Research Article

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PHARMACEUTICO-ANALYTICAL STUDY OF HARATALA MARITA YASADA BAHSMA: A REVALIDATION ON CLASSICAL AND CONTEMPORARY METHOD

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ABSTRACT

Rasasastra has laid much more stress on Rasayana concept of Ayurveda and which when administered orally was found to prevent diseases related to age. Bhasmas are being practiced safely in therapeutics; concerns are being arising on the safety issues in the recent past. Yasada bhasma was prepared by classical bhasmeekarana (incineration) method as per reference of Rasa Tarangini. Haratala used in the marana were processed with suitable sodhana method. Bhasma was prepared by 3 step process that is sodhana, jarana and marana. Three samples of Yasada bhasma was prepared to confirm the study reproducibility. Quality control parameters were analyzed both chemically as well as with modern parameters. Raw material quality was assessed through grahya lakshana, and those during the procedure of incineration via various bhasma pareekshas, end products through pH, LOD, Total ash, acid insoluble ash, water soluble ash and instrumental analysis like XRD, SEM, and EDAX. On basis of comparing samples with analytical parameters like NPST and XRD etc. best sample of Yasada bhasma has been selected. Among which the classically incinerated samples are found to be of standard quality, showing hexagonal ZnO crystalline phase. The more symmetric XRD spectra and symmetry of particles and reduced particle size was noted in classically prepared bhasma. EDAX revealed difference in concentration of zinc and oxygen in both the samples. Based on the empirical evidence and classical baseline principles, logical reasoning was done to end up in an accurate report in present study.

Keywords: Yasada bhasma, Marana, XRD, SEM, Bhasma pareekshas, Pitara yantra

INTRODUCTION

Ayurveda textbook recommends Yasada bhasma as choice of treatment in many diseases. Though Bhasmas are being safely practiced in therapeutics in Indian scenario; concerns are being raised on safety issues in the recent past. So, there is a necessity to assess and develop safety profile and to generate evidence. Bhasmas or metallic and mineral preparations used in Ayurvedic medicine, are traditionally made through a meticulous and classical method known as puta (incineration). This process involves heating the raw materials using cow dung cakes at specific temperatures and durations. Bhasmas prepared through classical method have been used for centuries with documented safety and efficacy in Ayurvedic texts. Using modern method might lead to incomplete transformation or even toxic substances, as rapid or uneven heating can result in impurities. The present paper deals with the synthesis and characterization of Haratala marita Yasada bhasma by using traditional method of heating as well as by using electric muffle furnace. The prepared bhasma was analyzed as per Ayurvedic guidelines as well as by using modern analytical methods like XRD, SEM, and EDAX.

MATERIALS AND METHODS

The Yasada bhasma was prepared as per the classical reference from textbook Rasa Tarangini[1]. Various pharmaceutical processing's like purification (visesha sodhana), heating and roasting (jarana), levigation (bhavana), caking (chakrikarana), incineration (puta) are involved in the making of bhasma. Puta has been carried out using both classical methods of gajaputa as well as electric muffle furnace.

Selection and Collection of Raw Materials

For the identification of the exact raw materials collected from different parts of India authentication based on grahya lakshanas[2] mentioned in the classical textbooks and available modern parameters (flame test) were done and selected the ideal sample which is preferred for this study. In case of herbal drugs, cultivation was done in the herbal garden of college for assuring the genuinity. Harvesting of the plant parts were done as per the need.

Purification (Visesha Sodhana)

Raw Yasada was purified[3] by melting and pouring in liquid media method (dhalana). In this method raw Yasada sample was heated in an iron pan till it completely melts and then poured into the liquid media (churnodaka) taken in Pitara yantra[4].The melted sample when cooled is collected and washed with warm water and dried. This process was repeated for 7 times.

Lime Water (Churnodaka) preparation

Lime (churna) was taken in a clean vessel, and water was added and stirred well in the ratio of 250 mg lime: 60 ml water. [5] It was kept stand still overnight (9 hours). The supernatant fluid was collected and filtered with a clean filter paper/cloth and kept preserved in green glass bottle.

Making of Pitara yantra
It consists of an iron vessel with an iron lid. Iron vessel should be of that size which can occupy 8 times sodhana dravya that of metal to be purified. The lid should have a small opening through which the molten metal is poured into the yantra, which should be little lowered[6]. Rasa Darpana mentioned 2 types of pitara yantra, mrittika and loha variety.[7] As per Rasayana Saram the yantra is designed in such a way that the poured molten metal is not able to jump out of the vessel while doing dalana.

Heating and roasting
After purification, to make the process of calcinations easier it has undergone an intermediate process called jarana. [8] After jarana metal becomes more brittle and luster less, which was then subjected to roasting (jarana). The sample of Yasada after purification was taken in an iron pan (loha kadahi) and melted. Melted sample was stirred with the help a fresh Neem branch (*Azadirachta indica*) (44.5 cm long 6 cm diameter 697 gm weight). This process was started in brahma muhurta as it is intense heat consuming and continued till whole till whole metal was converted into powder form (6-hour 30 min). After the procedure the metal was transformed into grayish very fine powder which was then sieved through cloth and then washed with lukewarm water 21 times to free the alkalinity each time checking the pH with pH paper.

Levigation
The roasted Yasada sample was triturated[9] with juice of *Alo vera* till subavita lakshanas are attained.[10]

Incineration Caking (Chakrikarana): Haratala was initially powdered and purified in Kushmanda swarasa[12] and then added 1/4th the quantity of Yasada with jaritha Yasada. A weighed amount of *Aloe vera* juice (Kumari swarasa) in a volume necessary to make the solid powder in a loose paste is added to the material from the side, simultaneously mixing it with a pestle. Bhavana was done by adding *Aloe vera* juice enough to completely soak the sample with proper and constant pressure and frequency and chanting mantra. As the paste tightens due to loss of moisture, it is transferred into a tray and weighed. Round flat pellets with a thickness of 0.5 cm and diameter of 3-4cm thus prepared. The pellets were kept for drying under shade. [11]

Making of cow dung cake (Upala Nirmana)
Fresh cow dung is taken and made into cow dung cakes using an iron mould having diameter 12.72 cm and height 4 cm.

Incineration
Samples were taken into mud pot (sarava) of similar dimension for each sample and shape the mouth of casseroles so that there is minimum gap between them on sealing (sandhi bandhana). The pit was filled with Gajaputa (54.9×54.9×54.9) with cow dung cakes 245 each having an average weight of 180 gm. This was divided into three forth below (184 Nos) and one forth above the samputa (61 Nos). Maximum temperature attained was between 800 ^{0}C - 1000 ^{0}C. The process was repeated 4 times. The final form of bhasma was light yellowish. For incineration with electric muffle furnace temperature was slowly increased up to 550 ^{0}C for 1½ hour. Then temperature was kept constant for 3 hours. The final form of bhasma was sandal yellowish. The prepared bhasma was analyzed as per classical methods and modern parameters.

RESULT

Table 1: Result of Yasada Purification (Sodhana)

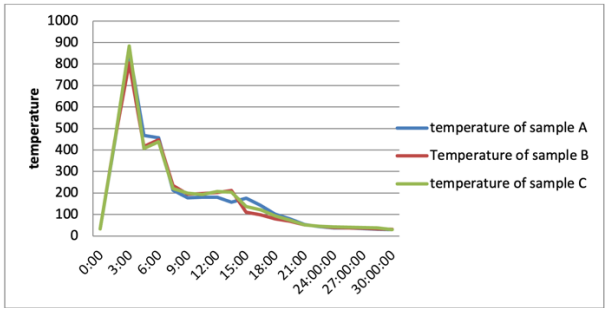
Particulars	Result
Amount of ashodhita Yasada taken	1304.5 gm
Amount of shodhita Yasada obtained	1222 gm
Amount of sludge formed	75.4 gm
Amount of Churnodaka	11.400 L
Average melting time	12.43 min
Loss of weight	82.5 gm
Loss percentage	6.32%

Table 2: Result of Yasada Roasting (Jarana)

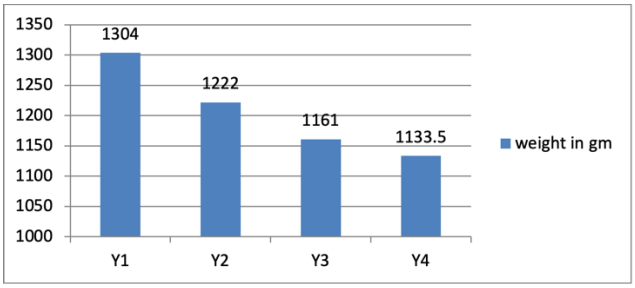
Particulars	Sample
Amount of sodhita Yasada taken	1222 gm
Amount of jarita Yasada obtained	1161 gm
Temperature of Yasada while jarana	311.5 ^{0}C
Loss of weight	61 gm
Loss percentage	4.99%
Time taken for jarana to complete	3 hours 30 minutes + 3 hours (tivragni)
Temperature maintained for tivragni	750 ^{0}C -1000 ^{0}C

Table 3: Result of Incineration (Puta)

Features	Sample A	Sample B	Sample C
Total weight of sodhita Yasada	378 gm	378 gm	378 gm
Total weight of sodhita Haratala	94.5 gm	94.5 gm	94.5 gm
Loss percentage	22.22%	19.54%	18.71%
Number of upalas used	254	254	254
Maximum temperature attained	800 ^{0}C - 1000 ^{0}C	800 ^{0}C – 1000 ^{0}C	800 ^{0}C – 1000 ^{0}C



Graph 1: Temperature Pattern of Gaja Puta



Graph 2: Change in Weight of Yasada in Various Procedures

Y1 - Initial weight of Yasada, Y2 - Weight of Yasada after visesha sodhana, Y3 - Weight of Yasada immediately after jarana, Y4 - Weight of Yasada after washing of jarita Yasada

Physical analysis of Yasada bhasma

Prepared bhasma was analyzed chemically as well as physically by classical methods. Observations are recorded in Table 4.

Table 4: Results of Physical Analysis of Yasada Bhasma

Test	YB_1	YB_2
Touch	Texture of the bhasma was very soft	Texture of the bhasma was soft
Odour	Odorless	Odorless
Color	Pale sandal yellowish	Sandal colored.
Nischandratwam	No luster was observed in the sunlight	No luster was observed in the sunlight
Rekhapurnatwam	Bhasma enters to the minute furrows of the fingertip	Bhasma enters to the minute furrows of the fingertip
Varitaratwam	Bhasma floats over the stagnant water	Bhasma floats partially over the stagnant water
Unnama	Rice grain remains as it is over the floated bhasma	Rice grain sinks to the bottom
Slakshnata	Soft and very smooth to touch	Soft and smooth to touch
Nirutha	Weight of silver remains the same when heated with bhasma	Weight of silver slightly changed when heated with bhasma
Kacha kachabhava	Positive	Positive

YB_1: Yasada bhasma prepared by incineration with classical method of heating
YB_2: Yasada bhasma prepared by incineration with electric muffle furnace

Table 5: Chemical Analyses of Samples

Modern parameters	YB_1	YB_2
pH	6.44	6.49
LOD	0.05%	0.06%
Total Ash	99.02%	98.06%
Water soluble Ash w/w	2.90%	3.25%
Acid insoluble Ash w/w	6.42%	6.54%

NPST Analysis

Table 6: Three Phases of Yasada Bhasma prepared in 5n HnO_3 on 10% Potassium Iodide Paper

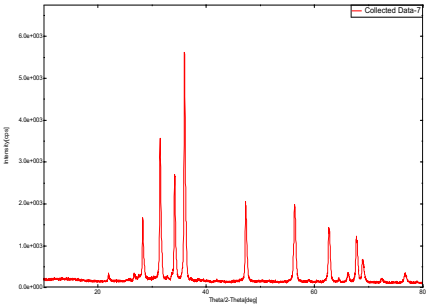
Samples	Changes in pattern and colour		
	Phase 1	Phase 2	Phase 3
YB_1	A centre white area surrounding a yellow circle white spot appears	The centre white spot size increased and a light orange boundary started appearing which is not continuous	The centre spot remains the same in colour but the boundary was more visible
YB_2	Centre colorless area surrounding a light brown ring started appearing	Centre colorless area surrounded by a white ring surrounded by light yellow color ring	Two concentric circles of white area surrounding a light yellow colored outer ring

XRD analysis of Yasada bhasma

XRD data of YB_1 and YB_2 are as shown in Figure 2.a, b.

Powder diffraction of the samples was done using coupled 2 θ /θ scan type in continuous scan mode from 2 θ angle of 3.000ºto 80.002º, sample rotation 15.0001 per minute, using copper anode, wavelength for display at 1.54059 A using Lynx eye detector and crystalline from 10.000 to 80.000. The XRD phase identification for YB_1 and YB_2 of main study showed difference in major phase and minor phase, XRD data shows hexagonal zinc oxide crystalline phases, JCPDS card 79-0208 located at 2θ=28.27, 31.49, 34.17, 36.00, 47.23, 56.29, 62.60, 67.69. No characteristic peaks from other phases of ZnO and impurities are observed, indicating high purity of the obtained ZnO in YB_1 characteristic peak at d=2.49(2θ= 36.00`), as that of zinc metal on d=2.08A, so the absence of this peak on d=2.08A in Yasada bhasma confirms that no crystalline zinc metal is present in Yasada bhasma sample. The diffraction peak 002, 100,101 are nearly of similar thickness. This clearly indicating the presence of symmetry in the crystalline shape. Intensity of peak increases with decrease in the full width half maximum (FWHM) of zinc oxide nano particle.

The YB_2 sample incinerated with EMF which showed a sharp increase and sudden lowering in maximum temperature. This can be a reason for the difference in peak spectra of YB2 sample from YB_1 sample. XRD data shows hexagonal zinc oxide crystalline phases, JCPDS card 79-0208 located at 2θ=29.24, 31.38, 34.07, 35.86, 56.25, characteristic same range peaks from other indicates the presence of impurities, indicating less purity of the obtained ZnO in Yasada bhasma sample. Characteristic peak at d=2.50(2θ= 35.86`), as that of zinc metal on d=2.08A, so the absence of this peak on d=2.08A in Yasada bhasma confirms that no crystalline zinc metal is present in YB_2 sample. On comparing the bhasmas obtained by modern method as well as strictly following the classical method, it showed that the classical method bhasma of Yasada is of the best quality, while incineration in EMF, the bhasmas never passed varitaratwa. Also, they're observed distractions and the thickness of the lines in the graph of XRD which showed presence of other particles in higher concentrations. The appearance of the final product obtained by two methods was drastically different, in colour of bhasma with different properties.



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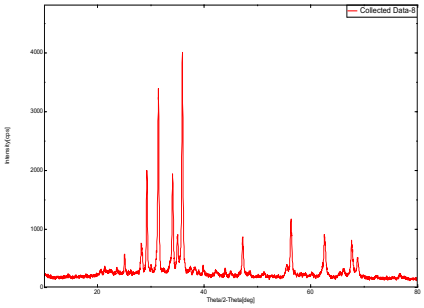


b

Figure 1: a. XRD spectra of classically incinerated Yasada bhasma (YB_1), b. XRD spectra of Yasada bhasma incinerated with EMF(YB_2)

Table 7: Values of "D" And Intensity at Different 2- Theta Values for YB1 and YB_2

Yasada Bhasma YB1			Yasada Bhasma YB2		
Angle 2- theta	Net intensity count	d value Angstrom	Angle 2-Theta	Net intensity count	d value Angstrom
21.9347^0	53.89	4.04866	25.0761	48.89	3.54832
26.6627^0	42.66	3.34065	28.2147	151.31	3.16032
27.5173^0	28.67	3.23882	29.2498	315.49	3.0508
28.2725^0	344.28	3.15399	31.3861	698.95	2.84784
31.499^0	808.85	2.83789	34.0743	391.96	2.62907
34.1722^0	638.15	2.62176	34.9663	141.13	2.56401
36.0051^0	1376.02	2.49239	35.8644	871.27	2.50184
47.2398^0	537.94	1.92253	39.76	31.02	2.26523
56.0967^0	68.59	1.63817	47.2057	184.66	1.92384
56.2905^0	586.49	1.63299	55.4135	84.48	1.65674
62.6038^0	446.58	1.48263	56.2516	253.28	1.63403
64.4767^0	10.46	1.44461	62.5216	278.98	1.48438
66.1552^0	52.23	1.41138	66.0552	38.12	1.41327
67.693^0	382.78	1.38301	67.6149	208.6	1.38442
68.8004^0	176.14	1.36343	68.75	92.53	1.3643
72.3522^0	37.8	1.30499			
76.6949^0	85.86	1.24155			

SEM Analysis

Morphology and size of Yasada bhasma was determined by SEM analysis is shown in figure 1 SEM result shows that crystal size range from 63.75nm to 100nm which is much smaller as compared to raw metal) which indicated the reduction occurred in particle size after proper incineration in classical method. While that of YB_2 in EMF method suggests that average particle size ranges from 137 nm to 345.6nm. Which is higher compared to YB_1.

EDAX Analysis

Elemental composition of YB_1 and YB_2 using EDAX are shown in table EDAX study confirmed the presence of zinc and oxygen in maximum percentage. Oxygen, Sulphur, Zinc, and Carbon is present in YB_1 and YB_2 some other elements like silicon, calcium, arsenic was also reported.

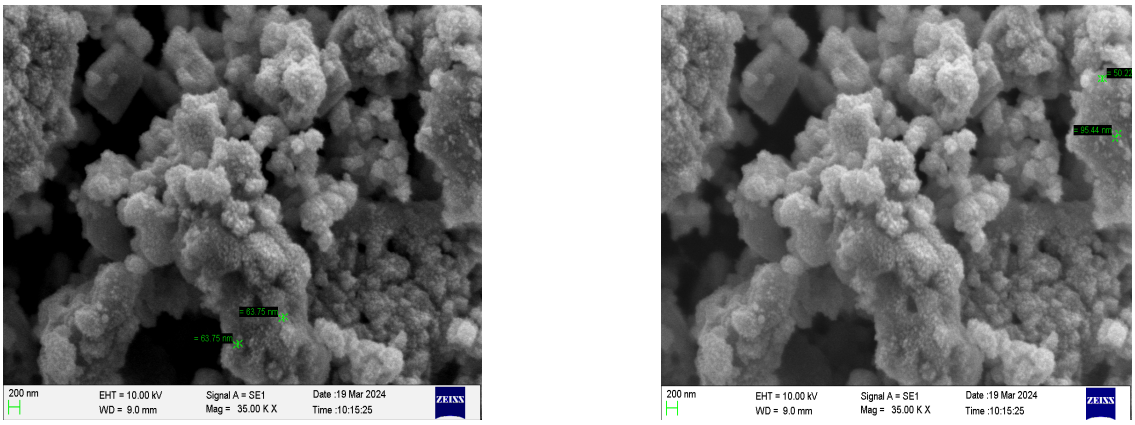
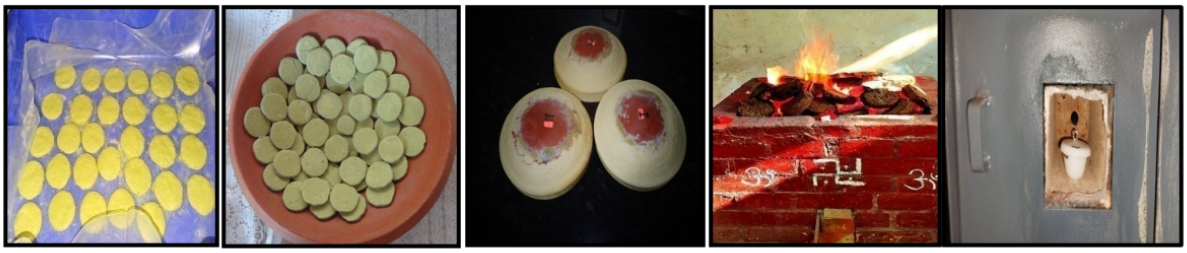
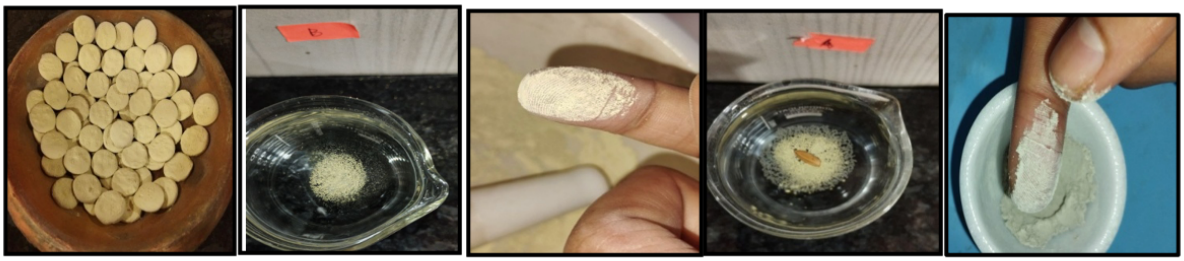


Figure 2: SEM micrographs of YB_1 AND YB_2

Tivragni **Jarita Yasada** **Upala** **Kumari (*Aloe vera*)** **Levigation**



Caking **Samputikarana** **Sealing Casseroles** **Puta** **Incineration-EMF**



After 4th Puta **Varitaratwa** **Rekhapurnatwa YB_1** **Unnama** **Rekhapurnata YB_2**

YB_1- UV light **NPST-YB_2** **NPST –YB_1**

Preparation of Yasada Bhasma

DISCUSSION

Generally, metals and minerals as such are toxic to human body but pharmaceutical processing make them into a susceptible form that they are highly effective without any untoward effect in therapeutic dose. Hence the aim of this pharmaceutical study is to prepare Yasada bhasma ensuring its quality strictly according to the classical methods. Each and every minute facts and observations regarding the processes were recorded. Keeping this in mind the following procedures were carried out, selection and collection of raw drugs, Yasada purification, Haratala purification, Yasada jarana, cow dung cake making, levigation, pellet making and incineration. Out of the various market samples checked for grahya lakshana as per classical textbook, Yasada in the granule form was found to be satisfying the majority of grahya lakshana has been selected for the study. Haratala sample with 4 grahya lakshana as per classics [13] which was found to be patra Haratala variety has been chosen for the study. To analyze the quality of Churnodaka, with various market samples of lime (sudha churna), different samples of lime has been collected and analyzed with chemical parameters like pH, specific gravity. The sample showed the pH of 11.35 which has been stored in green glass bottle was found to be of good quality.

In this work Yasada bhasma has been made strictly following the classical method of bhasma preparation and to make calcinations easier it has been halted with an intermediate process so called jarana. Method of sodhana was dhalana in Churnodaka[14]. The medium is selected as because arsenic is a maraka dravya in this context. The calcium content of Churnodaka used for Yasada purification which may get imparted in zinc which is also acts as an antagonist for arsenic toxicity. Throughout the visesha sodhana of Yasada the change in weight of Yasada was almost uniform nearly 10-15 gm. The form change in the metal was uniform, where the metallic characters start declining from quenching in the Churnodaka medium in all 7 repetitions and continue till the end of quenching. pH of Churnodaka was slightly changing after each dhalana, the alkalinity seems to be contributing to a great extend in processing the metal.
From amongst the liquid media of visesha sodhana, the acidic nature is in the following sequence with respect to pH. Churnodaka (11.23)> Kushmanda (5.34)> Kumari swarasa (4.75). Loss of percentage of sodhana was 6.32%. Maximum degradation of metallic characters happened during the dhalana in the Churnodaka. Thus, we can say that the cutting' in to the metal is not only dependant on how far is the pH of that substance from the neutral, but there is something more which is attributed to the effect of that particular drug. Scanning the practical works for the media of sodhana, they seem to be bearing some organic enzymatic activity, in case of Churnodaka the chemical reaction that when zinc react with water to from zinc hydroxide and hydrogen gas. That may be the Churnodaka turned little cloudy after each dhalana.

The reaction is: $Zn + 2\ H_2O = Zn\ (OH)_2$

Here zinc hydroxide is formed as a white precipitate, and hydrogen gas is released, in the presence of excess calcium hydroxide, there might be complex interactions, but the primary reaction is between zinc and water. Churnodaka is already alkaline, and zinc hydroxide formed is a weak base, so the addition of zinc hydroxide will typically not cause a significant increase in pH, that might be the reason that there is not much significant change in pH of Churnodaka after each dhalana. Overall effect might be like pH may slightly increase or remain relatively stable, staying within the alkaline range (11.23-11.39). The first dhalana took more quantity of Churnodaka; successive dhalana the quantity was less by 600 ml. It has to be kept in mind that the volume of the media affects the rate of transformation, kind of transformation as well as quality of content of the matter. If we predict that trace elements are being contributed by the sodhana media, the more the media in volume, more will be the constituent trace elements, provided the weight of the medium, pressure, temperature and other influencing factors remain constant.

Haratala purification method selected for the study is swedana in Kushmanda swarasa. Kushmanda swarasa contains organic acids like citric acid and ascorbic acid. These acids can help to partially dissolve and neutralize some of the toxic arsenic compounds present in haratala. The pH 5.34 suggests mild acidity of the juice can lead to the formation of more water-soluble arsenic compounds, which can be removed during the washing or filtration stages of the purification process. The organic compounds present in Kushmanda swarasa such as polysaccharides, flavonoids, and other phytochemicals may act as chelating agents. This chelation can reduce the bioavailability of arsenic, rendering it less toxic and easier to eliminate or manage. The ascorbic acid in swarasa can reduce any oxidized forms of arsenic like As_2O_5 back to less toxic state. This process can stabilize the arsenic in a less reactive and less harmful form.

During jarana sodhita Yasada taken in an iron vessel (loha kadahi) and heated, when it gets completely melted, continous rubbing with fresh Nimba stick vigorously and continuously till all the Yasada converted into powder form and no metal particles were visible and the amount of avapa required is also tremendous, where it consumes almost equal of it. But after the preliminary process of exact determination, almost $1/6^{th}$ of the avapa is required though ideally mentioned quantity is $1/4^{th}$ in case of jarana with Apamarga root churna etc. That means, considering the weight of fresh Nimba kashta (neem stick) taken for jarana was 697 gm initially, and after jarana it was 233 gm, that means about 66% of Nimba particles are incorporated to the Yasada approximately. But to be in accordance with the text, the whole of the one fourth avapa was added. Thus, the performing of preliminary processes of visesha sodhana, reduce the amount of time and avapa for jarana. Then subjected to tivra Agni (750 ^{0}C) for 3 hours. After self cooling, the powder was sieved through a double layered cora cloth.

Before marana process the jaritha Yasada is triturated with Haratala, the latter very easily prevents the former from solidifying into a lattice structure, some of the metal combines with atmospheric oxygen to form oxide. Simultaneously the other elements accompanying both the metals through their respective sodhana processes form versatile compounds. Levigation of jaritha Yasada in Kumari swarasa is a complex process that not only physically modifies the zinc powder but also induces chemical interactions that can enhance the therapeutic properties of zinc, making it more bio available and potentially more effective.

During the classical method of calcination, on combustion every cow dung cake is going to reach a particular maximum temperature, but as the amount of cow dung cakes vary and as not all cow dung cakes are ignited simultaneously, till one mass of cakes reaches a maximum temperature and it starts falling another mass reaches this maximum temperature and takes over the temperature maintenance from the earlier mass, this way maintaining the plateau of maximum temperature. Faster is the rate of heating for the preparation of a compound, higher is the temperature required for its decomposition. Slower is the rate of heating for the preparation of a compound, lower is the temperature required for its decomposition. In any of the solids, if it has to undergo a state change, liquefaction occurs. This starts

at the surface of a chakrika when the optimum temperature is reached. This appears as several small spots called nuclei for liquefaction, throughout on the surface of the chakrika, which go on increasing centrifugally to merge into each other, forming a complete layer in the reactive state. If the optimum temperature is maintained, the layer-below and below undergo the same liquefaction through nucleation, till it reaches the center. The moment the temperature drops down, this process halts and from that very point of time, process of freezing starts. Contrary to the nucleation for liquefaction, the nucleation for freezing appears first in the center of the chakrika and spreads centrifugally to the surface. Hence, we find that the vertical section of a chakrika through, its center, yields the surface layer to have achieved the desired color prior to the center. After subjection of the chakrika once to a puta, not all the particles constituting them are exposed to the same pattern of heat. These are, hence, again levigated with aims already specified and exposed to heat. A stage is reached, when after such alternate levigations and heating, a vertical section of the chakrika passing through its center yields uniform visible characteristics. While using the electric muffle furnace, there is sudden rice in temperature and sudden fall in temperature as compared to classical method of incineration which took nearly 36 hours to complete whole process of incineration including self cooling. Product obtained was of uniform color which was different from that of classical method, and passed only rekhapurnata partially.

Safety and efficacy of a drug/product depends on its composition which is assessed with various analytical parameters. Physico-chemical analysis assessed both classical and modern parameters. Classical parameters include bhasma pareekshas. Varna of all Bhasma samples was found to be sandal yellowish as per RGB colour chart. All the samples satisfied varitaratwa, rekhapuranatwa, unnama, mrudu, nischandratwa, and dantagre kacha kacha abhava. In nirutha bhasma pareeksha weight of silver obtained after puta was the same as that before puta. Sample has LOD 0.05%, total ash 99.02%, water soluble ash 2.90% and acid insoluble ash 6.42%. Modern analysis and characterization mean that the radical change has been occurred in the bhasma by repeated incineration process.

XRD of Yasada bhasma prepared in two methods suggests that the zinc is present in zincite structure in major form. Absence of any crystalline zinc metal peaks and nano size of particle is confirmed. It was clear that zinc in the raw metal has been converted into ZnO nano particle by repeated process of incineration. The particle size was lesser in YB_1 as compared to YB_2. The disturbed peaks in the YB_2 suggested the presence of impurities or other elements.

SEM analysis revealed that the particle size of bhasma was found to be in the range of 63.75- 100 nm in YB_1 and 137-345 nm in YB_2. SEM also revealed that external morphology of the particle, where particles of YB_1 were granular and porous nature, while YB_2 was rectangular nonporous type. EDAX analysis shows the presence of zinc, carbon, oxygen, and sulphur in the sample YB_1, while the sample YB_2 showed. Addition of sulfur through adding Haratala has led to the formation of sulfide. The sudden identification of their existence and conversion to the sulfide form can be attributed as a virtue of the process itself. Presence of trace elements like arsenic, silicon, calcium in the YB_2 may be due to the change in method of calcinations. Thus, we can say from the phase determination images that all samples have yielded a uniform phase presentation, actually in the form of conversion, addition or subtraction first and again some conversion or addition subtraction phenomenon. These changes may be such as occurring on very subtle levels.

CONCLUSION

The present study focuses on the preparation of Yasada bhasma in classical method as well as contemporary method using electric muffle furnace. An effort has been made to assess the raw market samples of Yasada metal in terms of grahya lakshana, ideology behind the storage of Churnodaka in green glass bottle, and to validate the importance of puta in bhasma preparation and the safety profile of the bhasma in terms of method adopted for calcinations has been made. To assure the quality and safety profile of the Bhasma apart from the classical analytical parameters, modern characterization techniques like XRD (X- ray diffraction), SEM (Scanning Electron Microscope), EDAX (Energy Dispersive X-ray Spectroscopy) have been carried for both the samples. XRD reveals the conversion of zinc metal into, hexagonal, ZnO phase after proper incineration process. SEM reveals the bhasma prepared in the classical method is of minimum particle size in the nanometer range as compared to the bhasma prepared in the contemporary method, and the presence of trace elements like arsenic in more than the permissible limit. Thus, this characterization gives us an idea about the chemical form and composition, particle size and crystalline structure of bhasma made in two methods that can help us to correlate the toxicity related issues.

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