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BHASMA : AN IMPORTANT AYURVEDIC FORMULATION

Mohammed Saad*, Joshi Amol, Mahalaxmi Mohan

Department of Pharmacology, MGV's Pharmacy College, Nashik.

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For Correspondence:

Mohammed Saad

Department of Pharmacology, MGV's Pharmacy College, Nashik.

E-mail:

saadthepharmacist@gmail.com

ABSTRACT

Ayurveda is the oldest system among all life sciences originated in India thousands of years ago. Ayurveda and other Indian system of medicine uses metals, but their use is also amply described in Chinese and Egyptian civilization in 2500 B.C. Bhasma are unique Ayurvedic metallic / mineral preparation treated with herbal juice or decoction widely used for treatment of variety of chronic ailments since 7th century A.D. Bhasma means an ash obtained through incineration; the starter material undergoes an elaborate process of purification and this process is followed by reaction phase, which involves incorporation of some other minerals and/or herbal extract. Bhasma which contains Fe, Cu, S, Hg or prepared by other manufacturing process plays specific role in final product(s). Two methods for bhasma preparation are Putapaka and Kupipakwa. Size of bhasma particles are similar to nanoparticles which facilitate absorption and assimilation of drug into body system. Standardization of bhasma is utmost necessary to confirm its identity and to determine its quality, purity, safety, effectiveness and acceptability of product. But the most important challenges faced by these formulation are lack of complete standardization by physicochemical parameters.

INTRODUCTION

Ayurveda is the science made up of *Veda* (knowledge) and *Ayush* (life) i.e. knowledge of life. An Ayurvedic system adopts a holistic approach towards health care by balancing the physical, mental and spiritual functions of the human body[1].The traditional medicinal system practiced in India for several centuries is well known as Ayurveda. According to this medicinal system, metal based drugs known as 'Bhasma' involve the conversion of a metal into its mixed oxides. During these transformations, the zero valent metal state gets converted into a form with higher oxidation state and the most important aspect of this synthesis (known traditionally as 'bhasmikarana') is that the toxic nature (i.e. systemic toxicity causing nausea, vomiting, stomach pain, etc.) of the resulting metal oxide is completely destroyed while inducing the medicinal properties into it. The important step involved in the procedure for making 'Bhasma' is repeated treatment of a particular metal with plant juices and high temperature calcination in an earthen pot. *Rasashastra* is a section of Ayurveda which describe the use of metals, gems, minerals and poisons for manufacturing special formulation[2,5]. These metallic micro-nutrients were freely available in soil and water, enriching plants 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 fresh. [3]

Ayurveda system of medicine was highly appreciated and practiced during the golden era of Indian history. This system of medicine recognizes the importance of metallic micro-nutrients in our body. Deficiency or imbalance of these metallic micro nutrients in body results in manifestation of disease. 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 disease 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 specially effective in prevention and cure of disease related to the organ where they act[4,5]. Rasayana[1] (immunomodulation and anti-aging quality) and yogavahi (ability to target drugs to the site) are characteristics of a properly made herbo-

mineral/metals/ non-metals preparation, which is also nontoxic, gently absorbable, adaptable and digestible in the body. [6]

Bhasmas may be applied externally for skin disease and also for internal administration in the form of suspension in plant juices, for diseases like liver disorder, asthma, cough and chronic skin disease. Various salt, alum, sulphur, quartz, etc. had internal as well as external application. This particular system which was developed to achieve lohavedha (transformation of body for 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 Rasadidhatus). In this system the metals and minerals are termed as Dhatus and Updhatus, because of their specific role in ayurvedic systems and whose deficiency may cause many undesired problems in body. In Rasa text seven dhatus named *Gold, Silver, Copper, Iron, Tin, Lead,* and *Zinc* are described as essential element for the body[7]. These dhatus are present in our body in different concentration and combination. A state of equilibrium of these dhatus in body tissue is necessary for maintaining good health.

Although the use of mineral drugs like mercury and sulphur was recognized as toxic, it is possible to reduce and remove their toxicity by number of sodhana measures[8]. These include grinding of such drug with other acidic alkaline liquids or their boiling, fusion, sublimation etc. These measures in turn remove washable, soluble and volatile impurities of drugs of mineral origin. Sometimes 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 Chemistry. [9]

Metals play an important role in human body, the deficiency of which leads to various disorders. In Ayurveda, seven metals such as gold, silver, copper iron, tin, lead and zinc are described as essential elements for the body (Table 1). These metals are present in human body in different concentration and combination at various sites, and help the respective body tissues to perform their normal activities.

Table 1. Metals and their presence in human body

Metal	**Effects on human body**
Gold	Present in trace amounts in blood, semen, eyes, heart, upper layer of skin and intestines. Imbalance affects vision, causes general weakness in the body, dullness of

	intellect, loss of imagination power, voice and general disposition of an individual.
Silver	Present in bone marrow, upper layer of bones, gall bladder, and pancreas, inner layer of the skin, lungs, flesh, blood vessels, meninges (membrane which surrounds the brain), audio receptive glands and septum of nose. Imbalance affects mind and disposition, neurological disturbances, problems related to teeth, cataract, sores, and absorption from gut.
Copper	Present in upper and inner layer of skin, mucosa of soft tissue, large glands,eye pupil, hair, pleura and pericardium. Imbalance causes defects in cardio-vascular, central nervous and skeletal system. Deficiency affects production or red blood cells and hair keratization. Imbalance causes chronic inflammatory disorders in soft tissues
Iron	Major constituent of blood, present in the villi of the Intestine, eye pupil, hair and in small quantity in all tissues of the body. Has special effect on elderly people Imbalance causes arteriolosclerosis, anemia and general debility.
Tin	Present in every tissue, however more in abdominal muscles, blood and blood vessels, synovial membrane, outer layer of uterus, Imbalance causes malformation in bones, diseases of reproductive tract, affects formation of urine, polyurea, increased perspiration.
Lead	Present in blood and lymphatic tissue. Imbalance causes anemia, disturbance in gastrointestinal tract due to poor secretion of digestive juices, hemolytic anemia and ascites.
Zinc	Present in blood, brain, sensory tissues and flesh. Imbalance causes problems related to nervous system like despondency, anxiety, dullness of intellect, extreme forgetfulness, irritable temperament.

Perfect health is attributed to the state of equilibrium of these metals in body tissues. Any imbalance, whether excess or deficiency, disturbs the body metabolism. It has been described that metal based formulations, called Bhasmas, are highly effective in prevention and cure of various diseases related to the organ where they are naturally found**.** [10,11]

BHASMAS

Bhasmas are unique metal based drugs and they are suggested with herbal juice, fruits for treating variety of chronic diseases[2].Bhasmas are obtained by repeated calcinations and

incineration of liquid products by special process. During incineration metals are converted into its mixed oxides. Zero valent metal state is converted into metal oxides of higher oxidation state by this bhasmikarana process. Toxic nature of resulting metals oxide is completely destroyed while medicinal properties are introduces in this process**.** [12,13]

Classification of Bhasma

Bhasmas are generally classified based on their color and appearance or based on dominant metal or mineral group. Usual color of Bhasma is yellowish, black, dark, white, grey, reddish black and red depending upon drug used. [14]

1. Metal-based Bhasma
2. Mineral-based Bhasma
3. Herbal Bhasma

Importance of Bhasma

1. Maintain optimum alkalinity for optimum health
2. Provide easily absorbed and usable calcium
3. Cleanse the kidneys, intestines and liver
4. Maintain stronger bones and healthier teeth
5. Alleviate insomnia, depression
6. Keeps rhythmic heart beating
7. Keeps arrhythmias and minerals balance
8. Help metabolize iron in body
9. Aids nervous system functioning
10. Breakdown heavy metals and drug residues in body
11. Neutralize harmful acids that lead to illness
12. Achieve a healthy alkaline level by neutralizing acid
13. Protect body from free radical damage**.** [15]

The main advantages of Bhasma 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 forms. [16]

Characterization of Bhasma

Physical characteristics

(1) Color (Varna) [17]

A specific color is mentioned for each Bhasma. Alteration in each colour suggest that the Bhasma is not prepared properly. Because a particular metallic compound is formed during Bhasma preparation and every chemical compound possesses specific color.

(2) Nishchandratvam [18]

Bhasma must be Nischandra (lusterless) before therapeutic application. Chandratva (luster) is a character of metal. After proper incineration, luster of metal should not remain. For this test, Bhasma is observed under bright sun light, whether luster is present or not; if luster is still present, It indicates further incineration.

(3) Varitara[19]

Varitara test, applied to study lightness and fineness of Bhasma, is floating character of Bhasma on stagnant water surface. This test is based on law of surface tension. Little amount of Bhasma is taken in between index finger and thumb, and sprinkled it slowly on stagnant water surface from short distance. Properly incinerated Bhasma will float on water surface.

(4) Unama test [19]

It is further assessment of Varitara test. A grain of rice is to be kept carefully on the layer of floated Bhasma. Observe whether grain float or sinks. If grains remains as it is on layer, then Bhasma can be considered as excellent (properly prepared).

(5) Rekhapurnata [19]

This test is applied to study fineness of Bhasma. Bhasma particle should be minimum of size for easy absorption and assimilation in the body. Bhasma should be so fine that it can fill furrows of finger tips. A little amount of Bhasma is rubbed in between index finger and thumb to observe whether particles can fill furrows of finger tips.

(6) Slakshnatvam [20]

It is teclite sensation produced by Bhasma by simple touch with finger tips. Properly incinerated Bhasma attain this quality. Slakshna Bhasma can be absorbed an assimilated in the body without producing any irritation to mucous membrane of gastrointestinal tract.

(7) Avami[21]

The Bhasma should not produce nausea on administration. (14A technique known as the phased spot test has been developed by the investigators of Central Council for Research in Ayurveda and Siddha (CCRAS) of India to identify Bhasmas. This technique is very effective and accurate in identifying genuine quality of Bhasmas) [Figure 1].

(8) Susakshama[18]

It indicates fineness of Bhasma preparation. This character can be perceived by Varitara and Rekhapurnata. Bhasma must be Sukshma, so that it can be absorbed in the body easily.

(9) Anjana Sannibha[18]

Anjana (Collyrium) is smooth in character and it does not create any irritation whenever applied. Properly incinerated Bhasma should be smooth and should not create any irritation to mucous membrane of gastrointestinal tract.

(10) Particle size[20]

Prepared Bhasma should be in Churna (powder) form. Size of particles of Bhasma will be like pollen grains of Pandanus odoratissimus flower (Ketaki Rajah).

Chemical characteristics

(1) Apunarbhavata

It means incapability to regain original metallic form. For this test Bhasma is mixed with equal quantity of seeds of *Abrus precatorius*,[22] honey, ghee, borax then sealed in earthen pots and heated with similar grade of heat. Thereafter particular Bhasma is observed on self-cooling.

(2) *Niruttha*

Niruttha is to test inability to regain metallic form of metallic Bhasma. In this test *Bhasma* is mixed with a fixed weight of silver leaf and kept in sealed earthen pots, then similar grade of heat is applied and after self-cooling, the weight of silver is taken. Increase in weight of silver leaf indicates improperly prepared Bhasma.[23]

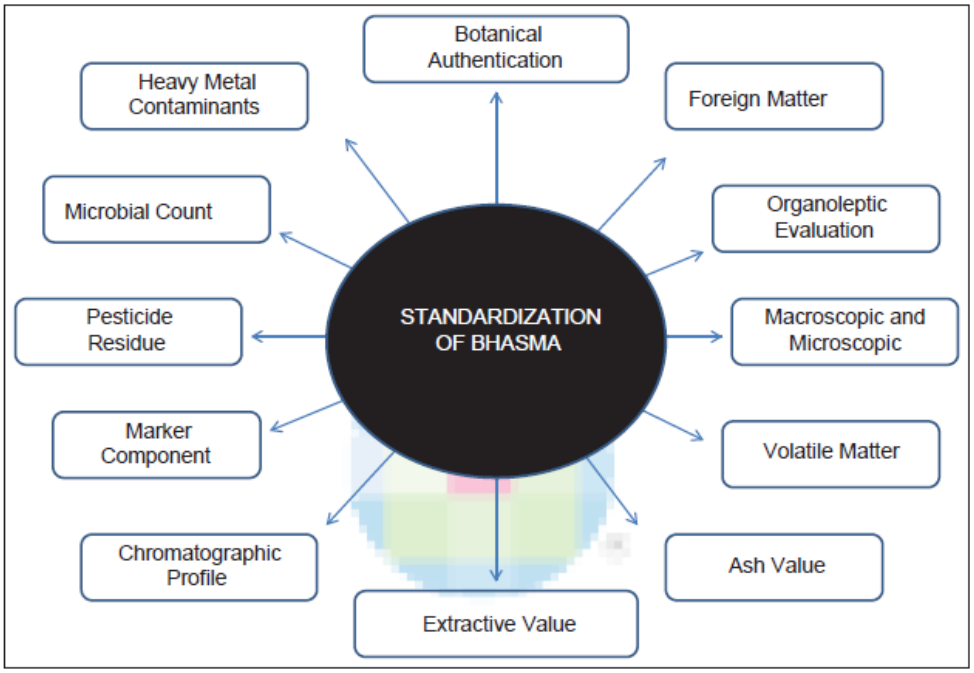

Figure 1: Standardization of Bhasma

Preparation of Bhasma

Bhasmas are being prepared by *Putapaka* method and *Kupipakwa* method. [24]

(1) Putapaka Method

Bhasma is being prepared by subjecting metals or minerals to three step procedures (*Shodhana*, *Bhavana* and *Marana*). Metals or minerals are made by hammering into coarse powder, which are subjected to *Shodhana* (purification), wherein metals or minerals are quenched in suitable liquid media for required times. *Bhavana* is a process of wet grinding, in which materials are ground with particular liquid media for a specific period. From levigated doughy mass, *Chakrikas* (pellets) are prepared and taken into earthen crucibles faced together, and junction is sealed by mud smeared clothes. Then heat is applied into this apparatus (*Sarava Samputam*) traditional *Puta* (heating grade) or electric muffle furnace for a specific time. This method is known as *Putapaka* in parlance of Ayurveda. After burning for specific time these materials are cooled down in an apparatus, *Sarava Samputa*. After repeating these procedures for particular time finally prepared *Bhasma* (incinerated metal) is collected. For metals having low melting point (lead, tin and zinc), between *Shodhana* and *Bhavana* procedure, one intermediate procedure called as *Jarana* (polling) is performed. In this procedure, metals are melted and

mixed with some plant drugs powders and are rubbed by an iron ladle with inner surface of pot until metals become in complete powder form.

(2) Kupipakwa Method

In this method, Bhasma are prepared by subjecting metals (gold, silver, copper, etc.) to four step procedures (*Shodhana*, *Kajjali* preparation, *Bhavana* and *Kupipakwa*). After *Shodhana*, metals are subjected for amalgamation with mercury, and then purified sulphur is mixed and triturated till black, lusterless, fine and smooth mass is prepared. This procedure is called as *Kajjali* preparation. Prepared *Kajjali* is levigated by particular liquid media for certain period. It is allowed to complete dryness and filled in a glass bottle (*Kachkupi*) covered by 7 layers of mud smeared cloth. Bottle is then subjected to sand bath (*Valukayantra*) for indirect and homogeneous heating for a certain period. After self-cooling, bottle is broken, sublimed product is collected from neck and Bhasma is collected from the bottom of bottle and ground to powder form.

Table 1:- Marketed Preparation of Bhasma

Company Names	Marketed Formulation of Bhasma
Shree Baidyanath Ayurved Bhawan (P) Ltd. Kolkata	*Abhrak Bhasma, Akik Bhasma, Vaikrant Bhasma, Godanti (Harital) Bhasma*
Shree Siddhashram Pharmacy, Jaipur, Rajasthan	*Abhrak Bhasma, Bang Bhasma, Kashish Bhasma, Ropya Bhasma, Tamra Bhasma, Swarna Bhasma*
Dindayal Aushadhi Pvt. Ltd. Dindayal City Mall, Gwalior	*Kashish Bhasma, Ropya Bhasma, Tamra Bhasma, Swarna Bhasma, Naga Bhasma*
Gurukul Kangri Pharmacy, Haridwar	*Swarna Bhasma, Ropya Bhasma, Tamra Bhasma*
Unjha Ayurvedic Pharmacy, Unjha, Gujarat	*Abhrak Bhasma, Bang Bhasma, Kashish Bhasma, Dhanwantary Prasad, Ropya Bhasma, Tamra Bhasma, Swarna Bhasma*

Table 2:- Marketed Bhasma product and their uses

Name	Ingredients	Doses	Uses
Swarna Bhasma	Ash of gold (Calcined gold)	12.5-62.5 mg twice daily	Improves body immunity, general weakness, anemia, energetic
Rajat Bhasma	Silver ash (Calcined silver)	62.5-125 mg twice daily	Irritable bowel syndrome, acidity, pitta disorders
Tamra Bhasma	Copper, mercury, sulfur	62.5-250 mg twice daily	Anemia, jaundice, digestive disturbance, abdominal disorders
Loha Bhasma	Iron, cinnabar	125-250 mg twice daily	Enlargement of liver, anemia, jaundice
Vanga Bhasma	Purified tin	125-250 mg once/ twice a daily	Obesity, Premature ejaculation, Anemia, Asthma, Cough, cold, bronchitis, gonorrhoea
Naga Bhasma	Purified lead	62.5-125mg once/ twice daily	Diabetes, Skin disease, Liver disease, Asthma, Non healing wounds, Diarrhoea, Arthritis
Jasada Bhasma	Purified zinc	125mg once/twice daily	Diabetes and age-related eye diseases, slow wound healing

Nanotechnology and Bhasma

Preparation constituting Bhasma are superior as it is manufactured with the help of nanotechnology[4]. 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 100nm 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 1m to 1nm the surface area to volume ratio increases by factor 10^9 which will again acts as 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 therapeutics; 10-100 and for aphrodiasic; 10-500 are needed number of Putapaka. Mardana (Trituration) and Bhavana (Levitation) process also helps to reduce the size of particles to nano size (less than 100nm in any dimension).

Nanotechnology is made possible by sophisticated analytical techniques like transmission electron microscope (TEM), scanning electron microscope (SEM), and atomic force microscope(AFM). Thus by using these instruments nano nature of Bhasma can be made to reality[23]. Nanoparticles have either positive or negative charge on their surface depending upon methodology adopted during preparations. Nanoparticles have greater application as drug carriers, diagnostic purpose, and specific therapeutic application. [25]

Metals like silver, gold, zinc, copper, calcium, and so many other are used in modern medicine as bhasmas without any adverse effect[5]. Out of 6000 herbal manufacturers 4000 producing ayurvedic medicines. In order to have good co-ordination between the quality of raw 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 ensuring the quality and is used to describe all measures which are taken during the manufacturing process leading to reproducible quality. [26]

Need for Standardization of Bhasma

Evaluation of 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 formulation used for treatment show that the raw metals used for their preparation lose their metallic characteristics and turn into mineral complex after processing. 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 medical arc repeatedly ground and fired in furnaces at temperatures between 1200^0C to 6000^0C are believed to remove the toxicity and impart remarkable therapeutic value to the compound. Some compound 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 and processed copper, mercury and sulphur metals (used against certain types of cancer and inflammatory disorder). The parameter studies included various liver function test, 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 metals and then followed by partially processed and processed copper. [27]

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