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Research Article

A COMPARATIVE STUDY OF SVARNA BHASMA PREPARED BY TRADITIONAL PUTA METHOD AND FURNACE METHOD TO ASSESS ITS PHYSICO-CHEMICAL PROPERTIES

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ABSTRACT

In the field of Rasashastra, bhasma plays an important role being having low dosage, absence of unpleasant taste and rapid action. Among all the bhasmas, Svarna bhasma is considered as a superior most being the best immunomodulator and being used in various medicinal formulations. In present study, Svarna bhasma has been prepared using traditional puta method as well as by using Furnace. In traditional Puta method 25 No. of puta were required to obtain the bhasma possessing all the qualities. Temperature pattern recorded during traditional Puta method was applied in Furnace method. Svarna bhasma obtained from traditional Puta method shows mixed phases of Au_2S and Au_2O_3 and the percentage of Au was found 98.69 while the bhasma obtained from Furnace method showed the structure of Au_2O_3 having percentage of Au 98.85.

Key words: Bhasma, Puta, Traditional Puta, Furnace.

INTRODUCTION

Rasashastra, one of the main tributaries of ancient Indian medical science includes the entire field of inorganic pharmaceutical preparations like metallic and non-metallic compounds of Ayurvedic Materia Medica. It is a branch of Ayurveda which deals with the various pharmaceutical processes like Shodhana, Marana, Jarana, Murchana and detailed description of metals, minerals, poisonous herbal drugs and animal products used therapeutically in the practice of Ayurveda.

Among the various groups of materials like Maharasa, Uparas, Dhatu, Ratna, etc., Dhatu i.e. metals has been given more importance as these are having specific properties. Bhasmas of Dhatu alleviates the diseases like Vali (Wrinkles), Palit (White hairs), Khalitya (Hair loss), Abalya (Weakness), Jara vyadhies (Diseases in old age) and it maintain the body healthy[1]. The metals when converted to their bhasmas, achieve the status equivalent to Mercury. They cure various diseases, provide a healthy body and prevent ageing on prolonged use[2].

Among all dhatus, Svarna is an important dhatu as it is having comparatively more and far reaching effects on the body. Also it is said that where all the medicines and Panchakarma fail in treating certain diseases, Svarna bhasma is found useful there[3].

Acharya Charak has given a lot of importance saying that no visha (poison) will act on a body which has been previously treated with Gold. Svarna is known for its Rasayana properties and its rejuvenation effect over the system of human body. For obtaining the bhasma of Svarna, Maran of Svarna i.e. Puta procedure has to be done. Marana is defined as the process which converts the purified metals and minerals into bhasma after subjecting them to bhavana (levigation) with swaras (juice) and agnisamyoga i.e. puta (heating).

Puta sanskara is done as per the traditional method i.e. by using cow dung cakes, pit, etc. But no clear reference is seen in the Rasagranthas regarding the weight and size of the cow dung cakes to be used. Also no clear mention is seen regarding the relation between the quantity of metal and number of cow dung cakes to be used. In the era of globalization, to meet international standards, Good Manufacturing Practices are necessary. It can provide quality assurance of the drug. During Marana of Rasadravyas, every time gross variation is seen. In order to overcome the variation in the Agnipaka, source of heat has been changed to Muffle Furnace in this study. Svarna bhasma has been prepared following the traditional puta method as well as using Muffle Furnace.

Physico-chemical assessment has been done for the material characterization of Svarna bhasma obtained from both the methods. It states the standard parameters to check the authenticity of the drug.

MATERIAL AND METHODS

It is remarkable that there are very precise pharmaceutical procedures and techniques described in the Rasashastra literature which converts the toxic metals/minerals into a suitable dosage form. The manufacturing process plays a specific role to convert raw material into mixture of compounds in the final product.[4] Following procedures were carried out for the preparation of Svarna bhasma,

Procurement of Raw material
Kanji (Fermented Rice), Takra (Butter milk), Kulatha kwath (Decoction of Horse gram), Gomutra (Cow urine) and Til Taila (Sesame oil) were used as raw materials. Svarna was procured from the local market and authenticated as per mentioned in the classical texts.
Preparation of accessary drugs:
Kanji[5], Takra[6] and Kulatha Kwath[7] were prepared as per classics for the process of shodhana.

Shodhan of Svarna
Shodhan of Svarna was done as per the reference from Rasatarangini (15/4-6) [8].
Main dravya (drug) - Svarna 20 gm.
Accessory dravyas (drugs) - Kanji, Takra, Kulatha kwath, Gomutra and Til Taila 5 liters each.

Procedure: Fine sheets of Svarna were made which were percible by needle. These sheets were heated to red hot on fire and quenched in Kanji, Takra, Kulatha kwath, Gomutra and in Til Taila respectively for 3 times in each. Fresh liquid was used for each quenching. After shodhan procedure; no weight loss was seen in the Svarna.

Preparation of Svarna bhasma by traditional puta method:
Preparation of Svarna bhasma by traditional puta method was done as per the reference from Rasatarangini (15/59-60) [9].
Raw materials :(Figure 1)
1. Shudhha Svarna - 20 gm
2. Shuddha Parad - 20 gm
3. Shuddha Gandhak - 20 gm
Bhavna dravya: Nimbu Swaras - 20 ml

Procedure
The sheets of Shuddha Svarna were cut into very small pieces (Figure 2).Equal quantity of Parad was added to it (Figure-3) and it was triturated with Nimbu Swaras till Pishti (Amalgam) of Svarna was formed. The Pishti was then washed with warm water. Then equal quantity of Shuddha Gandhak was added to it and the mixture was triturated. Chakrikas (small pellets) were prepared of the mixture and were allowed to dry under sunlight. Chakrikas were then kept inside a sharava (shallow earthen disc) and another sharava was inverted over it. The junction was sealed by mud smeared cloth to form a sharava samput and it was allowed to dry completely. After drying, it was subjected to puta (26 no.of cow dung cakes-Figure-4). After self-cooling, pellets were taken out, triturated again and subjected to next puta. From 1st to 14th puta, quantity of Parada to be added was reduced to 1/16th as per the reference. Total 25 no. of putas were required to obtain the Svarna bhasma. Details of the Puta are mentioned in the Table 1.

Recording of the temperature of puta
Temperature during each puta was measured using Pyrometer by inserting it in the sharava while subjecting it for puta. The temperature pattern of intermittent putas has been shown in Table 2. The temperature during first 4 putas had not been measured as less number of cow dung cakes was used as on trial basis. Then after observing the condition of the chakrikas, the number of cow dung cakes was increased.

Preparation of Svarna bhasma by Furnace method (Figure 5 and Figure 6)
Following the reference from Rasatarangini, Sharava samput was prepared similarly as described in the Traditional puta method. The sharava samput was placed inside the Muffle Furnace. The temperature recorded from the Traditional puta method was applied to the Furnace in this method. The temperature knob on the furnace was set at 700^0 C which was the average temperature recorded during Traditional puta method. Then the furnace was kept on till the temperature reached to 700^0 C. It took about 15 minutes. Then the Furnace was switched off and was allowed to cool. After cooling, sharava was taken out and similar procedure was repeated. It had to be repeated for 20 times to obtain the Svarna bhasma. Details of the Puta are mentioned in the Table 3 and the temperature pattern which was recorded during the 1st and 4th puta is shown in Table 4.
Svarna bhasma obtained following both the methods was subjected to the bhasma parikshas as well as to the analysis using modern parameters.

OBSERVATION AND RESULTS

Analysis using parameters described in Rasagranthas
Svarna bhasma obtained from both the methods were subjected to the bhasma parikshas described in Rasagranthas and were found appropriate.
1. Nishchandra - The bhasma was taken in a petri dish and observed for any luster in daylight through magnifying glass. No luster was observed in the bhasma obtained from both the methods.
2. Rekhapurnatvam[10] - A pinch of bhasma was taken in between the thumb and index finger and rubbed. It was observed that the bhasma entered into the grooves of the finger and could not be easily removed out.
3. Varitartvam[11] - A small amount of bhasma was sprinkled over the still water surface in a beaker. It was found that the bhasma particles floated over the surface of water.
4. Apunarbhava[12] - Bhasma when mixed with Mitrapanchak (Guda, Gunja, Madhu, Ghrita and Tankan) and heated at high temperature, did not undergo any change in its physical properties. It did not regain its original state.
5. Niswadu - The prepared bhasma were found to be tasteless when a small amount was kept on tongue.
6. Uttam[13] - When a grain was placed on the Varitar film of bhasma, it was floating like swan on water.

Analysis using modern parameters
Physico-chemical analysis-
Physical characteristics of the material obtained after each puta was recorded. The bhasmas were further analysed using following techniques.

1. Total ash value: Sample was taken in a weighed dish and was strongly heated in a Muffle Furnace at 750^0 C for 3 hours. Heating was continued till constant weight was obtained. The dish was cooled in a desiccator and weighed. Percentage of total ash with reference to air dried sample was calculated as

Total Ash = [100 x (weight of Ash)]/Weight of sample taken for test

The Ash value of the bhasma prepared using Traditional method was found 98.68% w/w. The Ash value of the bhasma prepared using Furnace method was found 98.89% w/w.

2. Scanning Electron Microscope (SEM)
The SEM test was carried out at SEM-EDS department, IITB, Powai in order to know particle size, shape, length and surface morphology of Svarna bhasma.

The SEM is an instrument that produces a largely magnified image by using electrons instead of light to form an image. A beam of electrons is produced at the top of the microscope by an electron gun. The electron beam follows a vertical path through

the microscope, which is held within a vacuum. The beam travels through electromagnetic field and lenses, which focus the beam down toward the sample. Once the beam hits the sample, electrons and X-rays are ejected from the sample. Detectors collect these X-rays, backscattered electrons and secondary electrons and convert them into a signal that is sent to a screen similar to a television screen. This produces the final image. The final image was build up from the number of electrons emitted from each spot on the sample.

The particles were viewed under successively increased various magnifications -X1000, X5000, X10000. The smaller particles were found adhered to large particles. The particles of Svarna bhasma obtained from the traditional method and from the Furnace method are in irregular shape and having size less than 1 μm to 5 μm.

3. X - Ray Diffraction (XRD)

In the bhasma obtained from traditional Puta method, maximum peaks were confirmed at 2 θ, 35.20 θ. It was confirmed with JCPDS 04-0784. It shows most of the peaks corresponding to Au.

In the bhasma obtained from Furnace method, maximum peaks were confirmed at 2 θ, 37.85 θ. It was confirmed with JCPDS 04-0784. It shows most of the peaks corresponding to Au.

Determination of particle size was done by Bragg's law. The average grain size of the bhasma obtained from traditional method was found to be 2.3758A and that of the bhasma obtained from Furnace method was found to be 2.3736A.

4. Atomic Absorption Spectrophotometry (AAS)

The technique makes use of absorption spectrometry to assess the concentration of an analyst in a sample. The electrons in the atom in the atomizer can be promoted to higher orbital (excited state) for a short period of the time (nanoseconds) by absorbing a defined quantity of energy (radiation of a given wavelength). This amount of energy i.e. wavelength, is specific to a particular electron transition in a particular element. In general each wavelength corresponds to only one element and width of an absorption line is only of the order of a few Pico meters (pm), which gives the technique of its elemental sensitivity. The radiation flux without a sample and with a sample in atomizer is measured using a detector and the ratio between the two values (the absorbance) is converted to analyst concentration or mass using Beer-Lambert Law.

The percentage of Au in the bhasma obtained from traditional method was found 98.699 while that from Furnace method was fo Bhasmas are the basic and unique preparations of Rasashastra.und 98.858.

The percentage of other contents has been shown the Table 5.

Table 1: Details of intermittent Puta (Traditional method)

Puta Number	Weight of Shudhha Svarna (gm)	Weight of Shudhha Parad (gm)	Weight of Shudhha Gandhak (gm)	Quantity of Nimbu Swaras (ml)	Number of Vanyopalas used	Weight of bhasma after puta
1	20	20	20	20	4	39.998
	Weight of Shudhha S of bhasma before Puta					
2	39.998	18.75	20	20	6	34.990
5	30.881	15	20	20	14	28.87
10	19.261	8.75	20	20	20	19.76
20	19.52	-	20	20	20	19.42
25	19.05	-	20	20	20	19.00

Table 2: Temperature Pattern of Traditional Puta Mehod (intermittent Putas)

Time in Hours	Temp. in ^{0}C			
	5th Puta	10th Puta	20th Puta	24th Puta
Initial	29	27	30	28
0.15	209	205	189	166
1.15	680	715	686	678
2.30	577	545	589	637
3.30	519	473	530	538
4.30	459	422	447	465
5.30	393	354	350	383
8.30	180	137	107	114
9.30	93	80	64	68
10.30	53	-	-	-

Table 3: Details of Puta (Furnace Method)

Puta Number	Weight of Shudhha Svarna (gm)	Weight of Shudhha Parad (gm)	Weight of Shudhha Gandhak (gm)	Quantity of Nimbu Swaras (ml)	Weight of bhasma after puta
1	20	20	20	20	23.998
	Weight of Shudhha S of bhasma before Puta				
2	23.998	18.75	20	20	22.99
5	20.881	15.00	20	20	19.878
10	19.76	8.75	20	20	19.76
15	19.649	-	20	20	19.646
20	19.575	-	20	20	19.500

Table 4: Temperature Pattern of Puta per 100^0 C interval of 1st and 4th Puta

Temperature in ^{0}C	Time in Hours	
	1st Puta	4th Puta
100	Initial	Initial
200	0.10	0.15
300	0.25	0.30
400	0.40	0.47
500	1.00	1.05
600	1.20	1.30
700	1.35	1.43
600	3.27	3.35
500	5.02	5.15
400	6.52	7.03
300	7.48	8.00
200	9.05	9.17
100	10.10	10.22

Table 5: Percentage of the contents observed in AAS in the bhasma obtained from Traditional Puta Method and Furnace Method

Sr. No.	Parameters	Results	
		Traditional Puta Method	Furnace Method Results
1.	Aurum	98.699 %	98.858%
2.	Mercury	0.90 %	0.88%
3.	Sodium	0.30 %	0.20%
4.	Zinc	0.08%	0.06%
5.	Sulphur	0.0002%	0.0002%
6.	Arsenic	0.0010%	0.0005%
7.	Iron	0.0010%	0.0015%



Figure 1: Shudhha Svarna, Shuddha Gandhak & Shuddh Parad



Figure 2: Pieces of Shuddha Svarna



Figure 3: Shuddha Parad being added to Shuddha Svarna



Figure 4: Traditional Puta



Figure 5: Muffle Furnace

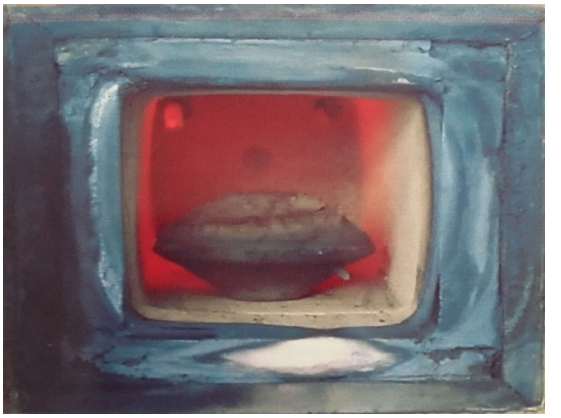


Figure 6: Puta being given in the Furnace

DISCUSSION

Bhasmas are the basic and unique preparations of Rasashastra. In present study, pharmaceutical study of the Svarna bhasma following the traditional puta method and the Furnace method has been done. Also analytical study of the bhasmas obtained from both the methods has been done. In traditional puta method, Puta process makes the dravya (drug) into acceptable form for better assimilation of the drug. In the era of globalization, to meet international standards, Good Manufacturing Practices are necessary. They can provide good quality assurance of the drug. So variation in the bhasma preparation has become a major problem. In order to overcome the variation in the Agnipaka, this study is a step towards the standardization of bhasma by changing the source of heat in calcination process i.e. by using Muffle Furnace for heating purpose instead of Traditional puta.

Svarna dhatu, being enumerated in the Shuddha (Pure) loha category and its bhasma being used in various formulations which are used in the treatment of various diseases like Shwaas (Dysponea), Kaas (Cough), Pandu (Anaemia), has been selected for the present study.

While preparing Svarna bhasma, Shodhan, the first and important procedure was carried out following the reference from Rasatarangini (15/4-6), as the shodhan dravyas stated in the reference i.e. Kanji, Kulatha kwath, Gomutra, Til taila are easily and widely available. The Maran (incineration) procedure was done referring the method from Rasatarangini (15/59-60). In this process Shuddha Parad and Shuddha Gandhak are used which makes the Svarna bhasma useful in various diseases. Nimbu swaras may be altering the doshas in the Svarna being having Amla rasa (acidic nature). During trituration, the physical form of the material is changed when stress in the form of attrition is applied. In this process formation of finer particles is achieved by wet grinding. Bhasmas obtained from the methods were passing all the bhasma parikshas indicating its fineness, lightness and nirutthatva (not obtaining its original state).

Ash value: Ash value is the direct indicator of organic and inorganic content of the material. Ash is the residue of substance remaining after complete incineration. The proportion of ash remains constant for that particular substance. It mainly contains the inorganic matter of the substance. Bhasma, literally means Ash and is a metallic preparation. Being inorganic in nature, their ash value should be high. The Svarna bhasma prepared using traditional method is having its total ash value 98.68% and that from Furnace method is having 98.89% which is comparatively high.

SEM: The percentage of micron sized particles was more in the Svarna bhasma obtained using Furnace method than in the Svarna bhasma obtained using traditional method. The bhasma should be fine enough to work into blood circulation. The particles having Nano size might be working into blood circulation. Other particles having size >1 µm might be working merely as catalyst.

AAS: AAS analysis showed the concentration of Au in the bhasma obtained from Traditional method 98.699% while that obtained from Furnace method showed 98.858%.Thus the concentration of the Au element is found quite higher than the other elements. So such bhasma may be showing properties of Svarna bhasma described in the granthas and able in treating the various diseases.

According to the organoleptic tests and the bhasma parikshas carried out, it can be concluded that bhasma obtained from both these methods has achieved expected qualitative parameters as per the classical text. Furnace method achieved the bhasma parikshas earlier than the classical method due to concealed heating. Also Furnace method could be used in order to reduce batch to batch variation.

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