. Therefore an attempt has been made to carry out comparative pharmaceutical standardization of *Naga Bhasma* prepared by two different methods. In present work, incinerated lead was prepared from *Parada* (mercury) media and *Vasa* (*Adhatoda vasaica* Niss.) media and observations of each step were recorded carefully to assure its pharmaceutical standardization.

MATERIAL AND METHODS:

The following unit processes were performed pharmaceutical study–

Preparation of media required for Naga Samanyaand Vishesha Shodhana (general and special purification): 6 kg raw *Naga* was taken from Ayurvedic pharmacy, IPGT & RA, Gujarat Ayurveda University, Jamnagar. *Tilataila* (sesame oil), *Kulattha kwatha* (*Dolichos biflorus* Linn.e. - horse gram for decoction) and *Gomutra* (cow urine) were procured from local market and from Goshala, Jamnagar respectively. *Kanji* (sour gruel) and *Takra* (clarified butter milk) were prepared as per classical reference from *Parada Vidyaniya*^[6] and *Sushurata Sutra*^[7] respectively. *Vasa* stems for *Naga Jarana* (open pan frying) and *Vasa* leaves for levigation were collected from botanical garden, IPGT & RA, Gujarat Ayurveda University, Jamnagar.

General and specific purification of Naga: General purification was carried out by three times quenching of melted lead in sesame oil, clarified butter milk, sour gruel, cow urine and decoction of horse gram respectively.^[8] Each time new liquid media was taken. For 1 kg *Naga*, 2 l liquid media was taken. Special purification was done by seven times quenching of melted *Naga* in *Churnodaka* (lime water).^[9] Detail of ingredients and quantity taken for purification and incineration is depicted in [Table 1].

Incineration of Naga by using herbal media: It was done in two steps viz *Jarana* with *Vasa* stem and *Marana* with *Vasa Kwatha*.

Jarana of Naga: Three batches of *Vishesha shodhita Naga* (each 930gm), *Vasa* stems (3 pieces, each approx 4 feet long and average 6 cm in diameter) were taken for *Jarana*. *Shuddha Naga* (purified lead) was heated in an iron pan. After complete melting, *Naga* was strongly rubbed with *Vasa* stem. After 2 hrs *Naga* was converted in to yellow powder. Then powdered *Naga* was collected in centre, covered with earthen saucer and strong heat was given for 3 hrs till all powder become red hot. Heating stopped after 3 hrs. On next day, powder was collected.^[10]

Naga Marana by herbal media: *Jarita Naga* (500 gm for each batch, 3 batches) and freshly prepared *Vasa Kwatha* (Decoction of leaves of *Adhatoda vasaica* Niss. 100 ml for each batch prepared before each *Putra*) were taken. *Vasa kwatha* was added in *Jarita Naga* and levigated for 3 hours, till formation of smooth mass followed by *chakrikarana* (preparing small pellets). These *chakrika* (circular pellets) were allowed to complete dry in sunlight. After complete drying

these pellets were collected in earthen saucer and covered with another earthen saucer. The junction of earthen saucer was sealed by mud smeared cloth and allowed for complete drying. For incineration electric muffle furnace (EMF) was used instead of traditional *Putra*. The saucers were placed in EMF and subjected for incineration. On next day the saucers were collected, incinerated pellets were removed and again levigated with fresh *Vasa kwatha* followed by *chakrikarana* and incineration. This procedure was repeated for seven times for each batch.^[11]

Marana of Naga by using Parada media: *Marana* procedure by this method involve four steps such as *Shodhana* of *Gandhaka* (sulfur), *Shodhana* of *Parada*, *Naga Pishti* (amalgam of lead) preparation and *Putra* (incineration cycles).

Shodhana of Gandhaka: Three batches of raw *Gandhaka* each of 4 kg were taken for *shodhana*. Cow milk in double the quantity of *Gandhaka*, was taken in one stainless steel container. A muslin cloth in four layers was tied to the mouth of the container. *Gandhaka* powder and *Goghruta* (cow ghee) in equal quantity were taken in another stainless steel container which was then heated on a low flame to melt the *Gandhaka*. The mixture was thoroughly stirred while heating. As soon as the *Gandhaka* was melted the mixture was poured in the container containing milk. *Gandhaka* poured in the milk get solidified at the bottom of container forming a solid hard cake. The cake was then washed with hot water and grounded to form powder. The powder was repeatedly washed with hot water to remove the oily part of *Goghruta*. The washed powder was then dried and subjected to further processing. The above process was repeated for two more times on the *Gandhaka* powder obtained at the end of each processing. Thus at the end of third procedure *Shodhita Gandhaka* (purified sulfur) was obtained.^[12]

Shodhana of Parada: Three batches of raw *Parada* each of 1 kg were taken for *shodhana*. Garlic juice of sufficient quantity was poured in *Khalva Yantra* (mortar and pestle) containing *Parada*, taken for *Shodhana*. The mixture of *Parada* and Garlic juice was grinded till the mixture turned completely black. The blackened garlic juice was removed by siphoning and fresh garlic juice was poured to continue grinding. The grinding was continued for 7 days. At the end of 7th day grinding was stopped and blackened garlic juice was once again removed. The grinded *Parada* was then washed with hot water and filtered through clean white muslin cloth. Thus *Shodhita*

Parada(purified mercury) was obtained and collected in glass container.^[13]

Preparation of NagaPishti: 500 gm *Naga* was heated till complete melting and poured in *Khalvayantra* containing 125 gm *Parada* and triturated till formation of *Naga Pishti*. *Nimbu swarasa* (lemon juice) was added to facilitate trituration. In such way three batches were prepared.^[14]

d) Naga Marana by using Parada media (Putra procedure): *Gandhaka* was added in prepared *Naga Pishti* and triturated with *Nimbu swarasa* up till formation of homogenous mixture. Then *Chakrika* were prepared and allowed to complete dry under sunlight followed by creating *sharavasam Putra* and *Putra* in EMF. After 3rd *Putra*, 1/4th *Gandhaka* to the initial weight of *Naga* was added. Similar procedure repeated for subsequent *Putra*.^[15]

OBSERVATION AND RESULTS:

Samanya and Vishesha shodhana: During *Samanya Shodhana* of *Naga* flame caught from second time of quenching in sesame oil. Pungent smell, hissing sound and a rush of black fumes were observed after quenching and iron ladle turned yellow in colour. Before first quenching in clarified butter milk, flame coughed in melted *Nagadu* due to presence of sesame oil. No significant change in test and odour of all liquid media were observed after quenching. Some part of *Naga* was converted into yellowish powder form after each quenching. Melting time of *Naga* was gradually increased after *Shodhana* in each media. Shining of *Naga* was decreased after quenching in sour gruel and cow urine, while it was significantly decreased and blackish ash was observed floating over melted *Naga* after *Shodhana* in decoction of horse gram. Average time taken for melting of *Naga* in sesame oil, clarified butter milk, sour gruel, cow urine, and decoction of horse gram were 5.24, 5.92, 6.63, 6.74, 8.33 and 8.41 min respectively. Hissing sound was heard while pouring of melted *Naga*. Slight shining was appeared after *Shodhana* in lime water. Average time taken for melting of *Naga* in lime water was 8.46 min. Detail of Weight of *Naga* before and after *Samanya* and *Vishesha Shodhana* is given in [Table 2].

Naga Jarana: Black fumes were found coming while *Naga Jarana*. Up to 4 inches *Vasa* stem was burned till *Naga* become yellow powder i.e. in 2 hrs. On the next day Yellow powder of *Naga* was obtained with slight reddish particles. Average 0.72 % weight gain was observed after *Jarana*. [Table 3, 4, 5 and 6]

Naga Marana by Vasa media (NBH): Before 1st *Putra Naga chakrika* were yellowish, soft and easily breakable and after *Putra*, *chakrika* were slight hard, having slight redness at the circumference and mixed yellowish redness at the center. Soft in touch and no friction of metallic particle experienced at the time of powdering *chakrikas*. No metallic particles of *Utthapita Naga* (regained particle of Lead) were observed. Before 2nd *Putra*, colour of *chakrika* was pink red and after 2nd *Putra* it becomes redder. Hardness increased although *chakrika* were easily breakable. No metallic particles of *Utthapita Naga* were observed. Redness of *chakrika* increased after 3rd *Putra*. *chakrika* were soft in touch, easily breakable and not have any shining at the cut surface. *Sindoorvarna* (reddish colour) *chakrika* obtained after 4th *Putra*. *Chakrika* were soft in touch, easily breakable and not have any shining at the cut surface but the cut surface was also *sindoorvarna*. *Sindoorvarnatva* increased after 5th *Putra*. *Chakrika* were soft in touch, easily breakable and not have any shining at the cut surface. Similar characters were observed after 6th and 7th *Putra* except that *Bhasma* was finer and *sindoorvarna* increased. Batch to batch detail of temperature and weight changes in *Naga* are given in [Table 7, 8 and 9].

Naga Pishti preparation: Fumes were coming out after pouring melted *Naga* in *Khalva Yantra* containing *Parada*. *Naga* become greenish powder after 1 hr trituration. After that *Nimbu swarasa* was added to facilitate trituration, the greenish color of *Naga* changed to more dark. Daily 3 hours trituration was required for continuous 3 days to completely form *Naga Pishti* [Table 10]

Naga Marana by Parada media (NBP):

During 1st *Putra*, after addition of *Gandhaka* and grinding for 1 hour mixture become completely black. After 1st *Putra* all *Chakrika* were mixed and a multiple bubble like black swallow mass with shining particles of *Parada* was observed in all *sharava*. Maximum temperature given was 515^o C and it was maintained for 15 min. No particles of *Utthapita Naga* (regained particles of metallic lead) were observed after *Putra*. For 2nd *Putra* temperature increased up to 600^o C and made constant for 20 minutes. After 2nd *Putra* all *Chakrika* were mixed and a multiple bubble like black swallow mass with slight shining particles of *Parada* was observed in all *sharava*. No particles of *Utthapita Naga* were observed after 2nd *Putra*. Temperature increased to 650^o C and maintained for 15 minutes during 3rd *Putra*. After 3rd *Putra*, *Chakrika* were observed in mixed form with bubble like puffed mass. No particles of

Utthapita Naga were observed after 3rd Puta but shinning in *Naga chakrika* was slight positive. Temperature decreased by 50^o C i.e. 600^oC temperature was given for 4th Puta. Maximum temperature was maintained for 5 minutes. Slight shinning in *Naga chakrika* was observed. Maximum 600^o C temperature was given for 5th Puta. It was maintained for 5 minutes. Shinning in *Naga chakrika* was still present but less than 4th Puta. After 6th Puta, similar characters were observed to the 5th Puta except that very shining in *Naga chakrika* was observed to a very lesser extent. Temperature decreased for 7th Puta i.e. 575^oC temperature was given which was maintained for 5 minutes. No shinning was observed in *Naga chakrika* which indicates completion of procedure. *Naga Bhasma* was observed complete *Varitara* (floating on water surface) and *Rekhapurna* (inter between lines of finger and should not glitter) [Table 11, 12 and 13].

Discussion:

Tila taila, *Takra*, *Gomutra*, *Kanji* and *Kulattha kwatha* are the media mentioned for *Samanyashodhana* of metals while *Churnodaka* is mentioned for *Vishesha shodhana* of *Naga*. *Tila taila* and *Gomutra* were procured from local market and other media were prepared by adopting classical references. There were six batches of *Naga* each containing 1 kg raw *Naga*. Three times quenching is advised in *Sharangadhar Samhita* for *Samanya shodhana* and for each quenching gravimetrically double quantity of fresh liquid media was required. It means for complete *shodhana* of six batches total 36 lit each liquid media was mandatory. Therefore sufficient quantity of raw materials for preparation of media required for *Naga Samanya* and *Vishesha shodhana* was taken which results in obtaining 36 to 40 l yields.

The metallic preparations occupies significant seat in *Ayurvedic pharmacopoeia*. The metallic preparations are used in the form of *Bhasma* (incinerated powder) and *shodhana* is first and most important step before preparing their *Bhasma*. *Shodhana* of metals is divided in two steps viz. *Samanya shodhana* and *Vishesha shodhana*. *Samanya Shodhana* is mostly performed by heating the metal up to red hot stage or up to complete melting then quenching for either three or seven times in each liquid media viz sesame oil, clarified butter, cow urine, sour gruel and decoction of horse gram respectively. *Vishesha Shodhana* involves similar procedure of heating or quenching but the liquid media is different for different metals. Conversion of *Naga* into *Bhasma* form is quite

difficult process due to low melting point of *Naga*. *Shodhana* help either in the disintegration of molecules or particles of metal to divide them into finest division and to expose maximum surface area of metal/mineral for further process. It means a well did *Shodhana* will definitely helpful for the preparation of *Naga Bhasma*. The *Shodhana* treatments include media of acidic (eg. *Takra*, *Kanji*) and alkaline nature (eg. *Churnodaka*) and performed by heating followed by quenching into cold liquid media. This makes the metal brittle, reduces particle size and thus exposes maximum drug to the purifying medium. *Naga* was heated and after melting it was poured for 3 times in *Tila taila*, *Takra*, *Gomutra*, *Kanji* and *Kulattha kwatha* in order. In some texts seven times quenching is advised. More the number of quenching more will be brittleness and physico-chemical changes in the metal. For seven times quenching more liquid media, time and human effort is required. Therefore an attempt made to reduce the expenditure, time and human effort by adopting the reference of three times quenching.

Average 2.9 % weight gain was observed after *shodhana* in sesame oil due to adhesion of oil content while average 0.94, 0.85, 1.91, 1.57 and 0.52 % weight loss was noted after *Shodhana* in clarified butter milk, sour gruel, cow urine, decoction of horse gram and lime water respectively. *Naga* is slightly soluble in alkaline and acidic media and the strong heating converts some particles of *Naga* into PbO, this may be reason behind weight loss. The media used are slight acidic, acidic, acidic, slight basic, basic and strong basic in order. The order of quenching is changed by various *Acharyas* so the exact reason behind the particular sequence is not explainable. During quenching it was observed that 2 l liquid media was sufficient enough for complete immersion of 1 kg *Naga*. *Naga* acquired silver luster after each quenching. This may be because impurities of *Naga* may get attracted towards the chemical components present in the media forming a bond with them. Thus they may get separated. So each time new liquid media was taken. Liquid media may also impart disintegration of which improve the quality of *Bhasma*.

Intense heating and sudden dipping may create changes in physical as well as chemical properties of *Naga* making it suitable for *Bhasma* formation. Gradual increase in melting time is seen while quenching in various liquid media. This may be due to conversion of some part of *Naga* into powder form (PbO). This powdered *Naga* absorbs the liquid media during quenching. The liquid media forms a layer around the metallic *Naga*. When this *Naga* is heated again, liquid media evaporates first which cause delay in rise of

temperature while heating, powder form of *Nagasettles* at the bottom of the iron ladle. So there is delay in heat transfer from iron ladle to metallic lead causing delay in rise of temperature. According to *Ayurvedic* point of view, after repeated quenching, the heat stability of *Naga* may increase, causing an increase in time for melting. Some scholars opine that there is increase in melting point of *Naga*, but analytical study proves that there is no significant increase in the melting point. Although *Naga*, which gets converted into powder form (PbO) during *Shodhana*, has melting point 888°C. pH, specific gravity and total solid content of each liquid media was slightly increased after quenching of *Naga*, this may be due to slight alkaline nature of *Naga* and dissolution of some part of melted *Naga* or some impurities.

Strong heating up to 750°C in open iron pan and continuous rubbing with fresh *Vasa* stem causes strong chemical reaction between melted *Naga* and oxygen present in wet *Vasa* stem as well as the oxygen in open air. After three hours all *Naga* get converted into yellowish powder which is lead oxide (PbO) with mixture of organic ash. Three hours were taken for complete *Jarana* of one batch of *Naga* while *Jarita Naga* was allowed for self-cooling for 12 hours. Average 0.72 % weight gain was detected after *Jarana* which confirms the mixing of ash of *Vasa* stem. Thus it is difficult to decide actual nature of *Jarita Naga* but it can be assumed that *Jarita Naga* must be in organo-metallic form. The weight gain in all batches also suggests their compound form.

Bhavana is an important procedure in *Marana* of metals. It is well understood that to facilitate *Bhavana*, metal should be either in amalgam form or in powder form. Therefore *Jaraba* procedure is advised in the *Marana* methods of metals which utilizes herbal media for *Bhavana*. Three batches of *Jarita Naga* were used for preparation of *Naga Bhasma* by herbal media. It is observed that 50 ml *Vasa Kwatha* is sufficient for *Bhavana* to 500 g *Jarita Naga*. However to form a more soft mass which is better for *chakrika* preparation, 100 ml fresh *Vasa Kwatha* was utilized. Firstly 50 ml *Vasa kwatha* was added and triturated till nearly complete drying of mixture, then again 50 ml *Vasa kwatha* was added and again trituration was done. Three hours were required to complete this procedure. Formed soft mass was subjected for *chakrika* preparation followed by drying of *chakrika* under sun light and incineration in EMF. Same *Bhavana* was adopted for subsequent incineration cycles. *Naga* has very low melting point but due to *Jarana* process, *Naga* acquired heat stability and thus no any mass of *Utthapita*

Naga was observed after every *Puti*. Increasing and decreasing pattern of temperature was adopted to avoid any possibility of *Naga Utthapana*. Average 7.62 g weight gain was observed after each *Bhavana* which is due to addition of some herbal part. Hence it is clear that some herbal part remains in *chakrika* which take part in the formation of *Bhasma*. It can be interpreted that the heat stable mineral ingredients present as phyto-constitute in herb get added in *Bhasma* which helps to convert it into organo-metallic form. Although the proportion of organic component will be minimal but it will definitely affect the therapeutic properties as well as safety of final product. Average 2.17 % weight loss is detected in NBH preparation which may be due to adhesion of fine powder into *Khalva Yantra*.

According to the adopted reference NBH should be *Sindoorvarna* after 7 *Puti*. In present study *Sindoorvarna* appeared in NBH after 4th *Puti* but the *Bhasma* didn't passed other tests, hence giving was continued. Seven *Puti* are advised in classical reference and the same were required in this study. After 7th *Puti* NBH completely passed the classical tests such as *Varitaratva*, *Rekhapurnatva*, *Niruttha* and *Apunaryhava*.

Parada Samanya Shodhana was done by using the reference of *Dharanidhar Samhita*. This classical text is not available but the same is mentioned in *Parada Vigyanaya* by V.M. Dwivedi. This reference was adopted as it is easy to perform, require less effort and the purpose was to use *shodhita Parada* for *Naga Pishti* preparation. It can be said that as the basic aim of utilizing *Parada* for *Naga Marana* is to impregnate *Yogavahi* property of *Parada* into *Naga*. *Parada* possesses great affinity towards all metals. When *Parada* come in contact with any metal it gets easily converted into amalgam form. It is understood that during any chemical combination only the particles on the surface take part in chemical reaction. Triturating *shodhita Naga* with *Parada* will definitely leads to formation of *Naga Pishti*, but this process will take much time and looks tedious. May be ancient seers of *Rasashastra* had performed such experiment and arrived at the conclusions that *Naga* in melted state is more suitable for amalgam formation than solid *Naga*. Hence in classical reference melted *Naga* is advised to pour in *Khalva Yantra* containing *Parada*. Three hours for three days was required to prepare *Naga Pishti* by this method. Lemon juice was used to facilitate trituration. Lemon juice is acidic and acidic media enhance the chemical reactivity of *Parada* to with other metals. Average 0.48 % weight loss was observed which is due to adhesion of little quantity of *Pishti* in *Khalva*

Yantra and splitting of some quantity while trituration.

Gandhaka was required for *Naga Marana*. Hence after preparation of *Naga Pishti*, *Gandhaka Shodhana* was done by melting it with ghee followed by pouring through muslin cloth into stainless steel vessel containing hot milk. Average 0.76% weight loss was occurred which is due to adhesion of *Gandhaka* particles to cloth and removal of some impurities. Purified *Gandhaka* was made into powder form to facilitate trituration with *Naga Pishti*. Same *Bhavana* process as mentioned in NBH preparation was performed in NBP preparation except that 300 ml lemon juice was taken for *Bhavana* instead of *Vasa kwatha*. In classical reference three *Puti* are mentioned to prepare *Bhasma* but in present study seven *Puti* were given to prepare *Bhasma* devoid of shining. *Naga Bhasma* was *Varitar* and *Rekha-purna* after third *Puti* but there were shining particles which indicates presence of metallic part or remnant of mercury. Hence further *Puti* were given till complete disappearance of shining.

Proportionally double quantity of *Gandhaka* is mentioned which was added till third *Puti* but after third *Puti* equal quantity of *Gandhaka* was added. This was done as the quantity of *Puti* *Naga* increased considerably due to presence of extra *Gandhaka*. To avoid further increase and based on the chemical proportion of sulfur to combine with Lead, it was decided to add equal *Gandhaka* after 3rd *Puti* onward. Similar increasing and decreasing pattern of temperature mentioned previously was also adopted in NBP preparation. Maximum temperature given was 650° C.

Role of *Bhavanadravya* in *Marana* process: *Bhavana dravya* forms an herbal coat on the surface of metal particles and form a surfactant and thus facilitate the further processing. This is similar to the surfactant mediated production of nano particles.

Reason for using EMF instead of classical *Puti*: Standardization mainly aims at reproducibility. Temperature variations are observed in classical *Puti* system of heating according to the season due to the variation of humidity, temperature as *Puti* system is an open method where there is very possibility of loss of heat by which it require more energy to meet the loss. For standardization it is necessary to document and reproduce the temperature patterns. With EMF heating temperature pattern can be maintained according to need with precision and minimal loss of energy

as it is a closed system. Chances of contamination are also loss with EMF heating. Hence this study is planned to validate the pharmaceutical procedure of *Naga Bhasma* prepared by using herbal media and by applying EMF heating.

Incineration cycles: Incineration was done in two steps viz *Bhavana* and incineration in EMF. *Naga* was trituated with *Bhavana dravya* for three hours i.e. up till the liquid get completely absorbed. Round pellets were prepared because round shape facilitates maximum exposure of heat during incineration. Herbal liquid used for *Bhavana* and continuous levigation leads in formation of coat of herbal particles over metallic surface. When it is subjected for incineration due to the presence of herbal material the superficial surface of *Naga* particles reacts and oxides may get formed. These oxides again get reduced to their initial form and get separated from core particles. When again subjected for *Bhavana* then herbal media forms coat over other particles. Thus repeated incineration cycles cause repeated oxidation, reduction and separation of surface particles from core particles. This results in conversion of metal into micro and nano particles. It is found that *Bhasma* possesses significant percentage of nano particles along with micro particles.

Temperature pattern: *Naga* is a quick melting metal. If high temperature given for first incineration then there is possibility that *Naga* will regain its metallic nature. Therefore for first three incineration cycles temperature was increased gradually followed by alternate decrease and increase in temperature (Graph 1).

Duration of procedure: For six batches, one day was required for *shodhana* in one liquid media. Thus *Samanya* and *Vishesha shodhana* took six days. Three days were required for *Jarana* of three batches. Seven and nine days were required for *Parada Shodhana* and *Naga Pishti* preparation respectively. *Gandhaka* was purified in one day. For *Naga Marana*, one day was needed for *Bhavana* and drying of pellets. Incineration was done on next day. Two batches were taken simultaneously and third batch was prepared separately. Thus *Marana* procedure took 28 days for NBH and 30 days for NBP. Total duration of procedure from starting *Shodhana* to obtaining final product was 37 days for NBH and 48 days for NBP.

Conclusions:

Gravimetrically double quantity of liquid media than weight of *Naga* is more suitable for *shodhana* process. *Jarana* and *Pishti* preparation makes

further incineration procedure easier in the method which utilizes herbal and *Parada* media respectively. Average 69.4 % and 30.11 % *Naga Bhasma* can be prepared in seven incineration

cycles in EMF at maximum temperature 650°C by *Vasa* and *Parada* media respectively. Preparative procedure of *Naga Bhasma* with *Vasa* media is easier *Naga Bhasma* prepared from *Parada* media.

TABLES

Table 1: Ingredients and quantity taken for *Naga Bhasma* preparation

Sr.no	Name of Ingredient	Quantity	No. of Batches	Total Quantity
1	<i>AshuddhaNaga</i>	1 kg	6	1X6 = 6 kg
2	<i>Tilataila</i>	6 l	6	6X6 = 36 l
3	<i>Takra</i>	6 l	6	6X6 = 36 l
4	<i>Kanji</i>	6 l	6	6X6 = 36 l
5	<i>Gomutra</i>	6 l	6	6X6 = 36 l
6	<i>Kulatthakwatha</i>	6 l	6	6X6 = 36 l
7	<i>AshuddhaGandhaka</i>	4 kg	3	4X3 = 12 kg
8	<i>AshuddhaParada</i>	1 kg	3	1X3 = 3 kg

Table 2: Average observations obtained during *Naga Shodhana*

Sr. No.	Media	Average time* (min)	Average weight (g)		Average change (g)	% change
			BS	AS		
1	<i>Tilataila</i>	5.24	1000	1029	29.00↑	2.9 ↑
2	<i>Takra</i>	5.92	1029	979.66	41.66↓	0.94↓
3	<i>Kanji</i>	6.63	978.83	965.66	14.83↓	0.85↓
4	<i>Gomutra</i>	6.74	965.66	947.16	18.05↓	1.91↓
5	<i>Kulatthakwatha</i>	8.33	946	931	15.00↓	1.57↓
6	<i>Churnodaka</i>	8.41	930	925.66	12.56↓	0.52↓

* Average time taken for complete melting of *Naga*, BS=Before shodhana, AS=After shodhana, ↑ - Increase, ↓ - Decrease

Table 3: Average observations obtained during *Naga Jarana* (Three batches)

Sr. no.	Duration (hrs. / min.)	Observations
	00.00	Process started
1.	00.15	Melting is started
2.	00.30	<i>Naga</i> completely melted, trituration with <i>Vasa dand</i> (stem) started.
3.	00.45	Melted <i>Naga</i> is converted in to the powder form
4.	01.00	Approx 25 % <i>Naga</i> is converted in to the powder.
5.	01.15	Approx 50 % <i>Naga</i> is converted in to the powder
6.	01.30	Approx 75 % <i>Naga</i> is converted in to the powder and colour of powder is greenish orange.
7.	01.45	All <i>Naga</i> is converted in to the powder form.
8.	02.00	Some powder started to floating in air.
9.	02.15	Same as above
10.	02.30	Same as above
11.	02.45	Same as above
12.	03.00	Yellowish orange color appeared. A <i>sharava</i> kept over powdered <i>Naga</i> and <i>Tivragini</i> given for three hours and then allowed for complete cooling.

Table 4:- Weight of *Naga* before and after *Jarana*

Batch no.	Weight of <i>Naga</i> before and after <i>Jarana</i>		
	Before <i>Jarana</i> (g)	After <i>Jarana</i> (g)	% gain
Batch-I	940	945	0.53
Batch-II	876	882	0.68
Batch-III	921	930	0.97

Table 5: Change in the length of *Vasa Danda* (VD) after *Jarana* of *Naga*

Sr.	Batch	Length of VD (BJ)	Length of VD (AJ)	Reduction in Length	% change
1	NB 1	140 cm	120 cm	20 cm	14.28 %
2	NB 2	120 cm	102 cm	18 cm	15.00 %
3	NB 3	133 cm	112 cm	21 cm	15.78 %
Average change				19.66 cm	15.02 %

Table 6: Change in the Weight of *Vasa Danda* after *Jarana* of *Naga*

Sr.	Batch	Weight of VD (BJ)	Weight of VD (AJ)	Weight of VD	% change
1	NB 1	2.62 kg	2.24 kg	380 g	14.52 %
2	NB 2	2.24 kg	1.892 kg	348 g	15.53 %
3	NB 3	2.314 kg	1.964 kg	350 g	15.12 %
Average change				360 g	14.99 %

Table 7: Detail of Marana of Naga (NBH1)

No. of Puta	Wt. of Chakrikas		Max. Temp. (°C)	Time required for attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Wt. of loss after Puta (g)	% loss
	Before Puta (g) (after Bhavana)	After Puta (g)						
1 st	512	496	500	30 min	Yellowish Red	Soft	16	3.12
2 nd	505	494	550	35 min	Yellowish Red +	Soft	9	1.78
3 rd	504	493	600	38 min	Yellowish Red ++	Soft	11	2.18
4 th	498	490.4	560	35 min	Sindoorvarna	Soft	7.6	1.52
5 th	492	481.6	600	40 min	Sindoorvarna	Slight hard	10.4	2.11
6 th	491.4	480	550	32 min	Sindoorvarna	Soft	11.4	2.30
7 th	486	477.4	600	40 min	Sindoorvarna	Soft	8.6	1.76

Table 8:- Detail of Marana of Naga (NBH2)

No. of Puta	Wt. of Chakrikas		Max. Temp. (°C)	Time required for attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Wt. of loss after Puta (g)	% loss
	Before Puta (g) (after Bhavana)	After Puta (g)						
1 st	513	498	500	30 min	Yellowish Red	Soft	15	2.92
2 nd	507	496	550	35 min	Yellowish Red +	Soft	11	2.16
3 rd	505	494	600	38 min	Yellowish Red +	Soft	11	2.17
4 th	500	487.6	560	35 min	Sindoorvarna	Soft	12.4	2.48
5 th	493	482.8	600	40 min	Sindoorvarna	Slight hard	11.2	2.27
6 th	492	487.6	550	32 min	Sindoorvarna	Soft	4.4	0.84
7 th	495	483.6	600	40 min	Sindoorvarna	Soft	11.4	2.30

Table 9:- Detail of Marana of Naga (NBH3)

No. of Puta	Wt. of Chakrikas		Max. Temp. (°C)	Time required for attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Wt. of loss after Puta (g)	% loss
	Before Puta (g) (after Bhavana)	After Puta (g)						
1 st	511	497	500	30 min	Yellowish Red	Soft	14	2.73
2 nd	506	496	550	35 min	Yellowish Red +	Soft	9	1.77
3 rd	505	493.2	600	38 min	Yellowish Red +	Soft	12	2.37
4 th	502	489.2	560	35 min	Sindoorvarna	Soft	12.8	2.54
5 th	496	486.8	600	40 min	Sindoorvarna	Slight hard	9.2	1.85
6 th	495.2	483.6	550	32 min	Sindoorvarna	Soft	11.6	2.34
7 th	494	483.2	600	40 min	Sindoorvarna	Soft	10.8	2.18

Table 10: Average observation of NagaPishti preparation

Sr.	Ingredients	Quantity	Trituration / day	Total days	Bhavanad ravya	Obtained wt.	Weight loss	% yield	% loss
1	ShodhitaParada	125 g	3hrs	3	300 ml	622 g	3 g	99.52	0.48
2	VisheshShodhit aNaga	500 g							

Table 11: Detail of *Marana of Naga* (NBP1)

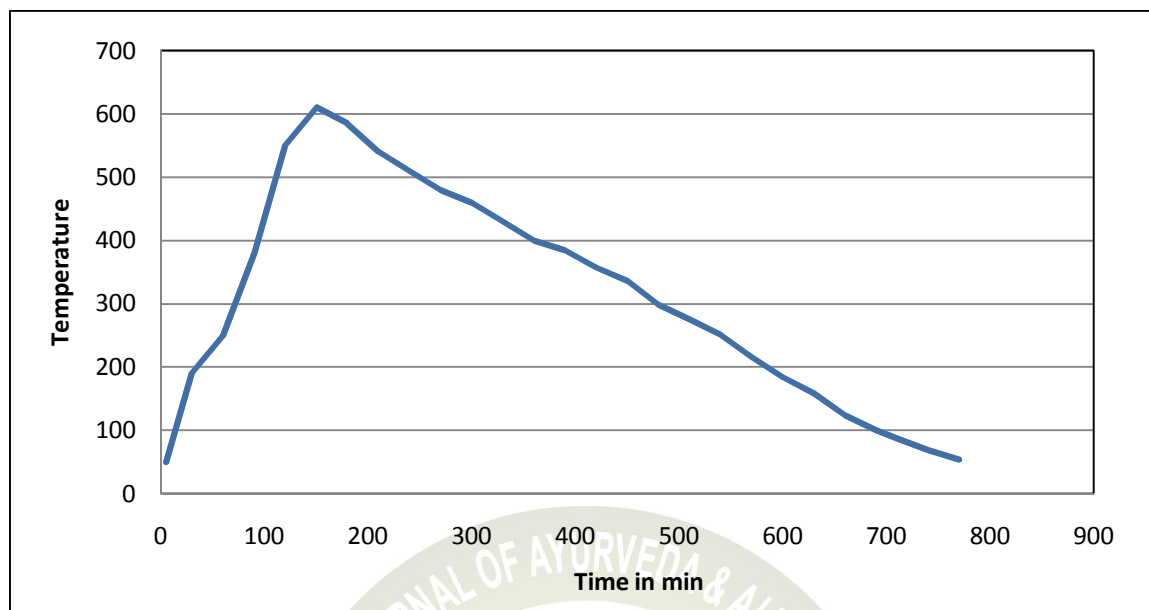
No. of Puta	Wt. of Chakrikas*		Max. Temp. (°C)	Time to attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Chandrika	Wt. of loss after Puta (g)	% wt loss.
	Before Puta (g)	After Puta (g)							
1 st	1740	904	525	30 min	Black with shining	Soft mass	++	836	48.04
2 nd	1910	623	600	35 min	Shining reduced	Soft mass	+	1287	67.38
3 rd	1650	625	650	37 min	Slight Shining	Soft mass	+	1025	62.12
4 th	630	605	650	35 min	Slight Shining	Soft	+	25	3.96
5 th	610	570	600	30 min	Radish black	Soft	+	10	1.63
6 th	578	545	600	28 min	Black	Soft	+	33	5.70
7 th	551	529	575	24 min	Black	Soft	-	22	3.99

* Weight of *NagaPishti* after addition of *Gandhaka* and *bhavana* of *Nimbuswarasa*Table 12:- Detail of *Marana of Naga* (NBP2)

No. of Puta	Wt. of Chakrikas*		Max. Temp. (°C)	Time to attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Chandrika	Wt. of loss after Puta (g)	% wt loss.
	Before Puta (g) (after Bhavana)	After Puta (g)							
1 st	1752	907	525	30 min	Black with shining	Soft mass	++	845	48.23
2 nd	1912	623	600	32 min	Black, slight shining	Fine powder	+	1289	67.41
3 rd	1631	620	650	37 min	Black, slight shining	Fine powder	+	1011	61.98
4 th	624	607	650	34 min	Black	Soft	+	17	2.72
5 th	610	572	600	30 min	Black	Soft	+	38	6.22
6 th	578	547	600	29 min	Black	Soft	+	31	5.36
7 th	552	530	575	25 min	Black	Soft	-	22	3.98

Table 13:- Detail of *Marana of Naga* (NBP3)

No. of Puta	Wt. of Chakrikas*		Max. Temp. (°C)	Time to attain the max. Temp.	Colour of Chakrika after Puta	Hardness/ Softness of Chakrika	Chandrika	Wt. of loss after Puta (g)	% wt loss.
	Before Puta (g) (after Bhavana)	After Puta (g)							
1 st	1750	921	525	30 min	Black with shining	Soft mass	++	829	47.37
2 nd	1935	620	600	35 min	Black	Powder	+	1315	67.95
3 rd	1633	618	650	354 min	Black, slight shining	Fine powder	+	1015	62.15
4 th	622	591	650	35 min	Black	Soft	+	31	4.98
5 th	600	571	600	32 min	Black	Soft	+	29	4.83
6 th	575	541	600	30 min	Black	Soft	+	34	5.91
7 th	545	519	575	25 min	Black	Soft	-	26	4.77

Graph 1: Typical pattern of temperature adopted in EMF heating for NBH and NBP**REFERENCES:**

- Sharma HP. Rasa Yoga Sagar. editor. 4th ed. Vol. II, Varanasi: Krishnadas Academy; 1998.p.563-65.
- Vagbhattacharya. Rasa RatnaSamuchchaya. Kulkarni DA, editor. Reprint. New Delhi: MeharchandLaxmandas Publication; 1998. 3/70-72, p.64.
- Bhatta KG. Rasendra Sara Sangraha. Tripathi ID, editor. 2nd ed. Varanasi: ChaukhambaOrientallia; 1998. 1/191-96, p.48-9.
- ParvatiputraNityanath. Rasa Ratnakar. Mishra S, editor. 2nd ed. Varanasi: Chaukhamba Publishers; 2003. VadikhandaRidhhikhanda 3/84-86, p.35.
- Sadananda Sharma, Rasa Tarangini, Shastri K, editor. 11thed. New Delhi: MotilalBanarsidas Publication; 2000. 11/83-93, p.257-58.
- Dwivedi VM. ParadaVidyaniya 3rd ed. Datiya: Sharma Ayurveda Mandir ; 1997. 4/81, p.56
- Susruta. SushrutaSamhita (Nibhandasangraha commentary of Dalhanacharya and Nyayapanjika commentary of Gayadasa). YadavjiTrikamji, editor. Reprint. Varanasi: Chaukambha Sanskrit Samsthan; 2007. Sutra Sthana, 45/85, p.203.
- Sharangadhara. SharangadharaSamhita. Murthi S, editor. Reprint. Varanasi: ChaukhambaOrientallia; 2009. MadhyamaKhanda 11/2-3. p.145.
- Sadananda Sharma, Rasa Tarangini, Shastri K, editor. 11thed. New Delhi: MotilalBanarsidas Publication; 2000. 19/10. p.458.
- HarisharanandVaidya. BhasmaVigyana. 1st ed. Amritasar: AyurvedVigyanaGranthamala; 1954. p.327.
- HarisharanandVaidya. BhasmaVigyana. 1st ed. Amritasar: AyurvedVigyanaGranthamala; 1954. p.327.
- Sadananda Sharma, Rasa Tarangini, Shastri K, editor. 11thed. New Delhi: MotilalBanarsidas Publication; 2000. 2/21-24. p.15
- Dwivedi VM. ParadaSamhita, 1st ed. Mumbai: KhemarajShrikrisnadas Publication; 2011. 30/85. p.237
- Sadananda Sharma, Rasa Tarangini, Shastri K, editor. 11thed. New Delhi: MotilalBanarsidas Publication; 2000. 19/29-30. p.460
- Sadananda Sharma, Rasa Tarangini, Shastri K, editor. 11thed. New Delhi: MotilalBanarsidas Publication; 2000. 19/31-34

CITE THIS ARTICLE AS –

Dhirajsingh Rajput *et.al.*, Comparative Pharmaceutical Standardization of *Naga Bhasma* (Incinerated Lead) Prepared By Two Different Methods, *Int. J. Ayu. Alt. Med.*, 2014; 2(1):17-27

Source of Support – Nil

Conflict of Interest – None Declared



INTERNATIONAL JOURNAL OF AYURVEDA & ALTERNATIVE MEDICINE

#401/8-A, 4th Floor, Shiv Shrishti Apt.

Nardas Nagar, TP Rd., Bhandup (W), Mumbai – 400078

E:mail-editorijaam@gmail.com, Web- www.ijaam.org

