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ORIGINAL RESEARCH ARTICLE

Pharmaceutical and Identification Study of *Naga Bhasma*

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ABSTRACT

*Bhasma*s are traditional Indian medicinal preparations in which metals undergo thermal Treatment process to bring about thermal decomposition, phase transition, purification, Detoxification and their conversion into a digestible oxide or sulfide form *Naga Bhasma*, *which* is a Lead *bhasma*.In the present study we have selected A.F.I procedure for the preparation of *Naga bhasma*. The final product from the puta are characterised by using X ray diffraction to understanding the forms of lead oxide and their composition at the end of 50 puta and 60 puta.the lead content at the end of 50 and 60 puta have shown decrease in lead. the trace elements remain within the *bhasma* in the form of various oxides of calcium, tin, potassium, arsenic etc.

Key words: *Naga bhasma*, Lead, Total ash, Elemental analysis.

INTRODUCTION

Rasa Sastra is the methodology of preparation of Ayurvedic medicine and it includes the extraction of metals from their minerals, their purification and conversion into digestible metallic *bhasma*. The process of manufacturing metallic *bhasma* consists of *satvapatana* (metal exrtraction) and *bhasmikarana* (conversion to non toxic form). The processing of metals can be classified into *sodhana* (purification), *marana* (conversion to non toxic fine powder), *mardan* (preparation of intermediate mixture), *putapak* (reactions at high temperature).At the end of processing this microfine medicinal product has easy digestive power and quick reaction with the bile juices [1].Metal based drugs were prepared by transmutation of base metals into noble ones along with the use of plant extracts meant to eradicate the toxic effects of metal [2, 3]. In ancient times, lead was used as pill and as well as liquid jade [4]. When lead is subjected to a programmed heat treatment with herbal ingredients in a controlled atmosphere, reaction between the herbal and lead leads to the formations of a herbometallic preparation, called *Naga bhasma* [5]. This herbo-metallic preparation has been used in treating diabetes, diarrhoea, spleen and skin disorders [6]. *Naga bhasma* has shown testis regenerative potential on partially degenerated testes [7]. Clinical studies have proved the antidiabetic activity of *Naga bhasma* [8]. The preparation of *Naga bhasma* starts with purification steps in which the metal is quenched in thrice sequentially in sesame oil, butter milk, cow's urine, sour rice gruel and horse gram decoction [9]. The purification steps are called *shodhana* [10]. This is aimed at rendering the metal to a form capable of reacting with herbal ingredients to be added during the later stages of preparation. This purified lead is stirred well under heating with Aswatha twak and Chincha twak to reduce the metal to the powder form in a process called *Jarana* [11]. The powder form of lead is ground well with Arsenic disulfide and sour rice gruel until a doughy mass is obtained which is made into round shaped discs. These discs are sun dried well before being subjected to 50 cycles of *Arddha gajaputa* and 10 cycles of Gaja *puta*. The analysis of prepared *naga bhasma* samples revealed the presence of oxide, sulfate, and carbonate and arsenate forms of lead as a mixture [12]. Singh *et al*. (2010) found that *naga bhasma* contained lead sulfide in crystalline form along with the organic contents with the incorporation of various nutrient elements from the herbs during preparation. Histopathology study on rats revealed that prepared drug was totally safe at a dose of

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6mg/100g/day6. Pravin *et al*.(2009) prepared *naga bhasma* by following two different protocols and identified the drug to be present as lead sulfide with particles in the size range of 57.4-120µm. *Naga bhasma* causes cognitive dysfunctions and affects neurochemical parameters at high dosages [13]. *Naga bhasma* causes seminiferous tubule degeneration at highest doses. In the present work, in addition to the Pharmaceutical, physico-chemical characterization through conventional studies for studying the quality of *bhasma* such as floatability test *(varitara)*, metal irreversiblity test *(niruttha)*, detailed information on structural and chemical characteristics of *naga bhasma* has also been revealed by modern analytical instruments like X- ray diffractometer.

MATERIALS AND METHOD

Collection of raw drugs:

All the individual drugs of *Naga bhasma* preparations were purchased from local market, the raw drugs and metals were authenticated in the Pharmacy,National institute Of Ayurveda,Jaipur.

Pharmaceutical study:

Naga Bhasma was prepared with the ratio mentioned in A.F.I, part 1 at Department of Rasashastra and Bhaishajya Kalpana National institute of Ayurveda, Jaipur, Rajasthan. The process used for *Naga Bhasma* preparation are Shodhan,Jarana and marana.

ANALYTICAL STUDY

The physico-chemical tests were carried out in the Department of Chemistry,Rajasthan University,Jaipur. All the metal identification tests were carried out at Department of Metallurgy,Banaras Hindu University,Varanasi,Uttarpradesh.

RESULTS AND DISCUSSION

Physiological role of elemental lead has been under debate since time immemorial. While traditional *Ayurveda* proposed that imbalance of lead in human system causes anaemia and gastrointestinal disturbances due to poor secretion of gastric juices, modern medical literature do not report significant physiological effects of elemental lead [16]. Heating and quenching the metal in various plant and animal media (sesame oil, buttermilk, cow's urine, decoction of horse gram, sour rice gruel) removes the inorganic impurities and incorporating beneficial organic moieties into the metal, which render them suitable for further process of preparation of *bhasma* (grinding with plant drug and repeated calcination) [17].

Procedures involved for the preparation of *Naga bhasma*

SHODHANA

Naga and Manahshila were subjectd to shodhana refining process. Dhalana method was follwed for naga and bhavana was the process adopted for manhashila .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. The metals were subjected to heat treatment in an open air that means in the presence of abundance of oxygen. The metal proper might have complexed with this oxygen and converted into a compound form. Similarly the contaminants that are present in association with the metal 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. 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 impurities. Another observation, which was common in all process of shodhana, is the liquids lost their neutrality and become clear after quenching. This is because the hot molten metal when comes into contact with the liquid the solids, especially protenaceous and fatty type, suspended in the liquid might have been coagulated and precipitated because of the heat. The loss observed (as shown in (**Table 2**)in the metal at the end of the process in each liquid can be attributed to the handling.Similarly in case of manahsila the yield of adraka swarasa from fresh ginger was 72%. It was noticed that the colour of the manahshila has gradually changed after every trituration, the reason might be (1) the colour will vary from aggregation state to powdered state. Trituration converts the aggregate manahsila 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.

Jarana

This purified Naga were subjected to an inter-mediary process jarana as per (**Table 1**), before proceeding for marana. Jaran process a replica of polishing process employed in the refining process of lead etc. 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 some plants, whole plant parts of some plants, especially of alkaline natured for jarana process. Rest of the procedure is identical to polishing. This helped in total conversion of the metal into powder from. An increase in the final yield as per (**Table 3**) was noticed which is again due to the addition of ash of plant material used in jarna process.

Marana

The *Naga* was incinerated in association with *manahashila*. *Naga* was subjected to 60 putas. In initial 50 *putas*, a remarkable increase in *naga* was noticed and in last 10 *putas* the same was returned to normal weight as per the table no 2. 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.

It is important to understand the structure and composition of various constituents present in the *bhasma* which suppresses its toxic effects and inserting therapeutic effects to the metal. It has been hypothesized that repeated calcination of metal with suitable raw material change the inherent quality of the metal, which render them non-toxic and suitable for the treatment of chronic ailments18. The conventional tests like *Varitara*, *Rekhapurna*, *Niruttha* etc., performed to check the quality of *bhasma* are not quite reliable. Characterization of *naga bhasma* using modern analytical tools became inevitable[15]. Initially, total ash of the samples was determined to check proper incineration of the metal. This is an important parameter as improperly incinerated lead has been reported to introduce deleterious effects like diabetes, jaundice, emaciation, anemia, skin disorders, and oedema[11]. Accordingly the samples under investigation showed proper incineration of lead as evident (**Table 4**) from the total ash value (> 94%), negligible loss on drying (0.08%), lower solubility in acid (<35%). The results are comparable to the reported values [11]. The observation is supplemented further by performing *niruttha* test, during which a *bhasma* preparation containing free metal would form an alloy with silver thereby reducing the weight of silver. Lead-silver alloys are known to form at a temperature of 304 -579 ° C[18]. In the present case, weight loss occurs in the temperature range of 600 ° C -800 ° C suggesting the absence of metallic lead as per (**Table 5**). After ensuring the absence of free metallic lead by metal irreversibility test (*niruttha)* and ash analysis, the physical qualities of the *bhasmas* like, floatability *(varitara)* as seen in (**Fig 1 & 2**), appearance, and flow property of the samples were analyzed. In addition other elements such as calcium, tin, molybdenum and potassium are observed. X- ray diffraction patterns of *naga bhasma* are shown in (**Fig 3 & 4**). Naga *bhasma*(50 puti) sample shows diffraction peak at angle2theta=21.43,22.58,23.62,25.07,26.22,27.93, 28.61,29.85,31,31.86,32.9,37.02,38.35,40.56,43.24,44.86,45.44,47.92,49.63,60.26,66.2,76.37,82.06, 82.64 with reference to the JCPS file no confirming the presence of lead oxide(Pb_2O_3). Naga *bhasma* (60 puti) sample confirming the presence of lead oxide (Pb_3O_4), showing diffraction peaks at angle 2θ=21.43,22.67,22.97,23.42,26.5,27.78,29.58,30.2,30.89,32.01,34.08,35.21,38.17,41.82,43.14,45.3,45.31,47.15,49.5,50.3,59.59,64.66,69.19 with reference to the JCPS file no.the percentage of lead in the naga *bhasma* samples of 50 puti and 60 puti was 14.118% and 13.872% respectively.

Table 1: Weight of the Material of Naga after samanya shodhan and Jarana

Pharmaceutical procedure	Media	Initial weight (g)	Final weight (g)
Samanya shodhan	*Til Taila* ($T_1 - T_3$)	500gm	490gm
Samanya shodhan	*Takra* ($Tk_1 - Tk_3$)	490gm	480gm
Samanya shodhan	*Gomutrta* (Gm_1 - Gm_3)	480gm	470 gm
Samanya shodhan	*Kanji* ($K_1 - K_3$)	470gm	460gm
Samanya shodhan	*Kulattha Kvatha* (KKw_1- KKw_3)	460gm	440gm
Jarana	*Aswatha & chincha (g)*	440	490

Table 2: Weight of Material Before and After Puta

No. of Puta	Amount of material (J Naga+S.Manashila) (g)	Amount of Kanji juice added (ml)	Initial weight(g)	Final weight (g)
Ist puta	125+125	200	250	265
5th puta	247+65	100	262	257
10th puta	295+65	100	285	280
15th puta	320+65	100	325	325
20th puta	400+65	100	405	400
25th puta	415+65	100	430	430
30th puta	515+65	100	480	475
35th puta	550+65	300	600	600
40th puta	690+65	300	695	690
45th puta	724+65	300	745	745
50th puta	770+65	300	770	760
55th puta	365+65	100	295	280
60th puta	280+65	100	280	-

Table 3: Showing organoleptic Characteristics of Naga *Bhasma*

Organoleptic	*Naga bhasma*(50 puti)	*Naga bhasma*(60 puti)
a. Sound	Not Perceptible	Not Perceptible
b. Appearance		
i. Colour	Light brownish black	Light brownish black
iii. Flaking	+	++
iv. Rekhapurnata	+	++
v. Varitaratva	+++	++++
vi. Uttama/Unamana	+++	++++
c. Touch	Soft	Soft
d. Taste	Tasteless	Tasteless
e. Odour	Odour less	Odour less

Table 4: Showing the Ash (total, acid insoluble, water soluble) and moisture content of Prepared *Naga bhasma* samples

Batch	LOD (%) (w/w)	AV (%) (w/w)	AIA (%) (w/w)	WSA (%) (w/w)
Naga *bhasma* (50 puta)	0.08	95.78	83.47	34.62
Naga *bhasma* (60 puta)	0.06	94.30	81.06	34.50

Table 5: Showing weight loss percentage during *Niruttha* test Weight Change (%)

Batch	400 °C	500 °C	600 °C	700 °C	800 °C
Naga *Bhasma*(50 puta)	0.00	0.00	0.00	0.62	21.54
Naga *bhasma*(60 puta)	0.00	0.00	0.00	0.62	21.54

Table 6: Showing Elemental Composition of *Naga bhasma*

Sample name	% of Lead	% of Fe
Naga *bhasma* (50 puta)	14.118	1.391
Naga *bhasma* (60 puta)	13.872	1.618

Table 6: Showing Elemental Composition of *Naga Bhasma*

Sample name	% of Lead	% of Fe
Naga bhasma (50 puta)	14.118	1.391
Naga bhasma (60 puta)	13.872	1.618

Figure 1: Varitara test of 50 puti *Naga Bhasma*

Figure 2: Varitara test for 60 put *Naga Bhasma*

Figure 3: Showing XRD Pattern of 50 puti *Naga Bhasma*

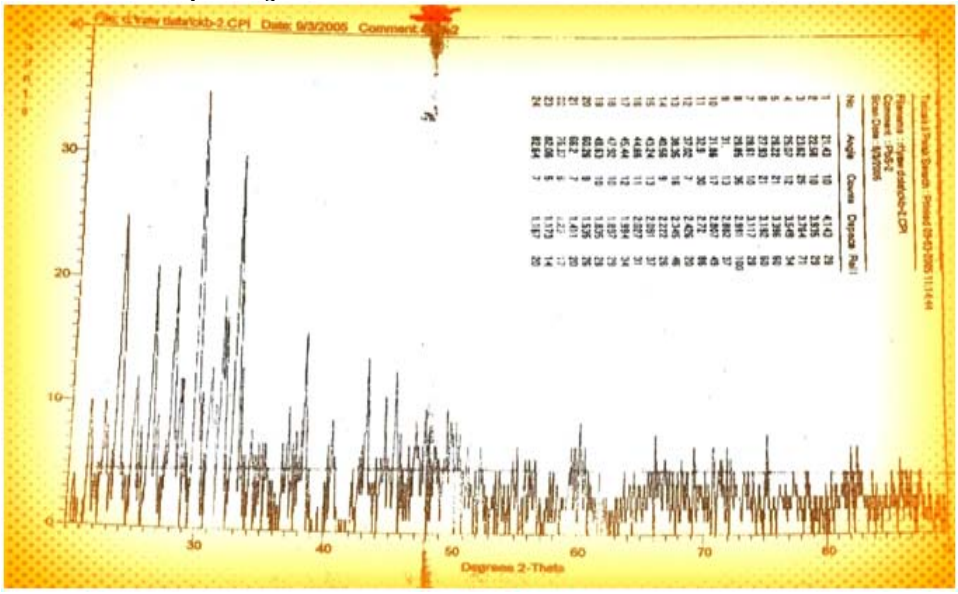
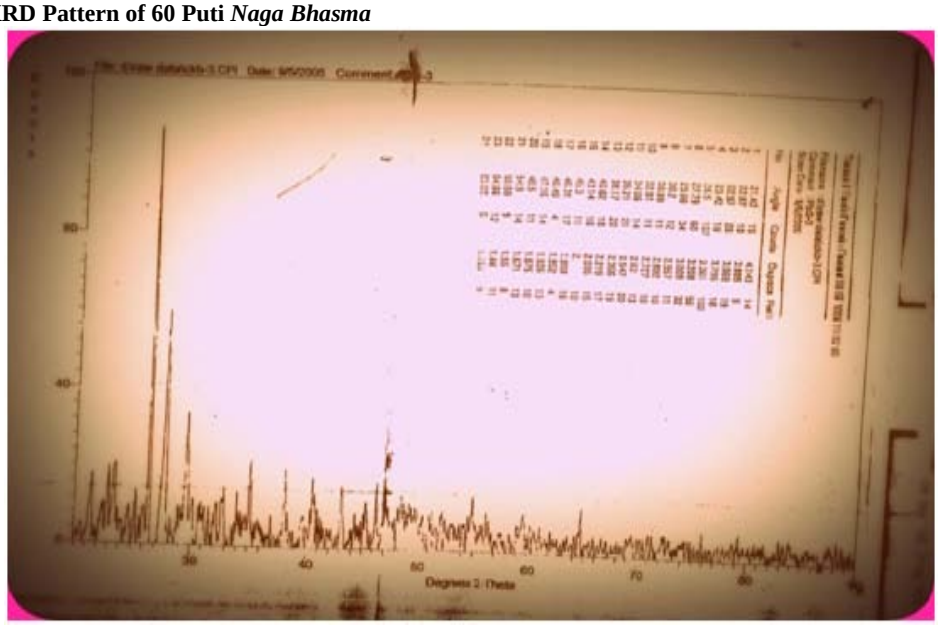


Figure 4: Showing XRD Pattern of 60 Puti *Naga Bhasma*



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CONCLUSION

The present study reveals that the lead content at the end of repeated *putas* has shown decrease in the case of 60 *puti naga bhasma* since the starting material is pure lead. The other elements remain within *bhasma* in the form of various oxides, sulfides etc. The source of these elements is either by mortar, raw material itself or the manahshila added during trituration.

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