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COMPARATIVE ANALYTICAL STUDY OF VANG BHASMA AS PER ANCIENT AND MODERN PARAMETERS

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ABSTRACT

Metals are known as therapeutic agents since ancient time but their use in therapeutics was limited; probably due to inability to convert them into suitable pharmaceutical form. In due course of time with the development of Rasa Shastra, many new pharmaceutical processing techniques evolved and many new formulations were developed. This revolution made the internal use of metals very easy by making them least toxic, highly absorbable and therapeutically very effective. There are several principles and references mentioned in the texts of Rasa Shastra for the processing of the metallic drugs to make them therapeutically effective and safe for internal use. In present study, two samples Vang Bhasma were prepared by two different methods based on classical principles of Bhasma preparation. Sample-1 was prepared by using Hingula and Aloe vera pulp as media for levigation and Sample-2 by using Aloe vera pulp only. These two samples were analysed on both ancient and modern analytical parameters for the quality analysis. On analysis, it was observed that both the methods of preparation of Vang Bhasma are equally effective on analytical parameters.

KEYWORDS: *Vang Bhasma, Hingula*, Levigation, Analytical parameters.

INTRODUCTION

The term *Bhasma* is generally applied to bio-compatible incinerated form of all metallic and non-metallic substances that are subjected to the series of processes for their conversion into bio-assimilable form. The starting material undergoes an elaborated process of purification (*Shodhana*), followed by the reaction phase, which involves incorporation of some other mineral or herbal extracts (*Bhavana*). Then the material is made into pellet form and at specific temperature calcinated in closed earthen plates in the pits with cow dung cakes as fuel or in Electric Muffle Furnace (*Marana*).[1] The end product is expected to be a nontoxic material and converted into bio-assimilable form.

In *Ras Ratna Samuccahya,*[2] it has been stated that *Bhasma* prepared by using *Parada* (mercury) as *Bhavana dravya* for *Marana* are better in qualities than the *Bhasma* prepared by using herbal media. So in present study, one sample of *Vang Bhasma* was prepared by using *Hingula* and *Aloe vera* pulp as *Bhavana dravya*[3] and another sample was prepared by using *Aloe vera* pulp only as *Bhavana dravya*[4] for *Marana* during preparation of *Vang Bhasma.*

AIMS AND OBJECTIVES

- To prepare two samples of *Vang Bhasma* by using two different methods.
- Comparative analytical study of both the samples of *Vang Bhasma* on both classical and modern analytical parameters.

MATERIALS

The raw materials *Vang* (Tin) and *Hingula* were procured from Govt. approved laboratory. Other herbs like *Aloevera, Apamarga* and materials used during *Shodhana* (Purification) were procured from Govt. Herbal Garden. The samples of these materials were authenticated and identified from accredited institutes.

METHODS

A. Method of Preparation of *Vang Bhasma* Sample-1 [Table-1]

It included three stages namely *Shodhana* (purification), *Jarana* and *Marana* (incineration).

1. *Shodhana*

a) *Samanya Shodhana:*[5] Raw *Vang* was heated to red hot stage and then quenched in *Tila* oil, *Takra, Gomutra, Kanjika, Kulattha kwatha* respectively 7 times in each media.

b) *Vishesha Shodhana:*[6] *Samanya shodhit Vang* was quenched in *Nirgundi Swarasa* mixed with *Haridra* powder for 3 times.

2. *Jarana:*[7] *Shodhit Vang* was put in an Iron vessel and heated over flame till it melted. Then equal quantity of *Asvatha* bark was added to it and rubbed till it turned into powder form.

3. *Marana:*[8] *Jarit Vang* was put in a mortar and 1/8th part *Shudha Hingula* was added to it and mixed. Then it was levigated with *Aloe vera* pulp with help of pestle. Then contents were dried, pellets prepared and subjected to heating at a temperature ranging 800-900 ^{0}C in an Electric muffle furnace. This process was repeated for 10 times.

B. Method of Preparation of *Vang Bhasma* Sample-2 [Table-1]

It also included three stages namely *Shodhana* (purification), *Jarana* and *Marana* (incineration).

1. *Shodhana*

a) *Samanya Shodhana*: Same as for Sample-1.

b) *Vishesha Shodhana:*[9] *Samanya shodhit Vang* was quenched in *Churnodak* for 7 times.

2. *Jarana:*[10] *Shodhit Vang* was put in an Iron vessel and heated over flame till it melted. Then 1/4th quantity of *Apamarg panchang* was added to it and rubbed till it turned into powder form.

3. *Marana:*[11] *Jarit Vang* was put in a mortar and levigated with *Aloe vera* pulp with help of pestle. Then contents were dried, pellets prepared and subjected to heating at a temperature of 600-800 ^{0}C in an Electric muffle furnace. This process was repeated for 15 times.

Table 1: Different Steps in preparation of *Vang Bhasma.*

***Vang Bhasma* samples**	***Vishesh Shodhana* Media**	***Jarana* Media**	***Marana* Media**	**No of *Puta***	**Average range of temperature**	**Weight of *Vang* initially taken**	**Weight of *Vang Bhasma* obtained**
Sample-1	*Nirgundi Swarasa* mixed with *Haridra* powder	*Ashwath twak churna*	*Hingula* and *Aloe vera* pulp	10	800-900 ^{0}C	350g	258.5g
Sample-2	*Churnodaka*	*Apamarga panchang churna*	*Aloe vera* pulp	15	600-800 ^{0}C	400g	364g

Table 2: Maximum temperature given to both samples of *Vang Bhasma.*

No. of *Puta*	**Maximum temperature given during *Puta***	
	Sample- 1	**Sample- 2**
1st *Puta*	800 ^{0}C	600 ^{0}C
2nd *Puta*	800 ^{0}C	600 ^{0}C
3rd *Puta*	800 ^{0}C	600 ^{0}C
4th *Puta*	850 ^{0}C	600 ^{0}C
5th *Puta*	850 ^{0}C	600 ^{0}C
6th *Puta*	850 ^{0}C	700 ^{0}C
7th *Puta*	900 ^{0}C	700 ^{0}C
8th *Puta*	900 ^{0}C	700 ^{0}C
9th *Puta*	900 ^{0}C	700 ^{0}C
10th *Puta*	900 ^{0}C	700 ^{0}C
11th *Puta*	-	800 ^{0}C
12th *Puta*	-	800 ^{0}C
13th *Puta*	-	800 ^{0}C
14th *Puta*	-	800 ^{0}C
15th *Puta*	-	800 ^{0}C

C. Method of Analytical Study

Both the samples of *Vang Bhasma* were subjected for analysis on Ancient parameters and Modern parameters. Analysis on Ancient parameters was done while preparing *Bhasma* by the scholars in the department. Analysis on Modern parameters was carried out at a Govt. approved laboratory with help of sophisticated instruments. The parameters used in analysis are-

i) Ancient Analytical Parameters:[12] *Varna, Rasa, Gandha, Sparsh, Varitaratva, Rekhapurnatva, Nishchandratva* and *Appearance.*

ii) Modern Analytical Parameters[13]

- Physico-chemical tests
- Qualitative/Quantitative tests:
  - PSA (Particle size analysis)
  - FT- IR (Fourier Transform Infrared Spectrometry)
  - XRD (Phase Identification of Diffractogram using X-ray Diffraction)
  - ICP-ES (Inductively Coupled Plasma – Emission Spectroscopy)

OBSERVATIONS AND RESULT

1. Ancient Analytical Parameters

Table 3: Result of analysis of *Vang Bhasma* on ancient parameters.

Parameters	Sample-1	Sample-2
***Varna* (Colour)**	Brownish grey	Yellowish white
***Rasa* (Taste)**	Tasteless	Tasteless
***Gandha* (Odour)**	Odourless	Odourless
***Sparsh* (Touch)**	Very Soft	Very Soft
Varitaratva	100%	100%
Rekhapurnatva	Positive	Positive
Nishchandratva	Positive	Positive
Appearance	Fine powder	Fine powder

2. Physio-chemical tests

Table 4: Results of Physio-chemical tests of *Vang Bhasma.*

Tests	Sample-1	Sample-2
pH	8	7.9
Loss on Drying	0.10%	0.29%
Acid insoluble ash	98.25%	92.75%
Water Soluble Extractive	0.8%	21.92%
Alcohol soluble Extractive	1.2%	0.46%

3. Particle Size Analysis (PSA)

This test was performed to evaluate the size distribution of particles in the sample. Particle size analysis is an objective parameter for the assessment of subjective property of *Bhasma* called '*Rekhapurnatva*' which is mentioned in our *Ayurvedic* classics. Smaller the particle size, larger is the surface area and greater are the chances of absorption.

Table 5: Result of Particle Size Analysis of *Vang Bhasma.*

Parameter	Particle Size	
	Sample-1	Sample-2
X_{10}	1.45 µm	0.75 µm
X_{16}	2.02 µm	0.90 µm
X_{50}	5.46 µm	2.60 µm
X_{84}	12.94 µm	11.03 µm
X_{90}	16.39 µm	16.41 µm
X_{99}	35.12 µm	41.18 µm
SMD	4.26 µm	1.85 µm
VMD	7.63 µm	6.07 µm

4. Fourier Transform Infrared Spectrometry (FT-IR)

FT-IR is most frequently used for characterization of quantitative and qualitative analysis for organic and inorganic samples. It identifies chemical bonds in a molecule. Advantages of FT-IR include its superior sensitivity and resolution, absolute wavelength accuracy and higher precision of measurement.

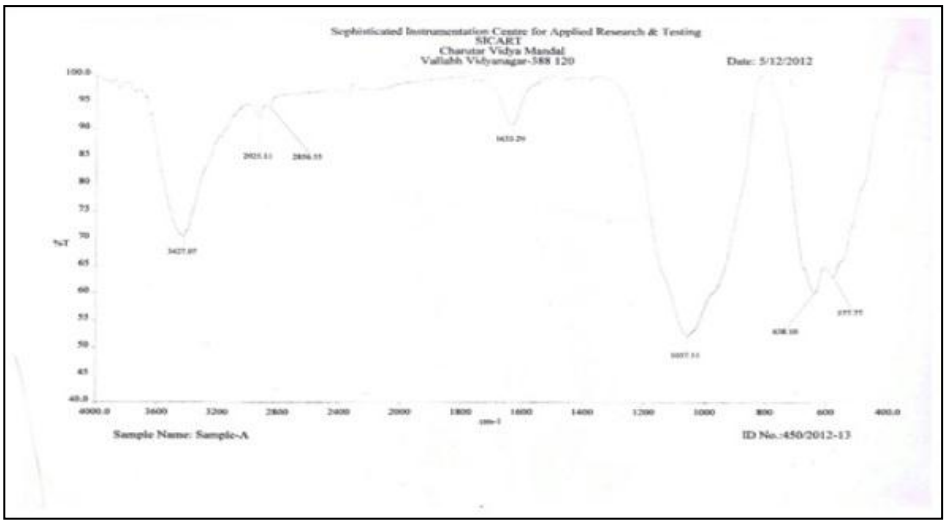

Fig. 1: FT-IR peaks of *Vang Bhasma* Sample-1.

Table 6: Bonding present in *Vang Bhasma* Sample-1.

FTIR wavenumber	Bond Present
3427	Primary and Secondary Amines and Amides N-H (Stretch)
2825.11	Alkanes C-H (Stretch), Carboxylic acid O-H bond, Aldehyde C-H bond
2856.55	Alkanes C-H (Stretch), Carboxylic acid O-H bond, Aldehyde C-H bond
1633.29	Alkenes C=C bond, N-H bend
1057.11	O-H vibration
638.10	Chloride, Bromide, Iodide C-X Bond
577.77	Finger print region

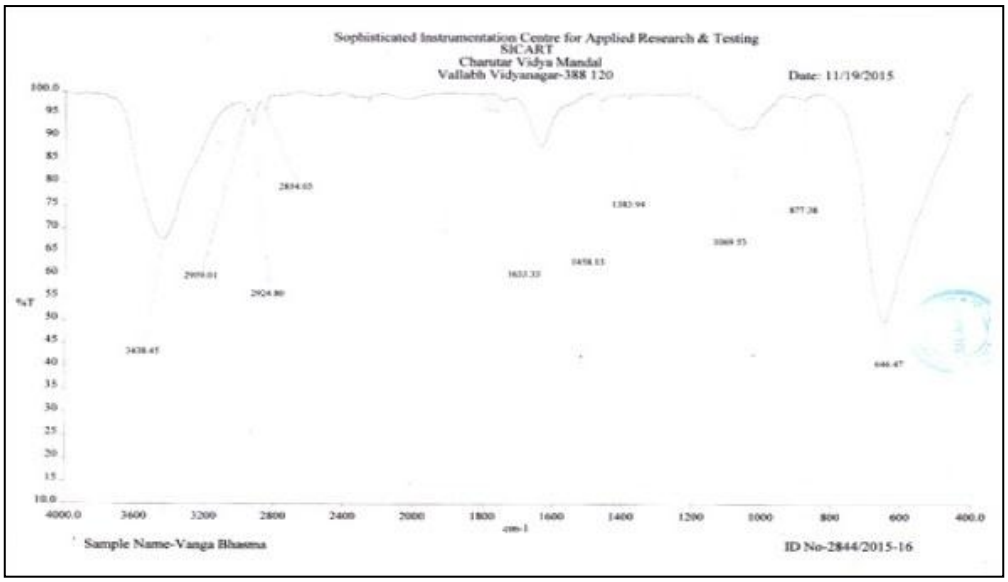

Fig. 2: FT-IR peaks of *Vang Bhasma* Sample-2.

Table 7: Bonding present in *Vang Bhasma* Sample-2.

FTIR wavenumber	Bond Present
3438.45	Primary and Secondary Amines and Amides,N-H (Stretch)
2959.01	Alkanes C-H (Stretch), Carboxylic acid O-H bond
2924.80	Alkanes C-H (Stretch), Carboxylic acid O-H bond
2854.03	Alkanes C-H (Stretch), Carboxylic acid O-H bond, Aldehyde C-H bond
1633.33	Alkenes C=C bond, N-H bend
1383.94	Fluoride C-X bond
1069.53	Amine C-N bond, Fluoride C-X bond
877.38	C-H, Aromatics out of plane bend
646.47	Chloride, Bromide, Iodide C-X Bond

5. X-Ray Powder Diffraction (XRD)

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions of the molecules present in the sample. The most widespread use of powder diffraction is in the identification and characterization of crystalline solids, each of which produces a distinctive diffraction pattern. The XRD of *Vang Bhasma* showed its crystalline structure.

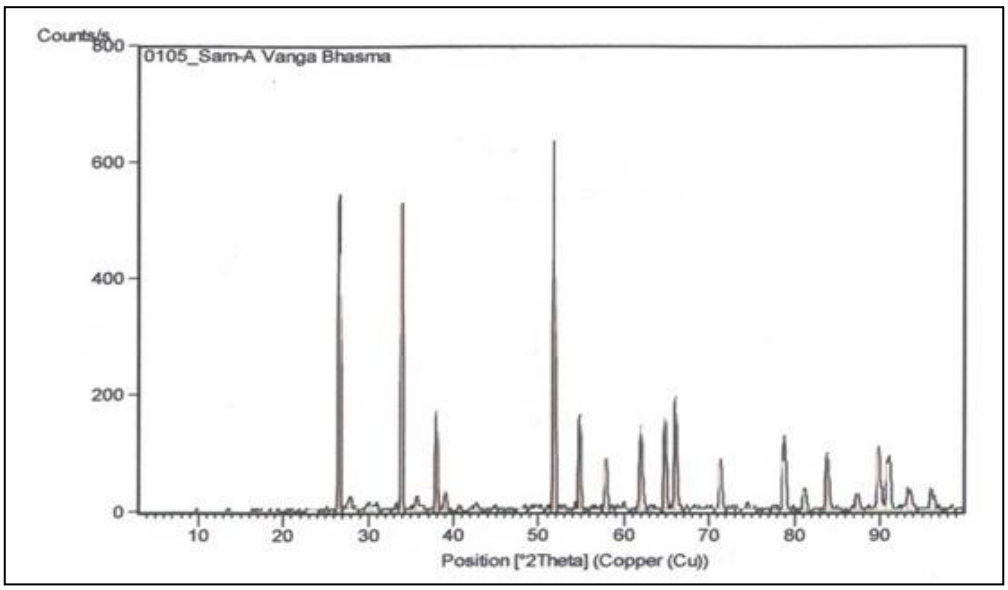

Fig. 3: XRD Peaks of *Vang Bhasma* Sample-1.

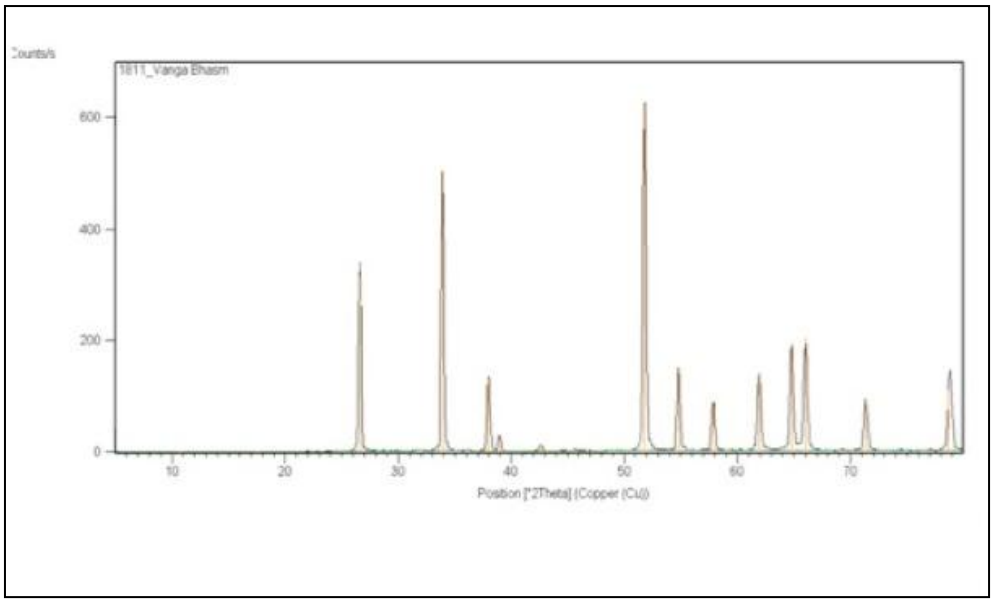

Fig. 4: XRD Peaks of *Vang Bhasma* Sample-2.

6. Inductively Coupled Plasma Emission Spectroscopy (ICP-ES)

Emission spectroscopy is regarded as the most reliable method for quantitative elemental analysis available at present. The scope of atomic emission spectroscopy has been considerably enhanced by the application of plasma as an atom ionization source for emission spectroscopy. Plasma is a cloud of highly ionized gas, composed of ions, electrons and neutral particles.

Table 8: Results of ICP-ES of *Vang Bhasma.*

Test Parameter	Sample-1	Sample-2
Arsenic, wt%	0.0003822	0.0002773
Mercury, wt%	Not Detected	Not Detected
Lead, wt%	0.00032734	0.0006621
Cadmium, wt%	0.00001866	0.0000251

DISCUSSION

Two samples of *Vang Bhasma* were prepared by using *Hingula* and *Aloe vera* pulp and only *Aloe vera* pulp as *Bhavna dravya* for *Marana*. Then both the samples were studied on both classical and modern parameters.

- **Discussion on Classical Analytical Parameters:** More number of *Puta* was given to Sample-2 to attain 100% *Varitarata Bhasma*. This difference might be due to absence of mercurial compound in Sample-2. Final color of Sample-1 *Bhasma* was brownish grey and Sample-2 *Bhasma* was yellowish white. This difference in color might be due to addition of *Hingula* in Sample-1. Rest all the classical parameters like *Gandha*, *Sparsha*, *Varitarta*, *Rekhapurnata*, *Nishchandratava*, *Apunarbhava* and Appearance were same for both the samples of *Vang Bhasma*.
- **Discussion on Modern Analytical Parameters:** FTIR showed similar organo-metallic bonds in both the samples of *Vang Bhasma*. The particle size of Sample-2 (6.07µm) was less than that of Sample-1 (7.63µm). This might be due to number of *Puta* given to Sample-2 were more to attain 100% *Varitarata Bhasma*. XRD showed Tin oxide as the major phase in both the samples of *Vang Bhasma* and rest are found in minor phase. ICP-ES test was performed for heavy metals estimation. It showed that all the heavy metals were in permissible limits and mercury was absent in both the samples.

CONCLUSION

On analysis of both the samples of *Vang Bhasma* prepared by two methods as per classical principle by adding *Hingula* to *Aloe vera* pulp and according to classical reference by adding *Aloe vera* pulp only as *Bhavna dravya* for *Maranaa*.. It is concluded that on analytical parameters, both the samples possess similar properties when analysed on ancient and modern analytical parameters. Hence, it can be stated that both the methods for preparation of *Vang Bhasma* are equally effective on analytical point of view.

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