



International Journal of Pharmaceutical Research and Development (IJPRD)

Platform for Pharmaceutical Researches & Ideas

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NAGA BHASMA AND IT'S XRD ANALYSIS

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ABSTRACT

Naga Bhasma is an organo-metallic preparation. It is prepared using Lead and different herbs and found effective in the treatment of diseases such as diarrhea, spleen enlargement and diabetes. Lead is considered as poisonous heavy metal but products containing Naga Bhasmas are non-toxic it is used by medical professionals practicing Ayurveda. The present work is an attempt to establish parameters for standardization of Naga Bhasma, these products are not standardized either from chemical and structural point of view. Therefore, study of these samples using modern analytical techniques is important and necessary to understand their status. The aim of the present study is to the characterize Naga bhasma on structural and elemental basis to address the role of the raw materials used during the preparation, compound form of the Naga bhasma. The different characterization techniques used present a role model for the quality control and standardization of such kinds of herbo-metallic medicines. In this communication, such study of Naga bhasma from chemical and structural point of view is reported that XRD peaks of Naga bhasma are identified to be as Pbo (Lead oxide), Pb₂O, Pb₃O₃, and Pb₂O₄. By using XRD Patterns obtained in Shodhana, Marana and Put process of preparation of Naga bhasma.

KEYWORDS : Ayurvedic drug, Bhasmikaran, Naga bhasma, Traditional medicines.

INTRODUCTION

A number of modern technologies are used to know the Showing 2θ (°) value of three strongest peaks of material characterization of Bhasma. Among them XRD peaks of *Samanya* and *Vishesha* Shodhita of a Naga bhasm. Analysis is one of the

important technique by which compounds of material and free metals etc can be detected. So in this scientific era it is very essential to determine changes in the material by Shodhana (purification), Marana (incineration) procedures. By this, one can say authentically the transformation

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of material in to a compound or orally administrable form¹. Various steps involved in the preparation of bhasma (or bhasmikaran) process are: - 1) Shodhan -Purification, 2) Jaran – Addition of Ashes of herbs, 3) Maran - Powdering, 4) Bhavan- Coating with herbal extract, 5) Sandharan- Preservation. Selection of these steps depends on the specific metal. Since Bhasmikaran, process is elaborate in details in the following paragraphs^{3,4}.

1. Shodhan: Shodhana is a process in which different drugs treated with various peshanadi (grinding etc.) karmas after mixing them with other drugs mentioned for the purpose with a view to remove their malas (toxins)². The principle objective of Shodhana is to remove unwanted part from the raw material and separate out impurities. Ayurveda classifies shodhana into a) General process and b) Specific process.

a. General process for shodhana:

The sheets of metals are heated till red hot and are successively dipped into liquids like oil, buttermilk, cow's urine, kanji, kulith kwatha etc. The procedure is repeated seven times.

b. Specific process for shodhana:

For some metals a specific process is described for shodhana e.g. for purification of Jasad, the molten mass is poured in cow's milk 21 times.

Objectives of shodhana process

In Rasa Shastra almost all the drugs right from mercury to poisonous herbal drugs advised to be process with specific shodhana methods before their internal use. Hence, thus shodhana process is aim to remove harmful substances/impurities presents in the drugs. It has observed that if parada, swarna etc. metals and abhraka makshika etc minerals are used in their impure form these are likely produces harmful toxicity effects or various diseases in the body. It also converts metals/minerals drugs in to suitable forms for further treatment with marana process. By the application of various shodhana process prescribed in rasa classics, physical and chemical changes take place and the impurities are removed out from the drugs⁵.

2. Jaran: It is the process where addition of ashes of different types of herbs takes place.

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3. Maran: Marana is the process in which metals and minerals they are made in to paste with various drugs and juices. Then it was subjected to fire treatment in a measured manner for reducing them to ashes. Maran literally means killing. As the name suggests in maran process, a change was brought about in the chemical form or state of the metal. This makes it to lose its metallic characteristics and physical nature. In short, after maran, metal can be converted into powder or other form suitable for administration. To convert various metals into a form appropriate for human consumption, several techniques have been employed which ultimately gave birth to concept: "Bhasma prepared by using Rasa i.e. mercury is the best, where as the one prepared using herbs are of better quality and those prepared using Gandhak (sulfur) are of inferior quality. Thus, there are 3 methods given for maran. It is carried out by heating the metal in presence of 1) mercury 2) plants and 3) sulfur.

Objective of marana process

It is described in Rasa Shastra that various metals, minerals, gems and animal products etc. should be used after converting them in to bhasma or pisti form. The main objectives of making bhasma are these drugs reduced to finest particles. Therefore, that could be absorbed in to the system, mix with raktadi dhatus and produces their desired effects without producing harmful side effects. Besides this, their natural properties are also enhanced and even new properties are inducted⁵.

4. Galan: The product is then sifted either through a fine cloth or through sieves of suitable mesh to separate residual material larger in size (Puranik and Dhamankar,1964h).

5. Bhavan: After one put is over the soccer is taken out & cooled. Then the chakrikas are given coating with herbal extracts.

6. Sandharan- Preservation.

7. Put: that which indicates the quantum of heat required by the Rasadi dravyas (Mercury/Metal/Mineral) for their "Proper paka" or incineration is known as puta⁶. As neither, less nor more heating is desirable. The medicines which are properly made pakva (supakva) are considered

best i.e. hitamoushadha. Because they are only suitable for internal administration, in general sense put means the mode of heating. It indicates the source and amount of heat required or considered necessary for the paka (conversion) of the substances in to suitable dosage forms to make it absorbable in to the system. Thus, the term putpaka use in this context forms a part of marana process. This helps in converting the metal and minerals in to bhasma. This form by disintegrating their particle in to a fine state of subdivision through the application of heat from different sources. In ayurvedic Rasa literature, various types of puts have been mentioned. these are consider necessary for preparing different bhasm from different Metals and Minerals⁵.

MATERIALS AND METHOD

Materials

Til Oil (sesame oil), Buttermilk (Takra), Gomutra (Cow's Urine), Kanji (Starch Paste), (Kulith Kwatha) Ashwattha (Ficus religiosa), Amlika (Tamrindus indica), Turmeric powder and Aloe vera juice.

Method

Preparation of Naga bhasma

Processing of the *Naga bhasma* done according to the "*Satiput Naga bhasma*" process described in the "*Bharat Bhaishashya Ratnakar*"⁷.

Lead so obtained was purified through sublimation. Lead metal was melted in iron ladle and poured into a vessel containing quenching of molten lead into different herbal juices. Quenching with Til Oil (sesame oil), Buttermilk (Takra), Gomutra (Cow's

Urine), Kanji (Starch Paste), (Kulitha Kwatha) purifies Lead and Aloe vera juice removes toxicity to generate specific organo-metallic complex. The process was repeated seven times with fresh herbal juice taken each time. In the first *puta* (step), Melted lead was stirred constantly with bark Ashwattha (Ficus religiosa) and Amlika (Tamrindus indica) stick till it becomes dried powder. After powdering followed by heating with Turmeric powder (*Curcuma longa* Linn.) for eight hours. After cooling, powder is sieve through 80 no. mesh then triturated with the juice of Aloe vera for 24 hours then remove mixture and put it into the oven at 105^{0c} for eight hours then powder is sieve through 100 no. mesh This was the first *puta* (step) *Naga bhasma* sample. The process was repeated again six times to get the finally prepared *Naga bhasma*. The powdered material was pack in airtight containers.

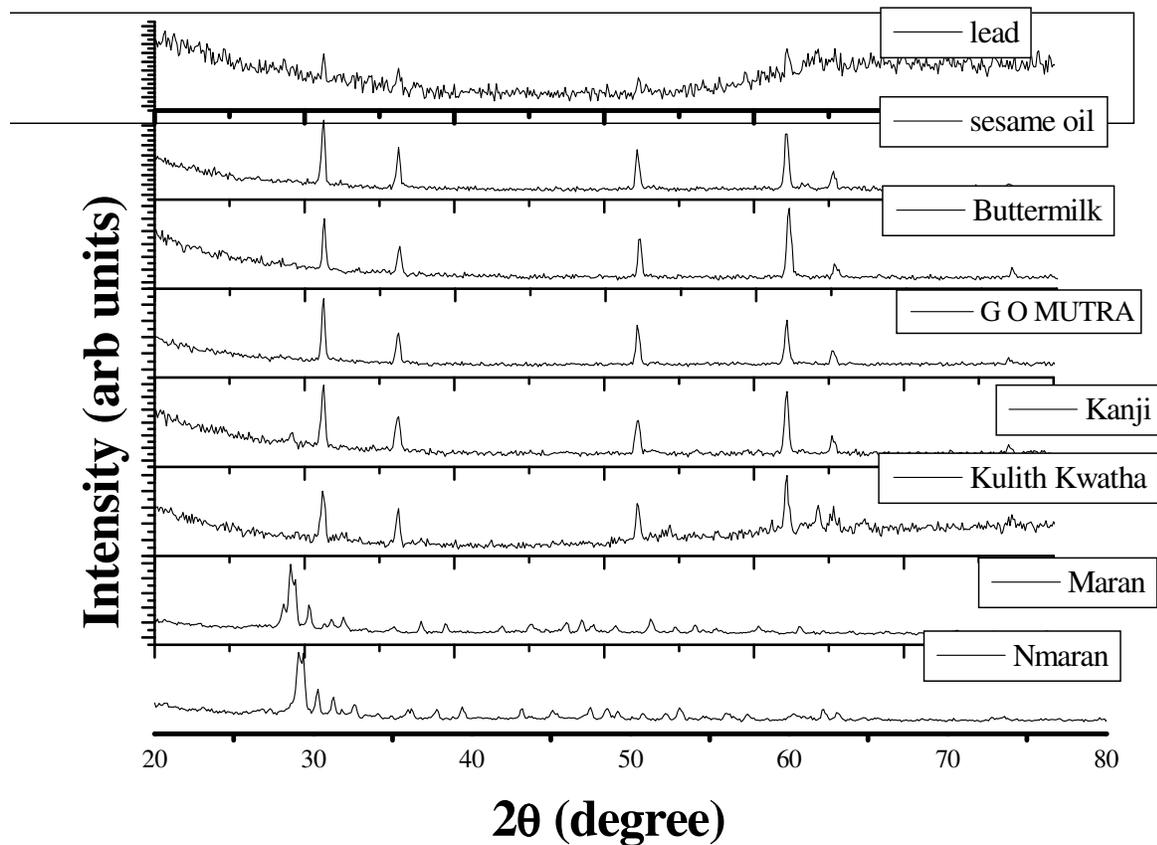
X-RAY DIFFRACTION ANALYSIS

XRD analysis of *Shodhana* process. Powdered *bhasma* was characterized by powder X-ray diffraction (XRD) using a Philips PAN analytical expert PRO X-ray diffractometer 1780. X-ray diffractometer with CuK α radiation ($\lambda=1.542$ Å). After Samanya Shodhana, obtained product was major quantity of lead oxide only. XRD peaks of these samples correspond to untransformed lead metal. This is the evidenced by presence of strongest Pbo peak.

XRD analysis for shodhana process

Table 1: Showing 2 θ ($^{\circ}$) value of three strongest peaks of *Samanya Shodhana* process."

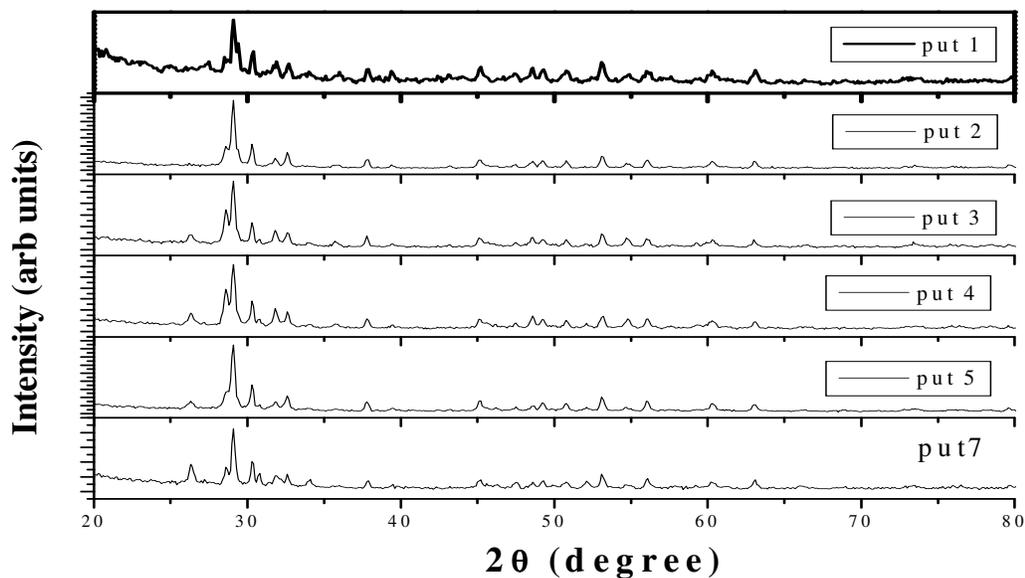
Sr. No	Naga	2 θ ($^{\circ}$) value
1.	Raw lead	24.6, 31.3, 36.3, 52.3, 61.1, 63.6, 67.8, 77.4, 80.2, 88.3,
2.	Sesame oil (til tail)	31.3, 36.3, 52.2, 62.1, 65.3, 7, 80.8, 85.4, 88.2,
3.	Buttermilk (takra)	28.5, 31.3, 36.3, 52.2, 62.2, 65.2, 77, 85.4, 88.2,
4.	Cow urine (Gomutra)	24.7, 31.3, 36.3, 52.3, 62.2, 65.2, 77, 85.4, 88.2
5.	Kanji (rice gruel)	24.6, 21.5, 31.3, 36.3, 52.3, 62.2, 65.2, 77, 85.4, 88.2,
6.	Kulith kwatha	31.2, 36.3, 52.2, 62.2, 65.3, 67.4, 77.2, 81.8, 85.4, 88.2,



“Figure 1: Figure showing the XRD peaks of Raw lead (initial material) and shodhana process of Naga bhasma.”
XRD Analysis for Put process

“Table 2: Showing 2θ ($^{\circ}$) value of three strongest peaks of Marana and Put process of Naga bhasma.”

Sr.No.	Naga bhasma sample	2θ ($^{\circ}$) value
1.	N maran (skin of tamrind and pipali used)	29.1, 30.3, 32.6, 37.8, 53.1, 62.2, 60, 63.2, 85.4.
2.	Maran (Turmeric powder)	29.1, 30.3, 32.6, 37.8, 50.8, 53.1, 56.1, 60.3, 63.
3.	Put – 1	29.1, 30.3, 32.7, 37.9, 50.8, 53.1, 56, 60, 63.1.
4.	Put – 2	29.1, 30.3, 32.6, 37.8, 50.8, 53.1, 56.1, 60.3, 63.
5.	Put – 3	29.1, 30.3, 37.8, 50.8, 53.1, 56, 60.3, 63.
6.	Put – 4	29.1, 30.3, 31.8, 37.8, 50.8, 53.1, 56.1, 60.3, 63.1.
7.	Put – 5	29.1, 30.3, 32.6, 37.8, 50.8, 53.1, 56, 60.3, 63.1.
8.	Put – 7	29.1, 30.3, 32.6, 37.9, 50.8, 53.1, 56.1, 60.2, 63.1.



“Figure 2: Figure showing the XRD peaks of Put process of Naga bhasma.”

OBSERVATION AND DISCUSSION

Shodhana process

Lead melted and poured into sesame oil, buttermilk, gomutra, kanji, kulith kwatha, after cooling, it was collected and the same process was repeated for seven times. On seventh pouring some amount of lead converted into solid, brittle, bright, silvery colour. Along with fine particles on heating the Pb-Pb bonds get energized and when plunged in to the shodhana process dravya get broken in to smaller fragment by reacting with water and oxygen. resulting in probably free Pb radicals. These free radical react with oxygen to get lead oxide (PbO). Since elemental lead is present along with 2 θ value of shodhana process shows 31.3, 36.3, 52.2, 63.1, 80.2, and its plane (111), (101), (311), (104), (211) values of plane respectively. The compound of shodhana process found are Indian fluoride hydroxide, maganize (Mn), Pb_3O_3 , PbO(lead oxide), iron (Fe).

Marana and Put process

Lead was triturated with kumari (Aloe Vera) juice till it turned to semi solid form. The same process of mixing of Aloe Vera juice and triturate it 24 hrs. For again six time to get Bhasma as describe in ayurvedic classics. The colour of product turned to orange after second heating. After fifth Puta the

Bhasma passed the ayurvedic test, Sukshma (minute), Niswadu (tasteless), Rekhapurnata (the particles of Naga bhasma should enter into furrows of fingers) as well as partially Varitara (Naga bhasma particles should float on surface of water) test. After sixth put Varitara test also observed in the Bhasma.

The constituents of Aloe Vera are⁸ – Hydroxyanthraquinone- barbaloin (a mixture of aloin A & B, the diastereoisomeric 10. C glucoside of aloe- emodin anthrone), γ - hydroxyaloin isomers. Other constituents include aloe emodin, chrysofanol, chromone derivatives- aloeresin B with its p-coumaryl derivatives oleoresin A and C and the aglyconealoesone, pH 4.5, Water- 99-99.5 %, Solid materials-Vitamins, Minerals, Enzymes, Sugars, phenolic compounds, Lignin, Saponins, sterols, amino acids, salicylic acids.

The reactions between lead compounds in Aloe vera are speculated as PbO, Pb_2O , Pb_2O_3 , Pb_2O_4 . The XRD spectra of Naga Bhasma shows that all peaks identified are PbO (Lead and its oxide) 2 θ value of Marana and Put process show that 28.7, 29.1, 30.3, 32.6, 53.1, 56.1, 34 and its plane (111), (111), (220), (200), (222), (222), (222) values of plane respectively. The compound of Marana and Put process found are PbO, Pb_2O_3 , Pb_2O , Pb_3O_4 .

CONCLUSION

Metallic preparations offered many advantages over plant drugs by virtue of their stability over a long period, lower doses, easy storability and sustained availability. In the *Samanya* and *Vishesha* Shodhita samples of Naga, two theta values of XRD peaks shows the untransformed lead metal occur during Shodhana (Purification) process.

The presence help in enhancing its potency. lead will oxidize quickly when treated with alkali in presence of Jarana (Roasting) process also capable to disintegrate Naga which is pre stage of Marana (Incineration) suggests that, the compound or product obtained by heating and processing Naga Bhasma formed by processing with Kumari (Aloe vera) gives the compounds PbO (lead oxide), Pb₂O (lead dioxide). Since elemental lead is present along with 2 θ value of shodhana process shows 31.3, 36.3, 52.2, 63.1, 80.2, and its plane (111), (101), (311), (104), (211) values of plane respectively. The compound of shodhana process found are Indian fluoride hydroxide, maganize (Mn), Pb₃O₃, PbO, iron (Fe). And the reactions between lead compounds in Aloe vera are speculated as PbO, Pb₂O, Pb₂O₃, Pb₂O₄. The XRD spectra of Naga Bhasma shows that all peaks identified are PbO (Lead and its oxide) 2 θ value of Marana and Put process show that 28.7, 29.1,30.3, 32.6, 53.1, 56.1, 34 and its plane (111), (111), (220), (200),(222), (222), (222) values of plane respectively. The compound of Marana and Put process found are PbO, Pb₂O₃, Pb₂O, Pb₃O₄. Having

Orthorhombic, Cubic, Tetragonal and Monoclinic structure of crystal found in process of Naga bhasma.

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