



Review Article

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EVALUATION OF HERBO MINERAL FORMULATIONS (BHASMA): AN OVERVIEW

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ABSTRACT

The holistic eternal healing science has achieved worldwide recognition because of remarkable efficiency in curing chronic and degenerative diseases with a few side effects. Bhasmas are Ayurvedic herbomineral formulation prepared from herbs, minerals and metals by calcinations process. Nano particles natures of bhasma make them unique and are widely recommended to treat chronic diseases in most efficient ways. Nano particulate nature and chemical characterization of bhasma can be estimated by using analytical instruments like X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Atomic absorption spectroscopy (AAS), Thermo gravimetric analysis (TGA), Scanning electron microscope (SEM), Atomic force microscope (AFM). In this review an attempt is made to gather the physical chemical and biological evaluation methods for bhasma and to develop a systematic approach for the quality control parameters of bhasma and thus make them more appreciable by the world.

Key words: Nano particles, Bhasmas, herbomineral, formulation, chronic diseases

INTRODUCTION

Ayurveda system of medicine was highly appreciated and practiced during the golden era of Indian history. This system of medicines recognizes the importance of metallic micro-nutrients in our body. Deficiency or imbalance of these metallic micro nutrients in body results in the manifestation of diseases. This concept has great relevance in present day situation as our world faces major ecological disturbances and consequently newer diseases. Ayurveda lays more emphasis on the prevention and treatment of diseases by keeping a balance between diet and life-style of an individual depending upon the environment he or she lives in. The necessity of metallic micro-nutrients for perfect health is a subject for intensive study. It has been observed that the metal based formulations are especially effective in prevention and cure of diseases related to the organ where they act^{1,2}.

Rasashastra is a section of Ayurveda which describes the use of metals, gems, minerals and poisons for manufacturing special formulations³⁻⁶. These metallic micro-nutrients were freely available in soil and water enriching plant and animal kingdom in previous days but now it has been deprived as our soil and water have badly polluted by raw metals and the by-products of industrialization. The main concept of Rasashastra lies in the transformation of base lower metals into noble higher metals and to use them for strengthening the body tissues and to maintain them as fresh⁷. They may applied externally for skin diseases and also for internal administration in the form of a suspension in plant juices,

for diseases like liver disorders, ulcer, asthma, cough and chronic skin diseases. Various salts, alum, sulphar, quartz etc. had internal as well as external applications. This particular system which was developed to achieve Lohavedha (transformation of body for the prevention of ageing and maintenance of positive health) Dehavedha, stressed more on Rasayana concept of Ayurveda (the ways and means by which one can achieve the best quality of Rasadidhatu). In this system the metals and the minerals are termed as Dhatus and Updhatus, because of their specific role in biological systems and whose deficiency may causes many undesired problems in the body. In Rasa text seven Dhatus named gold, silver, copper iron, tin, lead and zinc are described as essential elements for the body⁸. These Dhatus are present in our body in different concentration and combinations. A state of equilibrium of these Dhatus in body tissues is necessary for maintaining good health.

Although the use mineral drugs like mercury and the Sulphar was recognized as toxic, it is possible to reduce or remove their toxicity by a number of sodhana measures⁹. These include grinding of such drugs with other acidic or alkaline liquids, their heating and dipping in various liquids or their boiling, fusion, sublimation etc. These measures in turn remove washable, soluble and volatile impurities of the drugs of mineral origin. Sometime some organic / inorganic materials are added either in traces or in large amounts to these substances which helps either in their detoxification or in their potentiation. Rasashastra can be called Vedic Chemistry¹⁰.

Earlier the medicines were prepared by the physicians themselves for the patients and they were well experienced and trained in processing medications. It was common in practice to modify the preparations according to the need of the patients. Now the drug manufacturing is done in large scale and addition of substituent has become common. As the chances of adulteration has become common it has become mandatory to standardize the Ayurvedic preparations especially Rasoushadies, as they are used in alpamithra (minute quantities)¹¹⁻¹³. Harmful effects of metallic medicines in various body are well documented as in modern medicine.

In order to have a good co-ordination between the quality of raw materials, in process materials and the final products, it has become essential to develop reliable, specific and sensitive quality control methods using a combination of classical and modern instrumental method of analysis. Standardization is an essential measurement for ensuring the quality control of the herbal drugs¹⁴.

BHASMAS

Bhasmas are unique metal based drugs and they are suggested with herbal juices, fruits for treating variety of chronic diseases³. Bhasmas are obtained by repeated calcinations and incineration of liquid products by special process. During incineration metals are converted into its mixed oxides. Zero valiant metal state is converted to metal oxides of higher oxidation state, by this bhasmikarana process. Toxic nature of the resulting metal oxide is completely destroyed while medicinal properties are introduced in this process^{2,15,16}.

CLASSIFICATION OF BHASMA

Bhasmas are generally classified based on their colour and appearance or based on the dominant metal or mineral group. Usual colour of Bhasma is yellowish black, dark, white, grey, reddish black and red depending upon the drug used¹⁷.

Importance of Bhasma¹⁸

Bhasmas are most ancient form of administration having pharmacological activities like analgesic, anti-inflammatory, immune-modulatory, antioxidant and free radical scavenging activities. By the use of nanotechnology bhasmas are made target oriented with increased therapeutic efficacy^{19,20}.

The main advantages of Bhasmas are:-

- Potent in small dose
- Does not have any specific taste
- They can act quickly
- Available as very fine particles (nano size)
- Have good stability as compared to other dosage forms¹⁸.

Preparation of Bhasma

The process of preparing bhasmas includes

Shodhana (Purification) - By this process material becomes free from visible and invisible impurities, masses of minerals are converted to fine and brittle.

Bhavana: It is a wet trituration process using mortar and pestle. By this the materials are mixed uniformly and divided in to fine particles by rubbing and attrition that is the force applied which help to increase the surface area of the material and thereby increases the rate of reaction²¹.

Jarana: Small pellets are made and dried in sunlight. Their melting point are increased due to oxidation process. These pellets are arranged in earthen sharava (casserole) and covered with another sharava. Joint are sealed and dried again.

Putapak: Puta system of keeping – prepared sharava are heated, enumeration according to the nature of materials, inorganic part of plant material supplies trace elements to the materials. During putapaka material are formed on the surface of the particle.

Marana (Enumeration or calcinations): The compound materials are converted to another compound where elements are get reduced. Sometimes bhasmas are subjected to post-operative procedures like lohitarana and amritikarana to enhance the therapeutic properties of bhasmas^{5,19,20,22}.

NANOTECHNOLOGY AND BHASMA

Preparations constituting bhasma are superior as it is manufactured with the help of nanotechnology¹. It is the technology of material dealing with very small dimension usually in the range of 1-100nm. When the dimension of any type of material is reduced below approximately 100 nm its mechanical, thermal, optical, magnetic and other properties changed at some size. Thus within the same material one can get different properties. As the size of the sphere changes from 1 m to 1nm the surface area to volume ratio increases by a factor of 10⁹ which will again act as a key for catalyzing the medicine.

By increasing the number of Putapaka step of bhasmikarana the particle size can be reduced to desired size. Examples are for simple therapeutic; 10-100 and for aphrodisiac; 10-50 are the needed number of puttapaka. Mardana (trituration) and Bhavana (levitation) process also helps to reduce the size of particles to nano size (less than 100 nm in any dimension).

Nanotechnology is made possible by sophisticated analytical techniques like transmission electron microscope (TEM), scanning tunneling microscope (STM), and atomic force microscope (AFM). Thus by using these instruments nano nature of Bhasma can be made to reality²³. Nanoparticles have either positive or negative charge on their surfaces depending upon the

methodology adopted during preparations. Nanoparticles have greater application as drug carriers, diagnostic purposes, and specific therapeutic application¹⁹.

Metals like Silver, gold, zinc, copper, calcium and so many others are used in modern medicine as bhasmas without any adverse effects^{2, 21}. Out of 6000 herbal manufacturers 4000 are producing Ayurvedic medicines. In order to have good co-ordination between the quality of raw materials in process materials and final products, reliable, specific and sensitive quality control methods are essential. These methods should include classical and modern method of analysis. Standardization is a measurement for the ensuring the quality and is used to describe all measures which are taken during the manufacturing process leading to reproducible quality²⁴

The standardization is done to ensure safety and efficacy²⁵. One of the major problems faced by the herbal drug industry is non-availability of rigid quality control parameter for the herbal material and other formulation. Bhasmas are safe when prepared and used properly otherwise they can prove injurious to health. WHO guideline has described many quality parameters that have to be followed for safe and efficacious use of bhasmas and other Ayurvedic formulations^{14, 26}.

Mode of action of action of Bhasmas

Since Bhasmas are nanoparticles, they have large surface area, smaller size and uniform shape. So their internalization to the cell and consequent effects is occurring quickly. Thus the pharmacological efficiency of bhasma lies in the reduced particle size which is achieved by increasing the number of puta process (incineration)⁹.

Need for standardization of Bhasma

Evaluation of a drug means confirmation of its identity and determination of its quality and purity and detection of its nature of adulteration. The analysis carried out on the formulations used for treatment show that the raw metals used for their preparation lose their metallic characteristics and turn into mineral complex after processing²⁶. In their raw form, the metals like mercury, copper, sulphur and lead etc. would be highly toxic. However according to the ancient text of Ayurveda the traditional manufacturing process over a period of two to three years, whereby the medical arc repeatedly ground and fired in furnaces at temperatures between 1200 °C to 6000 °C are believed to remove the toxicity and impart remarkable therapeutic value to the compound. Some compounds for instance, have grinding and heating cycles repeated hundred times with each cycle lasting 4.7 days.

In order to prove the effect of processing in the elimination of toxicity of metal based formulations various toxicological studies were carried on raw, partially processed & processed copper, mercury and sulphur metals (used against certain types of cancer and inflammatory disorder). The parameters studied included

various liver function tests, hematological and histopathological studies. Based on the results obtained it can be inferred that processing indeed has profound influence in the elimination of toxicity as maximum deviation from normal values of various studies was found in rats treated with raw metal and then followed by partially processed and processed copper.

Characterization of Bhasmas²⁶

Bhasmas parikshas (ancient method of standardization)

Rekhaspurnata - By rubbing between fingers finest is tested.

Varitarq (floating test) – Pinch of bhasmas is added on the surface of clean water. It should float.

Unamas - Rice grain was placed on the surface of floating bhasmas. The floating should persist.

Niswadu (taste) – Pinch of bhasmas was placed on the tongue.

Nishchandrata – A pinch of bhasmas was taken and observed under bright sunlight. No shining particles in the bhasmas.

Nirdhumatva – A pinch of bhasmas was sprinkled on ignited charcoal and observed if fumes are emerging out.

Apunarbhava – bhasma was triturated with guda (jaggery), gunja (*Abrus precatorius*), Tankana (borax), madhu (honey), and ghrita (ghee). One gram each and a paste were prepared. This paste was kept in musha (crucible) and sandhibandhana (sealing) was done. It was then subjected to teevragni (intense heating up to 1000 °C) for an hour. After swangasheeta (self cooling) musha was opened and charred mass was powdered and observed for absence of shining particles.

Namburi phased spot test-First phase (0-5min), after putting a drop of yashada bhasma solution on potassium iodide paper, a wet central spot spread outside, In the second phase (5-20 min) it was observed that spreading of the drop^{13, 15, 28}.

By modern parameters, bhasmas has to be standardized according to WHO guidelines. Which includes the following parameters:-

Physiochemical Parameters

Which include physical standardization and chemical standardization.

Physical Standardization

Here Bhasmas were evaluated for

- Physical properties like colour, odour, taste and pH.
- Physical constants like total ash, acid insoluble ash, Water soluble ash and loss on drying
- Particle size determination by sieve analysis and by micromeritics methods
- Determination of floating property by placing a pinch of Bhasma over a tumbler of water.
- Determination of fineness and metallic luster by direct observation under direct sunlight.

Methods

Determination of total ash:-1 gm of formulation was taken in silica crucible and incinerated at a temperature 450°C until free from carbon and cooled and weighed.

Acid insoluble ash-Total ash was boiled for 5 minutes with dilute HCl. Insoluble matter was collected, washed, ignited and weighed.

Water soluble ash-Total ash was boiled for 5 minutes with 25ml of distilled water, cooled and collected the insoluble matter on ash less filter paper. Washed and ignited at 450°C. Subtract the weight of insoluble ash and the percentage was calculated.

Determination of loss on drying- The samples are taken in china dish and placed in hot air oven and the weight was observed in every half an hour till same weight was observed, weight lost is due to the removal of water and volatile ingredients.

Determination of pH- Aqueous solutions are prepared and measurements are carried out at 25 °C using pH meter.

Chemical Standardization ²¹

This involves use of different analytical instruments like

FTIR	To detect the composition of bhasma
Thermo gravimetric analysis (TGA)	To check the temperature of loss of adsorbed dioxygen species
Scanning electron microscopy (SEM)	To detect surface morphology
Atomic Force Microscopy	Gives Chemical Composition
X ray photo electron spectroscopy (XPS)	Gives valuable information about Surface states of sample bhasma.
Energy dispersive X-ray analysis (EDX)	chemical composition, crystallographic
X-ray diffraction methods (XRD)	structure and crystallite sizes of Bhasma are obtained
Atomic absorption Spectrometry (AAS)	Helps in quantitative determination of metals present in Bhasma
Bet Surface Area Measurement	Helps to find out the specific surface area of the particle of drug sample ^{3,15,20}

Pharmacological Studies⁸

Here the samples are tested for specific pharmacological activity using animal models. Animals have to be selected and they are treated according to GLP guidelines. Specific pathological conditions are produced by inducing agents. This includes specific activity studies and toxicological and histopathological studies of Bhasma under study.

This standardization parameter ensures the therapeutic effectiveness and quality control methods using sophisticated instruments for herbometalic formulations.

CONCLUSION

Bhasmas, an ancient herbomineral formulation used in Ayurveda, still have an important role in therapy due to its nano particle nature. Although they can be used for different ailments, lack of quality control methods and

nonsystematic standardization procedure made them unacceptable by modern world. So it is important to develop systematized standardization procedure to prove the therapeutic efficiency, purity and quality of these herbomineral formulations.

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