

A COMPREHENSIVE REVIEW ON BHASMA AND HERBOMINERAL FORMULATION IN AYURVEDA

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ABSTRACT

Ayurveda is one of the oldest system of medicine, The Ayurvedic literature Sarangdhar Samhita tinted the idea of polyherbalism to attain greater therapeutic efficacy. Polyherbal and herbo-mineral formulations combining the multiple herbs in a meticulous ratio, it will give an enhanced therapeutic effect and decrease the toxicity. Herbomineral formulation is known as Rasaaushadhies. Ayurvedic herbal and herbo-mineral preparations are used for the treatment of chronic and degenerative diseases without any side-effect. Herbo mineral formulation uses the metals and minerals for chronic disorders in different combinations, dosage forms and at various levels of purities. Hence it is very essential to prepare it in a proper way. As per the reported data, there are so many herbo-mineral formulations available in market which is useful in anaemia, diabetes, cancer, liver diseases, skin diseases etc. This review is an attempt to emphasis on the benefits and problems associated with it.

Keywords: Ayurveda, Bhasma, Heavy metals, Herbo-mineral

INTRODUCTION

In the few decades, there has been exponentially growth in the field of herbal medicines. Nature always stands as a golden mark to exemplify the outstanding phenomena of symbiosis. Today about 80% of people in developing countries still relay on traditional medicine based largely on the different species of plants for their primary health care. About 500 of plants with medicinal uses are mentioned in ancient literature and 800 plants have been used in indigenous system of medicine. The various indigenous systems such as Ayurveda, siddha, unani use several plant species to treat different ailments¹⁻³.

The “Ayurvedic Materia Medica” comprises of resources of plant, animal, metal, and mineral origin. Herbal extracts are being used as ingredients of poly-herbal, herbomineral, and metallic compound formulations this given in classical texts of Ayurveda including *Charakasamhita*, *Sushruta Samhita*, and *Ashtanga hridaya*⁴. Ayurvedic drugs in two group i.e. Kasthoushadhies (herbal preparation) and Rasaaushadhies (Herbo-bio-mineral metallic preparation).

Concept of Herbomineral Formulation

A specialized branch in Ayurveda, which is “Rasa Shastra” having literal meaning as “Science of Mercury” deals with materials known as ‘Rasa dravyas’. Rasa denotes mainly *Parada* (Mercury). Formulations made by mercury and incinerated metals and minerals are known as Rasa-aushadhies (Herbo-mineral-metallic preparations).

The rasa-aushadhies are having qualities such as instant effectiveness, requirement in very small dosage and ample therapeutic utility. There are four methods of preparation of these formulations i.e. *Khalviya Rasayana*, *Parpati Rasayana*, *Kupipakawa Rasyana*, *Pottali Rasayana*. *Mahalaxmivilas Rasa* is a herbo-mineral-metallic preparation comes under the *Khalviya Rasayana*⁵.

The herbomineral preparations essentially contain minerals and metals as integral part of the formulations but these metals are not present in elemental form. They are in the compound form and their fate in the body will not be the same as it is for the elemental form of heavy metals. The sophisticated manufacturing process of *Shodhana* and *Marana* ensure that deep changes are taking place in these minerals. The finished form after reaction with several organic and inorganic material of herbal origin is finally responsible for action, changing the properties of the toxic metal, making it therapeutically effective and provide safety of very high grade⁶.

Bhasmas:

Bhasma is an ash obtained by calcinations of metals. It is a unique preparation of Ayurveda with extracts of herbs and metals in combination which functions best when converted from their original metals to metal oxide forms⁷. It is prepared by calcinations of metals in a closed crucible in pits and with cow dung cakes (puta).

Bhasmas are biologically produced nano-particles and are taken along with milk, butter, honey or ghee which makes these elements easily assailable, eliminating their toxic effects and enhancing their biocompatibility⁸.

Types of BHASMAS¹⁰

Bhasmas are classified based on their colour and appearance. Scientifically they are classified based as metal, mineral and herbal bhasma, general examples of bhasma arerajatabhasma (silver), tamrabhasma (copper), lohahhasma (iron), pravalabhasma (shells) etc. bhasmas are generally yellowish, black, dark, white, grey, reddish black and red, depending upon the predominant drug as well as the other drugs used in the process of marara. They are stored in air tight container (glass or earthen) and maintain their potency indefinite.

Ayurvedic bhasmas are the ancient nanotechnology which demonstrates ancient nanosizepartical reduction in form of finished product. This Bhasma preparation procedure contains different steps due to which nanosize particle reduction can possible¹¹.

Example of some ayurveda Bhasmas:

Mandura Bhasma, Shukti Bhasma, Vanga Bhasma, Yashada Bhasma, Swarnmakshik Bhasma, Heerak Bhasma, Tamra Bhasma, Loha Bhasma, Abhrak Bhasma, Swarna Bhasma, Rajat Bhasma

Preparation of BHASMA⁹

The following steps are involved in the preparation of Bhasmas:

- I. **Shodhana:** Bhasma is prepared from purified minerals, metals, marine and animal products. The process of purification is called Shodhana. It is aimed to remove harmful impurities present in the drug or sometimes modification of undesirable physical properties of the drugs. It helps in enhancement of the therapeutic action and thereby increases the potency of drug. Shodhana is of two types – SamanyaShodhana and VisesaShodhana. SamanyaShodhana means simple metal purification another method is VisesaShodhana means purification of metal by dipping into specific vehical like cow urin, butter milk and milk.
- II. **Bhavana:** It is wet trituration process using mortar and pestle very fine powder will be form to increase therapeutic action.
- III. **Jarana:** Preparation of small pellates, allow to dry in sunlight. Put that pallates in earthen tray covered with another lid, joint are sealed and dried again.
- IV. **Putapaka:** Heating of Bhasma earthen tray continuously until total metallic lustere didn't get removed.
- V. **Marana:** It is essentially the burning process or calcination. It is subjected to fire treatment in a measured manner for reducing them to ashes. The objective of doing Marana Process is to reduce the size of the drug to its finest particles so that it absorbs easily into the system and produce their desired effects without producing harmful side effects.

Importance of Bhasma:

Bhasma use from ancient time for the purpose of analgesic, anti-inflammatory, antioxidant action, free radical scavenging activity, immunomodulatory action, anamia, chronic disorders and brain related degenerative disorders. By nanotechnology in bhasmas it can be use as target oriented with efficacy and less toxicity.

The main advantages of Bhasmas are:

- Potent in small dose.
- Does not have any specific taste.
- They can act quickly.
- Available in smaller partical size (Nanosized).
- Have good stability as compaired to other dosage form.

CHARACTERIZATION OF BHASMAS

There are certain characteristic that properly processed *Bhasma* should possess, some of the qualities are mentioned here¹².

1. Color (Verna): A specific color is mentioned for each *Bhasma*. *Bhasmas* are found in white, pale, or red colour. The colour of the preparation primarily depends on the parent material.

2. Lusterless (*Nishchandravam*): *Bhasma* must be lusterless before therapeutic application. For this test, *Bhasma* is observed under bright sunlight whether luster is present or not, if luster is still present, it indicates further incineration.

3. Lightness and Fineness (*Varitara*): *Bhasma* floats on stagnant water surface. This test is based on law of surface tension. Properly incinerated *Bhasma* is needed to float on water surface.

4. Tactile sensation: Tactile sensation can be absorbed and assimilated in the body without producing any irritation to mucous membrane of gastrointestinal tract.

5. Particle size: Prepared *Bhasma* should be in powder form. Particle of *Bhasma* should be like pollen grains of *Pondanusodoratissimus* flower (*Ketaki rajah*).

Physicochemical evaluation parameters for *Bhasma*:

- Physical parameters like colour, odour, taste, pH.
- Physical constants like total ash, acid insoluble ash, water soluble ash and loss on drying.
- Particle size determination of *bhasma* by micromeritics and sieve size method.
- Floating property determine by placing pinch of *bhasma* over tumbler water.
- Determination of fineness and metallic luster by direct observation of *bhasma* in sunlight.

Chemical standardization¹³:

This involves different analytical instruments like:

Instruments	Analysis
FTIR	To detect composition of <i>Bhasma</i>
Transmission electron microscope (TEM) and High Resolution TEM (HR TEM)	Particle size and size distribution
Zeta potential	Stability
Thermogravimetric analysis (TGA)	To check the temperature loss of absorbed dioxygen species
Scanning electron microscopy (SEM)	To detect surface morphology
Atomic force microscopy	Gives chemical composition
X ray photo electron spectroscopy	Gives valuable information about surface state of <i>Bhasma</i>
X ray diffraction method	Structure and crystalline size <i>Bhasma</i> obtained
Atomic absorption spectroscopy (AAS)	Helps in determination of quantitative metal present in <i>Bhasmas</i>
Beta surface area measurement	Helps to find out specific surface area of partical drug sample.

Table 1. Marketed *Bhasmas* products and their uses¹⁴

Sr No	<i>Bhasma</i>	Therapeutic role
1	<i>Heerak Bhasma</i>	Used in cancers, rheumatoid arthritis, bone marrow depression and cure immune disorders.
2	<i>Tamra Bhasma</i>	Used in jaundice, anemia and help to manage abdominal disorders.
3	<i>Loha Bhasma</i>	Help to cure liver enlargement, anemia and jaundice.
4	<i>Abhrak Bhasma</i>	Help in respiratory disorders, anemia, diabetes and reduces weakness.
5	<i>Swarna Bhasma</i>	Improves immunity, treat weakness and anemia.
6	<i>Rajat Bhasma</i>	Used for irritable bowel syndrome, acidity and pacify vitiate Pitta
7	<i>Swarmmakshik Bhasma</i>	Used for anemia, jaundice and chronic fever.
8	<i>Yashada Bhasma</i>	It is used for urinary diseases, menorrhagia and for Vata imbalance
9	<i>Vanga Bhasma</i>	It is good for fatty defects, used in urinary diseases and offers beneficial effects in anemia.
10	<i>Shukti Bhasma</i>	Having diuretic action, treat blurred vision and used externally for blisters.
11	<i>Mandura Bhasma</i>	It is used in enlarged spleen, hepatitis, anemia, edema, blood loss and treats itching.

Marketed Herbomineral preparations and their uses¹²

Herbomineral formulation uses the metals and minerals for chronic disorders in various combinations, dosage forms and at various levels of purities. Hence it is very essential to prepare it in a proper way. Literature review reveals many herbo-mineral formulations available in market which is useful in anemia, diabetes, cancer, liver diseases, skin diseases etc. The table showing different marketed formulation with its ingredients used for treatment of different illness

Name	Ingredients	Uses
<i>Swarnabasantmalti ras</i>	Gold, <i>piper-nigrum</i> , white pear powder	Tonsillitis, fevers, cough, bronchitis, decreased immunity, cancers, autoimmune disorders
<i>Kamdudha ras</i>	Ochre, <i>Tinospora cordifolia</i> , mica (calcined)	Hyperacidity, headache, fever, blood pressure
<i>Rasraj ras</i>	Red sulfide of mercury, mica, gold, iron, silver, <i>withania somnifera</i> , <i>Syzygium aromaticum</i>	Paralysis, hemiplegia, rheumatism, insomnia, stroke
<i>Shwaskuthar ras</i>	Black sulfide of mercury, aconitum ferox, sodium bicarbonate, piper nigrum, Trikatu'	Cough, pneumonia, bronchitis
<i>Kaharvapishiti</i>	Amber of succinite (trinkantmani), rosacentifolia (rose)	Bleeding
<i>Yogender rasa</i>	Red sulfide of mercury, gold (calcined), magnetic iron, mica, <i>myristicafragrans</i>	Polio, paralysis, muscular weakness, insomnia, headache
<i>Bolbadhras</i>	Black sulfide of mercury, <i>Tinospora cordifolia</i> , <i>Commiphora mukul</i>	Bleeding
<i>Jaharmohra pishti</i>	Powder of serpentine orephite	Natural source of calcium, useful in burning sensation, acidity, heart burn

Minerals/Bhasma and its Pharmacological uses**Swarna Bhasma (Gold):****Fig 1: Swarna (Gold) Bhasma**

The general preparation of Swarna Bhasma involves the three processes of shodhana, dravana, and marana. The leaves of gold are heated over fire and dipped in sesa (*Sesamum indicum*) oil when its red hot, process is continued seven times separately¹⁵. The soft leaves are processed with buttermilk/cow's urine and the decoction of kulattha (*Dolichous biflorus*), kanji (sour gruel processed from rice [*Oryza sativa*]), and radish (*Raphanus sativus*). Finally, the leaves are dried by heat¹⁶. The mixture is triturated and the paste thus obtained is dried under sunlight, this process is repeated 7 to 14 times using fresh aliquots of latex, and the final product is obtained. Finally become powder nature is dark brown color, fine in touch and tasteless¹⁷.

Uses:-It shows analgesic activity (against chemical, thermal, electrical and mechanical stimulation, stimulatory effect), antioxidant activity and also less toxic to liver proven by histological study as well as liver function test.

Mukta Shouktic Bhasma: Mukta shouktic Bhasma (MSB) is a calcium-containing Bhasma consisting of pearl (mote), Aloe vera Linn. (Guarpatha) and vinegar (kanji)¹⁸. This Bhasma is prepared from the outer covering of the shell (pearl-oyster), and is grounded and triturated with A. vera (taken as 1:4 proportion) and vinegar in sufficient quantity to make a homogeneous paste¹⁹. Standardization parameters of MSB are (1) bulk density and tapped density (used to indirectly calculate the flow properties by deriving Carr's index. The static angle of repose was determined by the funnel method). (2) Particle size analysis with dynamic light scattering method (particle size of MSB ranges from 1.22 to 10.20 μm having a mean particle size of $22.52 \pm 0.45 \mu\text{m}$). (3) Transmission electron microscopy (particles are irregular rod shaped).

Uses: It shows pharmacological activity like antacid, anti-pyretic and as a source of calcium²⁰. It is also used in tuberculosis, cough, asthma, dysmenorrhoeal, arthritis, rheumatism, conjunctivitis. Recent studies have shown that adding heated oyster shells to the diet of elderly patient increased the bone mineral density of the lumbar spine. MSB is one third to one-half as potent an anti-inflammatory as the amino salicylic acid further, even as MSB is widely used for its antipyretic activity²¹.

Varatika Bhasma:



Fig 2: Varatika Bhasma



Fig 3: Cypraea moneta (money cowry)

Varatika is identified as the external shell of sea animal *Cypraea moneta* money cowry Linn²². It occurs in the coastal areas of the sea. *Cypraea moneta* is commonly known as the [Figures 2-3]. Chemically it is carbonate of calcium. Its kashaya (decoction) was prepared for the purification process. Fresh Aloe-vera was collected and its juice was used for making cakrikas or pellets to be used in the incineration process of Varatika. Ingredients are the raw Varatika, Kulattha kashaya (Horse gram decoction for purification), Kumari svarasa (Aloe-vera juice) for grinding during incineration. It shows following organoleptic properties color is dull white fine powder, odorless, tasteless soluble in dilute HCl and physio-chemical analysis showed Loss on drying (0.6566%). It contains ash (2.06%), organic carbon (1.09%), total nitrogen (0.72%), total potassium (3.49%), total zinc (1.48 ppm), total iron (113.6 ppm)²³.

Mandura (Iron) Bhasma:



Fig 4: Mandura Bhasma

Iron Bhasma contains three basic processes shodhana, dravana, and marana. Iron is prepared by two steps: Purification and quenching by sinking the red-hot leaflet in liquid medium like fresh Triphala decoction (nishechan) or cow's urine and calcinations with repeatedly 9 times. Coarse pieces of sulfur are taken in khalva yantra and some amount of dewadali swaras are added for bhavana. It is rubbed thoroughly and the process is repeated for at least 7 days²⁴. Iron Bhasma should always be prepared with mercury; otherwise, it is not absorbed properly in the intestine. Another process includes lohamarakagana, amritkarana, and nirutthikarana. In the lohamaraka, fresh lemon juice is prepared and a specific amount of hingula powder is added. In the amritkarana process, equal amounts of Loha Bhasma and ghrita are placed in an iron pan and mixed properly under mild heat until the fat disappears²⁵. Finally form iron bhasma have characteristics like dark brown colour, fine touch, tasteless and having iron as Fe_2O_3 and iron as Fe so it is use in as heamatinic in anamia specially useful in jaundice and microcytic anamia.

Naga Bhasma:**Fig 5: Naga Bhasma**

Processing of the Naga Bhasma was done according to the Shastiputa Naga Bhasma process listed in the Grantha Ananda Kanda 2/6/25-28. Lead is purified through sublimation. Lead metal was melted in iron ladle and poured into a vessel containing lime water (called Curnodaka), decoction strength and filtered²⁶. The process was repeated seven times with fresh lime water each time. In the first puta (step), the purified lead thus obtained was melted with equal amount of manahsila (As_2S_2) and a small amount of Chichiri (*Plectranthus cuesta* L. Her.), herb (root, stem, leaves, flower and fruit generally all parts were used) until it becomes dried powder. After cooling, powder is triturated with the juice of Vaasa (*Adhatoda vasica* Nees.) leaf. Small pellets were made and dried in shade. Dried pellets were packed airtight in two earthen pots one above the other (called Sharavsamput). Finally the pots were subjected to heat in the electric furnace at 600° in aerobic condition. This was the first puta (step) Naga Bhasma sample. Sample thus obtained was used in the next step. In rest of the each steps (remaining 59 step), manahsila was added in $1/20^{\text{th}}$ proportion to the prepared Bhasma.

The process was repeated sixty times to get the finally prepared Naga Bhasma. The final product in the form of the pellets were taken out of the earthen pot and powdered. The powdered material was packed in airtight containers. Physio-chemical characterization powdered Bhasma was characterized by powder X-ray diffraction (XRD, IR, TEM, Atomic absorption spectrophotometer was utilized)²⁷.

Tamra (Copper) Bhasma:**Fig 6: Tamra Bhasma**

Tamra Bhasma is used as a single drug and also in combination with many medicinal plant juices and then repeated calcinations performed with air so that the metallic state is transformed into the corresponding oxide form, which is traditionally known as Bhasma²⁸.

Uses:-Tamra Bhasma is used for the management of liver disorder, arthritis, old age disorders, leukoderma, etc.

Abhrak Bhasma:**Fig 7: Abhrak Bhasma**

Abhrak bhasma is prepared by treating biotite (mica) with the juices of a number of re-constituent plants that make it a powerful cellular regenerator.

Uses:-It is a commonly used against hepatitis, use as hepatoprotective because it minimize lipid peroxidation²⁹. It is also a nervine tonic and is widely used in respiratory tract infections and anemia. It contains iron, magnesium, potassium, calcium, and aluminum in trace amounts. Abhrak Bhasma is an amorphous powder drug. It also contains silicates of iron, magnesium and aluminum³⁰.

Yashada Bhasma:**Fig 8: Yashada Bhasma**

Yashada Bhasma is specially processed with zinc. It is administered in sprue, diabetes, leucorrhoea and hyperhidrosis. The role of the Bhasma in arresting myopia has been examined in one study³¹.

Uses:-The studies presented here suggest Bhasmas may have a hepatoprotective effect. However, efforts should be made to study their beneficial effects on other systems. Especially, evaluation of their immunomodulatory and neuroprotective actions may prove to be rewarding³².

Sankha Bhasma:**Fig 9: Sankha Bhasma**

Sankha Bhasma is a powder prepared from the calcinated conch shell. It consists mainly of calcium, iron and magnesium.

Uses:-Sankha Bhasma is well known for its antacid and digestive properties. It is useful in hyperchlorhydria, sprue, colic and hepatosplenomegaly³³. A mixture of some ayurvedic medicines that contained Sankha Bhasma and the herbs Glycyrrhiza-glabra, Terminalia-chebula, and Piper-longum showed protection against duodenal ulcer in rats. Studies show that these drugs act on Bruner's gland by improving its secretory state³⁴.

CURRENT & FUTURE DEVELOPMENTS

At present there are three types of *Bhasmas*: metal based, mineral based and herbal based. In future this composition of *Bhasma* can be modified or new composition of *Bhasma* can be introduced. The method of manufacturing of *Bhasma* can be modified or improved for better quality and nanoproperty. Future application of this Nanomedicine, "Ayurvedic *Bhasma*" is immense in the field of healthcare and treatment. But official guidelines have to be set regarding: standardization, toxicity and safety studies, mass production issues, labeling rules, clinical studies and others.

CONCLUSION

Bhasma which contains metals, minerals, and animal products Bhasmas mainly employed for strengthen physical and mental health, longevity, to improve complexion and luster. Due to target action Bhasma is recommended in metabolic, neuropsychiatric, skin, kidney disorders, also for male and female infertility. Major drawback associated with Ayurveda is the lack of evidence based on its standard profile and quality. There is a lack of data supporting the efficacy of clinical trials in traditional medicines.

Ayurveda strongly recommended that precautionary measurements must be taken while using Bhasmas since improper preparation or use may cause severe harmful effects.

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