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Yashad bhasma: Synthesis and characterization

Babita Kale and Nilima Rajurkar

Abstract
Bhasmas are unique ayurvedic herbo-metallic preparations useful in various ailments. Quality of bhasma depends upon quality of starting materials, processing ingredients, meticulous trituration and heating cycle. To strengthen the quality of Ayurvedic product, standardization of bhasma is essential. Yashad Bhasma is zinc based bhasma which is used in the treatment of diabetes, eye diseases, night blindness, cataract, asthma, skin disease and acne etc. The present paper deals with the synthesis and characterization of Yashad Bhasma by using traditional method of heating as well as electric muffle furnace. The various steps of synthesis include Purification (Shodhan), Levigation (Bhavana) and Incineration (Maran). The prepared bhasma was analyzed as per ayurvedic guidelines as well as modern analytical techniques viz. XRD, FTIR, SEM, EDAX, TEM and DLS.

Keywords: Yashad Bhasma, Purification, Levigation, Incineration

1. Introduction
Ayurveda is science of life which deals with the use of herbs and herbal preparations for the treatment of various ailments [1]. Bhasmas are unique ayurvedic herbo-metallic preparations useful in various ailments. Quality of bhasma depends upon quality of starting materials, processing ingredients, meticulous trituration and heating cycle. To strengthen the quality of Ayurvedic product, standardization of bhasma is essential It is known that incomplete incineration would result in metal ion impurities which lead to the adverse effect and toxicity. Therefore tests were developed to evaluate particle size, density, Physical and chemical stability of Bhasma. In Indian traditional medicine Yashad Bhasma is a unique particulate preparation of zinc, which has been used by traditional practitioners for the treatment of various diseases such as diabetes, eye diseases, night blindness, cataract, asthma, skin disease, and acne etc. [2-3]. The present paper deals with the synthesis and characterization of Yashad Bhasma by using traditional method of heating as well as electric muffle furnace. The prepared bhasma was analyzed as per ayurvedic guidelines as well as by using modern analytical techniques viz. XRD, FTIR, SEM, EDAX, TEM and DLS.

2. Material and Methods
The Yashad Bhasma was prepared according to the method mentioned in the Ayurvedic literature [5]. The various steps involved were: purification (shodhan), heating and roasting (jaran) levigation (bhavana) and incineration (maran). The incineration method was carried out by using traditional method of heating as well as using electric muffle furnace.

2.1 Purification
Raw Yashad Bhasma was purified by liquefying and pouring method. In this process the raw Yashad was heated in the iron pan till it melts. The melted sample was then poured in 100 mL cow milk. This process was repeated 21 times.

2.2 Heating and Roasting
After Shodhan, the metal becomes more brittle and was then subjected to Roasting (Jaran). The sample after purification was taken in an iron pan and melted. The melted sample was stirred and rubbed with the help of *Azardica Indica* branch (18 cm long with 0.6mm inner diameter). This Process was continued till whole metal was converted into powdered form (8h). After heating and roasting (Jaran) process the metal was converted into very fine grayish powder which was fit for final step of Incineration (Maran).

2.3 Levigation
In this method the sample was triturated with juice of *Aloe vera.* The process was repeated seven times.

2.4 Incineration

The pellets were prepared after trituration of sample with fresh juice of *Aloe vera*. After drying, these pellets were kept in the casseroles (sharav). The sealing (sandhi bandhan) was done and subjected for heating by traditional method and using electric muffle furnace. The traditional method of heating was carried out using Kukkutput (40-60 cow dungs). The process was repeated four times. For incineration with electric muffle furnace, the temperature was slowly increased upto 450 ^{0}C for 1 ½ h. Then temperature was kept constant for 3h. The final form of bhasma was yellowish in color. The prepared bhasma was analyzed as per ayurvedic guidelines as well as using modern analytical techniques viz. XRD, FTIR, SEM, EDAX, TEM and DLS.

3 Results and Discussion

3.1 Physical analysis of Yashad Bhasma:

The prepared bhasma was subjected for chemical as well as physical analysis mentioned in the ayurvedic literature. The observations and the results during preparation of Yashad Bhasma are recorded in Table 1

Table 1: Physical tests of Yashad Bhasma

Sr. No.	Test	Y1	Y2
1	Touch	Texture of the bhasma was soft	Texture of the bhasma was very soft
2	Odor	Odorless	Odorless
3	Color	grayish	milky white
4	Nishchandratvam	No luster was observed in the sun light	No luster was observed in the sun light
5	Rekhpurnatvam	Bhasma enters in the minute furrows of the finger tip	Bhasma enters the minute furrows of the finger tip
6	Varitratvam	Bhasma float over the stagnant water	Bhasma float over the stagnant water
7	Unnam	The rice grain remains as it is over the floated bhasma	The rice grain remains as it is over the floated bhasma
8	Slakeshnata	soft and smooth to touch	soft and smooth to touch
9	Nirutha	Weight of silver remains same when heated with bhasma	Weight of silver remains same when heated with bhasma

Y1: Yashad Bhasma prepared by incineration with traditional method of heating
Y2: Yashad Bhasma prepared by incineration with electric muffle furnace

An examination of Table 1 indicates that both the samples of bhasma have cleared all the physical tests mentioned in the ayurvedic literature.

The synthesized Yashad bhasma was analyzed by using various analytical techniques such as XRD, FTIR, SEM, EDAX, TEM and DLS.

3.1 XRD analysis during Yashad Bhasma process

The crystalanity of the synthesized Yashad Bhasma was studied using XRD technique. It was carried out using X-ray diffractometer SHIMADZU AA-7000. The XRD spectra during preparation of Yashad Bhasma is shown in Figures -1-3

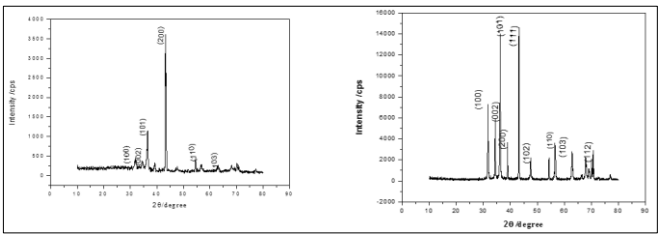

Fig 1: XRD spectra of Yashad Bhasma a) starting material b) after purification

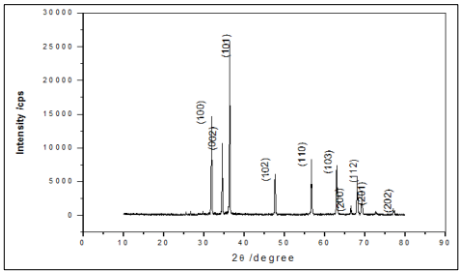

Fig 2: XRD spectra of starting material of Yashad Bhasma after heating and roasting process (jaran)

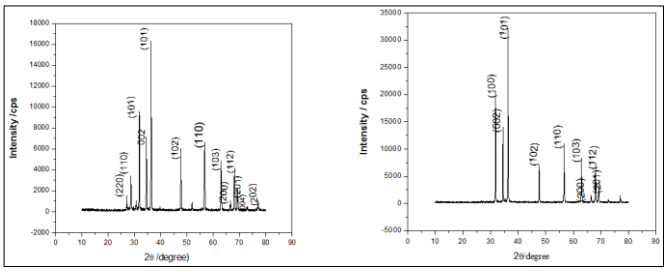

Fig 3: XRD spectra of Yashad Bhasma prepared by incineration with a) Traditional method of heating b) electric muffle furnace of heating

An examination of spectrum of starting material of Yashad Bhasma (Fig.1) shows characteristic peak of zinc metal at d= 2.09 and $2\theta = 43.23^0$ which is not found in the final products of Yashad Bhasma prepared by incineration with traditional method of heating (Fig.3a)) and electric muffle furnace (Fig.3b) This indicates that the crystalline metallic Zn is absent in the final product. The Zn metal peak also appears in the spectrum of Yashad Bhasma after purification (Fig.1b). But it is not observed in diffractogram of Yashad after Jaran process of Yashad Bhasma (Fig.2). This indicates that Jaran process is useful for phase transfer of metal. The sample identification was done by matching d spacing with standard JCPDS data 05-0664.The results show that ZnO (hexagonal) is the major crystalline phase present in Yashad Bhasma.

The diffraction pattern of final product shows the major peaks at angles 31.76^0, 34.42^0, 36.24^0, 56.58^0, 62.80^0, 67.90^0 and 69^0 corresponding to reflection from 100,002,101,102, 110,103, 200 and 112 crystal planes respectively. The peak intensity in final product is increased as compared to intensity of peak in initial material and after purification.

3.2 FTIR analysis during Yashad Bhasma process

FTIR analysis of Yashad Bhasma was carried out to identify the possible organic compounds in the bhasma. Spectra were

recorded in the region 400- 4500cm^{-1}
The characteristic absorption frequencies and related functional groups observed during FTIR analysis of Yashad Bhasma are listed in Table 2

Table 2: FTIR Analysis during Yashad Bhasma Process

Functional group	Absorption Wavenumber /cm^{-1}			
	Zn1	Zn2	Zn3	Zn4
Zn- O	517	576	539	517
C-O,=C-H	1133	1041	1041	901
-C-N	------	1227	1227	1227
C-H	-----	1371	1371	1371
-C=C, C=O	----	1657,1739	1739	1739
-C=N	2354	2886	2342	2386
O-H		3289	3740	3009, 3764

Zn1: after purification of starting material
Zn2: after heating and roasting of starting material
Zn3: Yashad Bhasma incinerated with traditional method of heating
Zn4: Yashad Bhasma incinerated with electric muffle furnace

The FTIR spectra of Yashad Bhasma show large number of well-defined peaks in the region 450 – 4000 cm^{-1}. The major peaks observed in the FTIR spectra of Yashad Bhasma after purification and in final product shows the presence of C=C, C=O and C-H bonds. The metal oxygen bond is not observed after the purification process. The absorption peak below 800 cm^{-1} is due to M-O bond
(Zn-O).
The source of organic group in final product is due to the plant material used during preparation, which contains several organic compounds eg. *Azardica indica* (neem) contains azadirachtin and derivatives basically terpin and lomonoids [6]. Thus from FTIR spectra it is concluded that, the Yashad Bhasma prepared is associated with the organic macromolecules from herbs used in the preparation. These organic molecules play important role to increase efficiency of bhasma.

3.3 SEM Analysis during Yashad Bhasma process

The morphological study of synthesized Yashad Bhasma was carried out using SEM analysis. The SEM micrographs at various stages during preparation of Yashad Bhasma are shown in the following Figures

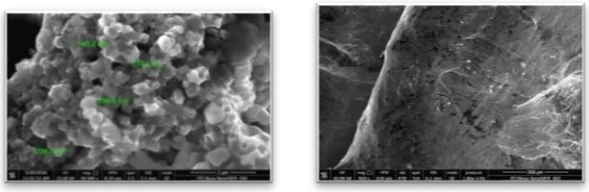

Fig 4: SEM micrograph of Yashad Bhasma a) Starting material b) After heating and roasting (Jaran) process

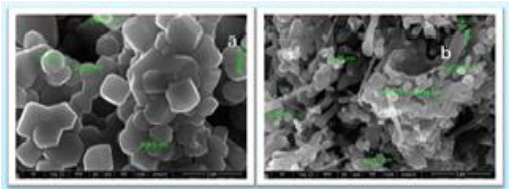

Fig 5: SEM micrograph of Yashad Bhasma a) prepared by incineration with traditional method of heating b) Prepared by incineration with electric muffle furnace

SEM studies clearly show the reduction in the particle size of the sample at various stages of preparation. The starting material of Yashad Bhasma shows rough surface morphology (Fig.4a) after heating and roasting (jaran) process it is observed that the sample is converted into small particles and shows granular morphology (Fig.4b) and smooth surface morphology. As can be seen from Figs. 5a and 5b, bhasma prepared by incineration with electric muffle furnace heating and traditional method of heating shows reduced particle size.
3.4 EDX analysis during Yashad Bhasma process:
Quantitative bulk elemental analysis is carried out by using EDX technique. The EDX analysis of synthesized bhasma was carried out on Bruker XSHLASH-6 I30 electron microscope and is shown in Figs. 6-7

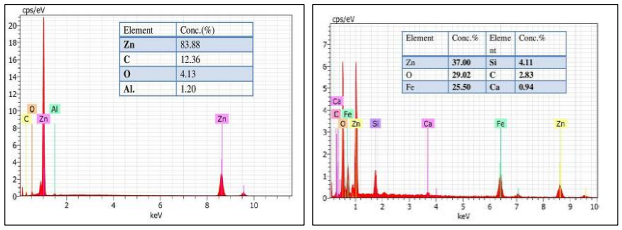

Fig 6: EDX analysis of a) starting material and b) after heating and roasting

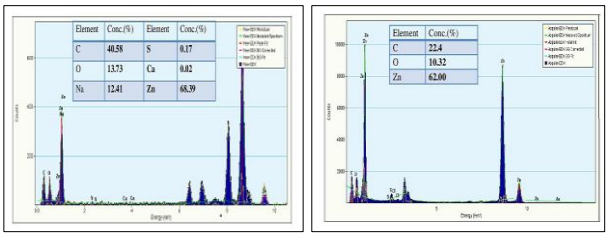

Fig 7: EDX analysis of Yashad Bhasma prepared by incineration with a) traditional method of heating b) electric muffle furnace

The EDX spectrum of starting material (Fig. 6a) reveals the intense peak of Zn. Along with Zn trace quantity of other elements such as Al, O and C are also present. The EDX spectra for the Yashad Bhasma after heating and roasting (jaran) process (Fig.6b) shows that the elemental concentration of Zn decreases and many other trace elements such as Zn, O, Fe, Si, C, Ca are incorporated in the sample. All these elements originate from medicinal plants used during prearation of bhasma [7-9]. The Yashad Bhasma prepared by incineration with traditional method of heating (Fig. 7a) shows the presence of C, O, Na, S, and Ca along with the Zn. The Yashad Bhasma prepared by incineration with electric muffle furnace shows (Fig. 7b) only C and O along with Zn.

3.5 TEM Analysis during Yashad Bhasma process

The Transmission electron microscopy (TEM) analysis at various magnifications was performed on TecnaiG2U-twin 200 Kv Lab 6FEI Netherlands. The results are shown in Figures 8-9

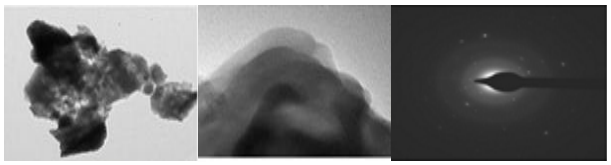

Fig. 8 TEM, SAED of Yashad Bhasma prepared by incineration with traditional method of heating

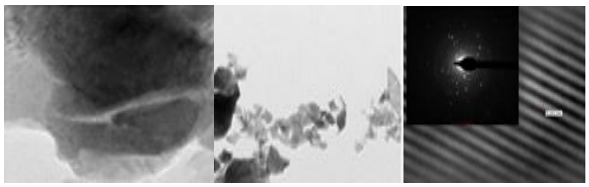

Fig 9: TEM, HRTEM, SAED of Yashad Bhasma prepared by incineration with electric muffle furnace heating

An examination of above figures shows bright spots in SAED pattern which again supports the highly crystalline nature of the Yashad Bhasma. Synthesized bhasma shows spongy nature. The inter planer distance in Yashad Bhasma prepared by incineration with electric muffle furnace (Fig. 8) is 0.343 nm,.

3.6 DLS analysis during Yashad Bhasma Process

The analysis was performed using DLS Brookhaven instrument to determine the particle size.

Dynamic light scattering of synthesized Yashad Bhasma is reported in Table 3.

Table 3: DLS analysis of Yashad Bhasma

Sr. No.	Sample No.	Diffussion coefficient/10 -9 cm2S-1	Effective diameter/nm	Polydispersivity
1	Y1	4.41	1111.15	0.29
2	Y2	7.76	632.20	0.23

Y1: Yashad Bhasma prepared by incineration with traditional method of heating.

Y2: Yashad Bhasma prepared by incineration with electric muffle furnace

An examination of Table 3 shows that the effective diameter for the bhasma prepared by incineration with electric muffle furnace heating is less as compared to the traditionally heated bhasma. The effective diameter for bhasma prepared by incineration with electric muffle furnace is 632.2 nm, while that of bhasma incinerated with traditional method of heating is 1111.5 nm. The polydispersivity of the bhasma incinerated by electric muffle furnace is 0.23 and traditionally heated sample is 0.29 respectively. The DLS spectra for Yashad Bhasma is shown in Fig. 10

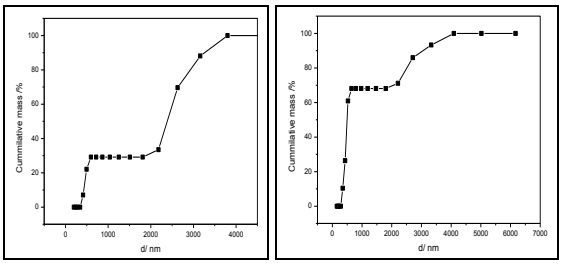

Fig 10: DLS spectra for Yashad Bhasma prepared by incineration with a) traditional method of heating b) electric muffle furnace

These studies reveal that Yashad Bhasma prepared by electric muffle furnace heating (Fig. 10b) has 70% nanoparticles in the range of 250-750 nm, while 20% nanoparticles are in the range of 750 nm to 2.5 µm; Further examination of shows that both bhasmas have trimodal particle distribution. The bhasma prepared by incineration by traditional method of heating shows 35% nanoparticles in the range of 500 nm while 65% particles have more than 500 nm size.

4. Conclusions

XRD of Yashad Bhasma shows the presence of ZnO and Zn. EDAX analysis of Yashad bhasma shows that various important nutrient elements are incorporated in the final product during preparation of Bhasmas. TEM of Yashad Bhasma shows the polycrystalline nature. Bhasma have passed the Ayurvedic Physical as well as physicochemical tests. These DLS studies reveal that yashad hasma prepared by electric muffle furnace heating has 70 % nanoparticles in the range of 250-750nm, while that prepared by using traditional method of heating has 30% particles are in the range of 200-700nm range. The commercial sample shows 20% particles in the range of 500-800 nm and 60% particles in the range of 800-1.5µm. It is observed that incineration by muffle furnace gives better results as compared to the Traditional method of heating.

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References

1. Bhargav SC, Reddy KR. Parmaceutical study of Kant Lauha Bhasma. International Journal of Ayurvedic Medicine. 2011; 2(4):199-213.
2. Bhojasettar S, Poorima BT, Jadar PG. Evolution of Market sample of Yashad Bhasma using Namburi Phase Spot Test. Journal of Ayurveda and Integrative Medicine. 2011; 2(2):69-71
3. Sarkar PK and Chaudhary AK. Ayurvedic Bhasma: the most ancient application of nanomedicine. Journal of Scientific & Industrial Research. 2010; 69: 901-905
4. Umarani RK, Paknikar KM. Yashad Bhasma, a zinc based Ayurvedic Preparation: Contemprory evidence of Antidiabetic Activity Inspires Development of Nanomedicin. Hindawi Publising Corporation,vol.2015,Article ID 193156,Pgs.9,http:///dx.org/10.1155/2015/193156
5. Sharma RS. Delhi Edition 11th Motilal Banarasidas Publication, Delhi, India; 2000, 362-477
6. Singh SK, Gautam DN, Kumar M, Rai SB. Synthesis, Characterization and histopathological study of lead based Indian traditional drug: Naga bhasma, Indian Journal of Pharmaceutical science. 2010; 72(1):24-30.
7. Shaikh W, Sofia S, Kazi TG, Usmanghani K, Kabir A, Sheerazi TH. Chemical constituent of Taamarindus indica L. Medicinal plant in Sindh, Khanzada. Pakistan Journal of Botany. 2008; 40(6):2553-2559.
8. Sharma DK, Rai S, Arora SS, Gupta PM, Sharma R, Chopra K. Study of trace elements in Aloe vera L. (Aloe barbandiensis Miller) viz. Liliaceae and its biological and environmental importance, J.Chem. Pharm. Res. 2011;3 (3):64-68.
9. Sharma A, Shailajan S. Detection of heavymetals fromleaf powders of *Annona squamosa* Linn. *Daturametel* Linn. and *Vitex negundo* Linn. using ICP-OES technique. Enviromental science an Indian Journal 2009; 4(4):135-137.