

The Ancient Indian Nanomedicine *Bhasma Kalpana*: An Abbreviated Overview

Dileep Singh Baghel*, Amit Mittal, Saurabh Singh

School of Pharmaceutical Sciences, Lovely Professional University, Jalandhar - Delhi

G.T. Road, Phagwara, Punjab (India)-144411

[*dileep.15210@lpu.co.in](mailto:dileep.15210@lpu.co.in)

ABSTRACT

Rasashastra is defined as a branch of *Ayurveda* which deals with a number of pharmaceutical techniques i.e. *Shodhana* (purification), *Marana* (calcination), *Jarana*, *Murchana* and other detailed discussion about *maharasa*, *uparasa*, *sadharanrasa*, *dhatu*, *ratna*, *visopavisa* etc. and animal products are also used therapeutically in practice of *Ayurvedic* medical sciences. *Marana* is an indigenous process of *Rasashastra* to make the *Bhasma* out of metals and minerals. It also named as *Bhasmikarana*. It is not advisable to use metals and minerals in their natural forms as a medicament for internal use. *Bhasmikarana* is a pharmaceutical procedure which helps to convert raw materials like metals, minerals, gems etc. into a micro fine, taste less, non-hazardous, acceptable, and absorbable form, which can be prescribed to use as a medicine.

INTRODUCTION

“*Rasashastra*” the word indicating itself, the science which deals with *Rasa* and many other minerals, metals, herbal poisons, *sudha varga* etc. get its establishment in the medieval period when the people felt its requirement owing to changing life style which leads to rise of many diseases [1-3]. Almost all the substances are prescribed for the therapeutic use in *Rasashastra* science which is needed to be undergone in a specialized process to transform it and make them human friendly and safe. So here comes the significance of *Shodhana*, *Marana* and whenever it is required the *Amritikarana* which processes in transforming these substances into non-toxic, disease eliminating and health promoting forms [3-5].

There are several techniques mentioned for the process of *Shodhana* and *Marana* in different texts of *Rasashastra* [1-3]. It is needed for the time to filter out the best method of the several and to prove its efficacy at every level pharmacotherapeutically. In *Rasashastra*, *Bhasma Kalpana* has attained an important position among the *Rasoushadhis* due to its assimilatory organo-metallic constitution and in the *Ayurvedic* world they are highly efficacious. Current time says metals and minerals cause toxicity to biological system but *Ayurveda* proclaims that the *bhasma* prepared from the same metals and minerals they are not only non-toxic, but also very much beneficial to human body [1-6]. This is tested by time but hesitation still remains due to lack of scientific documentary evidence.

HISTORICAL BACKGROUND

***Charaka Samhita:* -**

Described as the form of administration of metals in different nomenclature as *churna Lohadi Rasayana*. According to the available literature, this process can be considered as the infantry stage of *Marana*. Under this process, the thin leaves of the *Loha* are suggested to make red-hot and dip in to the decoction of *Triphala*, Cow's urine and other herbal *Ksharas* are used to make them fine powder like collirium and that powder should be kept in a mixture of honey and juice of *Amlalaki* for one year before use. This process fulfills the primary aims of *Marana* by converting a metal into a fine powder stage using *Agni Samyoga* and herbal products [7].

***Sushruta Samhita:* -**

Some modification of *Churna* called '*Ayaskriti*' is available. Metal is heated in *Musa* by *Agni* of *Khadir* wood up to red hot and dipped in *Aushadhi Swarasa*. This may be considered as primary stage of *Bhasma*. However, *Putra* and *Bhasma* words are not found [8].

***Astang hridaya:* -**

At one place *Anva Musha* is mentioned but *Putra* word is not used [9].

***Kashyap Samhita:* -**

Swarnaprasha method is mentioned [10].

Madhya Kala: -

During the golden period of *Rasashastra* i.e. from 7th century to 14th century, the *Acharyas* of *Rasashastra* gave notable contributions to this field and presented several treatises. For instance, it is the period of *Rasendra Mangal*, *Rasarnava* and *Rasa Hridaya Tantra* etc. all these texts are carrying the message of alchemy purposes & therapeutic purposes came together.

- ✚ 9th century A.D in *Rasa Hridaya Tantram* only *Puta* word was used.
- ✚ 11th century A.D in *Chakradat* by *Chakrapani* it is 1st time described regarding *Nischandra Bhasma* of *Abhakar*, *Mandura Bhasma*, *Loha Marana*, *Bhanupaka*, *Sthalipaka* and *Putapaka* was mentioned [12].
- ✚ 12th century A.D in text *Anandkanda* [13], *Rasarnava* [14] and *Rasendra Chudamani* [15] - various types of *Puta* were mentioned.
- ✚ In the same time in '*Chikitsasar*' (by *Vangasen*) they are of 3 types of *Loha*, 6 types of *Ayaskant*, procedure of *Loha Bhasma* preparation and *Marana* word was used [16].

DEFINITION OF MARANA

- ❖ The word "*Marana*" is derived from the root "*Mru*" which means to "Kill". In *Rasashastra* this word has been used to denote the process by which the hard matters like metals and minerals are converted into *Bhasma*.
- ❖ *Marana* is a process by which raw materials like metals, minerals, and gems etc. were converted into a micro fine, taste less, non-hazardous, acceptable, & absorbable form, which can be used as a medicine.

These definitions include the most important aspects of the *Marana* such as *Shodhana*, *Bhavana* and *Agnisamyoga* which leads to be *Bhasmikaran*. *Marana* is otherwise known as *Bhasmikaran*, which means to prepare *Bhasma* [17].

TYPES OF MARANA

Rasa Ratna Samuchchaya had classified the *Marana dravya* [18,19] as per the utilization of materials for *Marana*. They are:

- (a) By the use of *Rasa Bhasma* [*Shreshitya*].
- (b) By the use of Plant materials [*Madhyama*].

(c) By the use of *Gandhak* or *Gandhak* containing different materials [Kanishtha].

(d) By the use of *Ariloha* [Durgunaprada].

METHOD FOR PREPARATION

1. **Putapaka Method:** - *Bhasma* is being prepared by subjecting minerals or metals in *Shodhana*, *Bhavana* and *Marana* [3].
2. **Kupipakwa Method:** - *Bhasma* is being prepared by subjecting minerals or metals in *Shodhana*, *Kajjali Nirman*, and *Kupipakwa* [3].

MARANA PROCESS

Marana process involves 3 basic steps and they are -

1. *Purva karma* - *Shodhana* (purification), *Bhavana* [levigation], *Chakrikakarana* [Pellets formation] and *Sharavasamputikarana* [Sealing in an earthen vessel]
2. *Pradhana karma* – *Putra* (*Agni samyog*)
3. *Paschat karma* – *Swangsheetkaran* (Self cooling), Collection of *chakra* (Pellets), *Churinikran* (Trituration of pellets), *Bhasma Pariksha*

1. PURVA KARMA

A. Shodhana:

In this phase, the physical and chemical impurities are eliminating by different process like *Prithakkarana* (Separation), *Praksalana* (Washing), *Swedana* (Boiling under liquid media), *Mardana* (Grinding), *Patana* (Sublimation), *Atapa* or *Agni sosana* (Drying), *Nirvapa* (Heating and Quenching), *Dalana* (Melting and Pouring), *Bhavana* (Trituration with liquid and drying), *Bharjana* (Roasting), *Nirjalikarana* (Evaporation of water), *Galana* (Filtering), *Nimajjana* (Dipping), *Parisravana* (Filtration) and *Vilayana* (Elutriation). By this procedure material also make suitable for further processes. This not only include purification but also facilitate to decrease the unwanted effect with increasing of therapeutic efficacy [3, 20-23].

B. Bhavana:

Bhavana is an important aspect in the process of *Marana* which is also use for the purification. According to *Rasatarangini* it is the process, in which minerals, metallic powders etc. are subjected to soften in the suitable liquid, pestling and drying is known as *Bhavana* [21]. This is the first process applied to raw materials after the *Shodhana* process. In this process the *Shodhita* materials are triturated with indicated liquids [i.e. *Swarasa*, *Kwatha*, *Dugdha*, etc.] for mentioned time period. By, performing this process *Shodhita* materials will go through following changes -

1. Newer properties of various *Bhavana dravyas* are imposed on the *Bhasma*.
2. Particle size become smaller and smaller after each *Bhavana*.
3. *Shodhita* materials and *Bhavana Dravyas* are coming in close contact to make a homogenous mixture.
4. *Bhavana Dravyas* acts like a binding material for the forthcoming pellet formation stage.
5. By using particular *Bhavana Dravya* one can induce the desired therapeutic efficacy into the end products [20, 21, 24-26].

Bhavana process involves three stages -

- I. ***Drava Mishrana (Soaking)***: In the first stage of *Bhavana*. The powder of *Bhavana Dravya* will be put in a mortar and will be mixed with a suitable liquid like *Swarasa* and *Kwatha*. About quantity of the *Bhavana Dravya* scientist have different opinions. The above sentence say definition of *Bhavana* but it does not show the quantity of liquid to be used for soaking, but *Yadavji* has mentioned that the liquid for *Bhavana* is to be taken as much to make the *Churna* dip in it. Practical observations have been seen that this opinion also gives variation according to quality of *Churna*. So *Bhavana Drava* is usually taken in equal quantity to the *Bhavya Dravya*. The period of trituration and drying depends on the amount of liquid which is used [20, 21, 24-26].
- II. ***Mardana (Trituration)***: This is the second and important stage of *Bhavana* in which the *Bhavya Churna* will be pestle along with the *Bhavana Dravya*. Mortar and pestle made up of hard and dense stone is usually used in this

process. Pestling is done in a rotation. The weight of the pestle, pressure exerted by the worker and the distance covered in each rotation are the points to be noted here. The friction of this rotation will produce a kind of heat which will help in the absorption of the liquid. During this pestling, the particles of *Bhavya Dravyas* will be divided and subdivided into smaller and smaller particles allowing the liquid to come in more contact. This process partially fulfils the aim of *Marana* [20, 21, 24-26].

III. **Shoshana (Drying):** *Shoshana*, or drying of the *Bhavana Drava* naturally occurs and the trituration that is to be continued up to the drying of the liquid added for *Bhavana* process. The heat produced during trituration that is also helpful in drying the liquid [20, 21, 24-26].

C. Chakrika Nirmana: -

After completing the *bhavana* process *bhavita dravyas* will make *Chakrika* i.e. round flat shape with uniform thickness for proper exposure of heat during *puta* process. The word *Chakrika* was first time observe in *Rasa Ratna Sammucchaya* in the context of *Loha Maran* [27]. In *Rasamritam* by *Acharya Yadavji Trikamji* has mentioned that the *Chakrika* should be prepared in-between 1 to 2 *tola* [28]. It was quoted that instead of making it in round ball shape, flat, thin, round *Chakrika* should be prepared. It is facilitating that –

1. The drying process occurs so that the duration will be less.
2. By forming pellets one can adjust higher amount materials into a limited space of *Sharavas*.
3. A natural in-built reason is that the *Chakrika* is a parameter for testing the amount of heat supplied to the material. If in the places of *Chakrika*, the powder is subjected to *Marana* if it will not serve to judge the amount of heat supplied.
4. It enhances the surface area of the materials to allow maximum heat transfer during *Puta* process.
5. It also facilitates transformation of the material from the mortar to the apparatus in which *Marana* has to be carried out.

6. It helps to counter act the loss of prepared drugs after successive *Putra* with advantage of easy handling [20, 21].

D. Samputikarana: -

The dried *Chakrikas* should be kept and sealed in *Sharava* (concave earthen plates). Sometimes crucible is also used for calcination. Crucible are thermostatic and do not get disfigured at high temperature. They are used when *Bhasma* are prepared in muffle furnace. Properly dried *Chakrikas* should be arranged in minimum layers in *Sharavas*. The *Sharava* should be made of *Kalimitti* (black soil earthen plates), its size is mentioned as 4 *Kudav Pramana* it means having a capacity for 1 kg material this type of *Sharava* should be use [20, 21].

After arranging minimum layers or *Chakrika* in *Sharava*, it should be covered with another inverted *Sharava* and their edges are sealed with *Multani mitte* and piece of cotton cloth. The *Sharava Samputa* is then allowed to dry. The objectives of *Samputikarana* are -

- I. To protect the materials form contamination from ash produced by fuel.
- II. To apply uniform and standard heating to each pellet.
- III. To prevent complete oxidation of the materials kept inside the *Sharava Samputa*.
- IV. To check undesired excessive heating of the materials due to its insulation properties [27, 28].

• PRADHANA KARMA:

After *Sandhi Bandhana* the next Step is *Agni Samyoga*. *Putra* is the important process of *Marana* in which materials are subjected to the measured amount of heat by using *Vanyoppala* (cow dung cake). Wood, coal, fecal materials after harvesting [Tusha] etc. can be also used as fuel material as per the requirement of heat to be transferred to the materials. *Putra* are differentiated by means of names like *Maha Putra*, *Gaj Putra*, *Varaha Putra*, etc. Under this stage, the materials of *Marana* are subjected to higher temperature. *Putra* is the method used for the measurement of *Agni* in *Rasashastra*. During *Putra* process neither more nor less heat is given in order to get the best quality of medicine [20, 21, 28-32].

- **PASCHAT KARMA:**

This can be divided into 4 sub-steps. They are

1. *Swangsheetkaran* (Self cooling)
2. Collection of *chakrika* (Pellets)
3. *Mardan* (Trituration of pellets)
4. *Bhasma Pariksha*

Trituration of Pellets:

This process is performed to justify the following objectives.

1. Prepare a micro fine particle size.
2. Prepare an end product in which *Bhasma Pariksha* can be performed.
3. Convert the material into easily storable and dispensable form.

Bhasma Pariksha:

These are the analytical parameters for *Bhasma*; they can be further divided into two types.

1. Physical Parameters
2. Chemical Parameters

1. Physical Parameters:***Sookshmatva:***

By means of trituration after *puta* particles should bring up to that size where it attains the similar consistency to that of collyrium [33].

Mridutva:

After *puta* the natural hardness should be decreased and softened should be increased [33,34].

Shlakshnatva:

After *Puta* the natural roughness should be decreased and talc like soft touch should be increased [33].

Rekhapurnatva:

Triturated end product should be bringing to such a fine particle size where it can be settled down in between the furrows of the index finger and thumb [27].

Varitaratva:

Triturated end product should be floating on the stable surface of the water [27].

Nirdhoomatva:

This test is mainly employed for *Haritala*, *Somala* and *Parada Bhasmas*, where on dusting the *Bhasma* on an ignited red hot coal piece there should be absence of smoke from it [35].

Dantagreakachikachitvatva:

In this test when the *Bhasma* is put inside mouth and pressed in between the teeth there should not be a typical “*kach-kach*” sound, it means that the particle should be that much fine that there were no hardness. [33].

Nischandratvam:

Bhasma, when observed under bright sunlight, it must be luster free [33].

Avami:

The *Bhasma* should not produce Nausea on administration [34].

Vishesh varnopatti:

Identical specified colour developed after completion of *marana* process indicates that the *Bhasma* is prepared properly [34].

Unama:

A rice grain kept carefully on the layer of floated *Bhasma* must be floated on the surface [27].

2. Chemical parameters:***Gatrasatva:***

This test is employed to all the *Bhasma*, and to pass this test the prepared *Bhasma* must not contain any taste [33].

Nirutthatava:

When a prepared *Bhasma* is subjected to the same temperature level on which it was prepared, with previously weighed piece of silver in a crucible after cooling the weight of silver piece should not be increased. It indicates the absence of free metals [27].

Apunarbhavatva:

When a prepared *Bhasma* is subjected to the same temperature level on which it was prepared, with *Mitra Panchaka* the metallic luster should not be reappear. It indicates the absence of free metals [27].

Out of these *Apunarbhavatva* and *Nirutthatava* are mainly employed in cases of *Dhatu bhasmas*.

Importance of *Marana*:

1. *Marana* process turns the existing qualities of substance like heaviness, hardness, macro form into lightness, softness, micro form respectively.
2. It converts the metals and minerals to colloidal & assailable form.
3. It modifies the *Nirendriya* substance & inert substances into *Sendriya* & potentiative form.
4. It lessens the dose of the drug and gives rapid relief than herbal drugs.
5. It enhances the property of substance and preserves for longtime [29-35].

Some important factors:

1. If the substance of which *Bhasma* is to be made is volatile, then *Sandhibandhan* should be done properly and if non-volatile then some space should be kept open by this substance gets proper heat and *Bhasma* obtained is of desired color.
2. Arrangement of *Chakrika* in *Sharava* should be such that some blank space always lies between pellets, because if the *Chakrika* is properly dried so on heating volume of *Chakrika* increase (swells) and hence there may be chances of breaking of *Samputa*.
3. The dug for *Putra* should be made at dry place. As dryness supports maximum temperature duration and self cooling period.
4. The removal of *Sharava Samput* from *puta* must be after complete self-cooling. By this *Bhasma* obtained is softer in touch.
5. The hard substances like *Abharak*, *Loha*, *Makshika*, *Mandura* etc. should first be given immense heating followed by mild heating and opposite to this should be followed in case of soft substances like *Nag*, *Vang*, *Suvarna*, *Rajat*, etc.
6. *Musha* should be used when *Bhasma* of precious substances is to be made and simultaneously the temperature desired is of high range [29-35].

AMRITIKARANA

The method by which the left over *Doshas* of the *Mritha Lohas* etc. are eliminated is called *Amritikarana*. *Amritikarana* is expected to bring following changes in the *Bhasma*.

- Reduction in *Tikshnata* and *Agneyatatva*
- Increase in the potency.

During this process it is indicated that there will be *Varna-hani*. *Amritikarana* is the process that is very specific to particular drugs like *Tamra* and *Abraka* only, something indicating of their chemistry and of stability of final product, the *Bhasma* after *Marana*, in these drugs. During this process the organic matter added will get burnt and get added to the *Bhasma* [20,21, 32-37].

CONCLUSION

The prime goal of any medical system is to be serve the mankind to make them free from illness or prevent them from diseases. Medicines serve to intended purpose must be safe, effective, non-toxic and must not produces any adverse action. As we give more number of *Putra* (quantum of heat), the particle size of prepared *bhasma* are decreases leads to increase of bio-ability of the prepared *Bhasma*. Description and emphasis about *Bhasma Pariksha*, its properties and types, changes occur during preparation of *Bhasma* proves the advancement of *Rasashastra* during ancient science.

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