Ancient traditional technology for preparing bhasmas of metals and minerals with special reference to preparation of tamra bhasma

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This paper deals with the ancient technologies used for preparing Ayurvedic drugs from minerals, metals and poisonous raw materials. For preparing ayurvedic drugs from the above raw materials the process of Shodhana (Detoxification and Purification), Marana (Incineration), Amritkaranam (Nectorisation), use of earthen crucible, heat devices and its technologies, ancient technology for testing properly prepared Bhasmas for therapeutic purposes, ancient chemical analytical technologies with special reference to preparation of Tamra Bhasma have been described in detail.

Keywords: Ayurvedic drugs, Bhasmas, Tamra Bhasma

Ayurveda has its existence from prevedic period. To trace the history of use of various drugs in Ayurvedic system of medicine we have to depend upon Vedas, because they are the oldest source of Indian culture. A review of available literature indicates that this system of medicine might have been in vogue even prior to Vedas as we find references to various diseases and uses of herbs for medicinal purposes even before the period.

The authors of Samhitas added some new dimensions to the scope and definition of Ayurveda. According to Charaka Samhita “It is the knowledge of all about human beings, which relates to good and bad, weals and woe, the measurement of life and the things beneficial and harmful to life”. In fact there is nothing in the world which may not become the cause of human pleasure or worries, comfort or trouble and consequently does not come in perview of Ayurveda.

All the branches of medical knowledge such as Anatomy, Physiology, Pathology are included in Trisutra of Ayurveda, which is defined as causes, signs and treatment.

According to Yajurveda God Rudra is the original perceptor of divine type of medicine. The divine type of medicine may again be divided in to two main divisions, the first consists of Mantra (Vedic hymns), Japa (Silent prayers) and Yagya
(Religious offering), etc., while the second one consists of “Rasa”—special type of medicine.

**Rasa-Shastra**

The branch of Ayurveda which deals with the pharmaceutical preparation of Rasaushadhis is known as Rasa-Shastra. The main concept of Rasa-Shastra is to transform lower metals (lead, tin, copper, zinc) into higher metals (gold, silver) and to strengthen the body tissues and maintain them in a fresh and healthy state so as to remove poverty, senility, disease and death from the world.

Besides these, disease curing aspect is also included.

**Importance of Rasa-Chikitsa**

Rasa-Chikitsa was considered to be the most effective and time saving therapy. The preparations used under Rasa-Chikitsa being palatable, were preferred over other formulations for oral administration. Further these preparations have the advantage of being effective in smaller dose than the herbal preparations. In Rasa-Shastra the metals and minerals are also termed as Dhatus and Updhatus because of their specific role in biological system i.e. these can sustain body tissue by supplementing some of the essential elements to the tissues, whose deficiency causes many diseases in the body. Thus it can be said that on account of the above mentioned qualities and properties, the use of drugs of metal and mineral origin has become more frequent than the use of drugs of herbal origin.

**Use of metals and minerals as therapy**

In modern system of medicine the metals are generally not recommended for use as therapeutic agents as they are found to damage the tissues of various organs.

Rasa-Chikitsa of Ayurvedic system of medicine recommends the use of metals and minerals in the form of Bhasma and Kupipakwa Rasayanus, which are reported to be free from toxic effects on body tissues when used in proper doses. The treatment advocated in Ayurveda was also enunciated on the basis of re-establishing the normal proportions by ingestion of different objects including metals, minerals, vegetables and even animal tissues. In Ayurvedic Rasa-Chikitsa copper (Tamra) is an important metal used in the form of Bhasma in various preparations which are indicated for treating diseases like Pandu (Anaemia), Kustha (Skin diseases), Arsha (Piles) etc.

**Use of Tamra as therapy**

Tamra (copper) is a prehistoric material which came in to offing after the stone age. The period during which copper had its widest application in society is known as copper age or Tamra Yuga. In Vedic literature copper is mentioned by the name of Loha. Though in Charaka and Sushruta Samhita there are references to Tamra churna, the method of preparation of Bhasma remained in dark. The study of tantric literature reveals that the use of metal was known in that period yet it was kept under strict secrecy like Mantras and it remained so till Nagarjuna (7th-8th century A.D.) lifted the curtain. He suggested the use of metals in various Rasa texts and thus the secrecy of their use was brought to an end.
With the development of *Rasa-Shastra* to obtain usable form of metals and minerals, different processing/techniques like *Shodhana*, *Marana*, *Amritikarana*, *Lohitikarana* (obtaining desired colour in Bhasma), etc. came into existence.

**Shodhana**

Historically the *shodhana* concept was in existence at the time of *Charaka Samhita* as *Saucha*; it is described as one of the fundamentals considered necessary for the *Gudantarakadhanam* (alteration or addition of properties in the drugs). This concept was further developed after the development of *Rasa* (Metals and Minerals) therapy in the field of Ayurvedic medicine, i.e. from 8th century A.D. and onward. During the period ancient scholars who encouraged the use of metal and minerals as therapy also recognized their toxicity. During this period a number of *shodhana* measures were developed to remove or reduce their toxicity and to make them useful for the system. These include grinding of these drugs with vegetable extractives and with other acidic, or alkaline liquids, heating of metals and minerals and its quenching in various liquids or their boiling, sublimation, etc. These measures in turn are able to remove washable, soluble, volatile impurities of drugs of metal and mineral origin. Sometimes some organic or inorganic material either in traces or in large amount is added to these substances which helps either in their detoxification or potentiation in therapeutic efficacies.

The *shodhana* treatment also helps in impregnation of some organic material in the inorganic drugs for making the drugs as organo-metallic compounds and to make it more acceptable to body. Pharmacologically, *shodhana* also helps conversion of material in a state suitable for the further pharmaceutical processings like, *Marana*, *Amritikarana*, etc. The type of the process of *shodhana* may be selective depending on the nature of raw material. Some special techniques are described below.

**Techniques of shodhana**

1. **Prakashalana**—In this technique proper washing of raw material with water is done to remove the dust and to make it free from insects and microorganisms.

2. **Mardana**—In this technique triturating of raw material with some vegetable juices, decoctions, cow’s milk, etc. is done for detoxification and disintegration of raw material to make it suitable for the processing like *marana* of metals and minerals.

3. **Swedana**—Here boiling of raw material in certain juices, cow’s milk, cow’s urine etc. is done for increasing the brittleness of minerals and metals and for reducing the toxic character of some poisonous metals and minerals and also for infusion of therapeutically efficacious properties in metals and minerals.

4. **Galana**—Filtering of raw material through a sieve separates the adulterants if mixed in the raw material and also separates the heterogenous particles.

5. **Bhawana**—In this technique triturating of raw material with some juices, decoctions is done till complete dryness. This technique minimises the poisonous character and increases the therapeutic
potency of drug because qualities of liquids (vegetable juices and decoctions) also get infused with the raw material. This technique also disintegrates the raw material into fine particles.

(6) Bharjana—Here roasting of raw material is done. It is presumed that during bharjana, with evaporation of water content, some of the poisonous volatile and thermolabile content of raw material also gets destroyed.

(7) Nirvapa—In this technique, heating and quenching of raw material in some vegetable juices or lime water is done. This technique of shodhana remarkably increases the brittleness of minerals and metals and neutralisation of the toxic character of raw material takes place due to variable pH of liquids in which raw material is to be quenched.

(8) Dhalana—In this technique, melting of raw material and pouring in some vegetable juice/lime water is done. After this process the raw material partially gets converted into some compound form and brittleness of raw material increases.

(9) Patana—It involves distillation of raw material. It is a very useful technique for easy separation of adulterants mixed in the metals and mercury because temperature required for the distillation of mercury and other metals is different and due to this these can be easily separated from an amalgam by the process of distillation.

**Shodhana of Tamra**

Thin flakes of Tamra (copper) are recommended for pharmaceutical processing. For shodhana of Tamra, many methods are prescribed in the classical texts; some of them are as follows.

There is a general method for shodhana of all the metals. Here Tamra patra is heated red hot and quenched for seven times each in Til tail (sesamum oil), Gomutra (cow’s urine), Kanji (fermentation preparation- Sour gruel), Takra (curd diluted with water in \( \frac{1}{4} \) ratio), and Kulathi Kwath (decoction of Dolichos biflorus), respectively. In this method the liquids used for quenching, Tamra should be changed after each quenching and a fresh liquid should be taken for new quenching.

In other method for Tamra Shodhana, coating of Saindhava Lavana (rock salt) with Nimbu Swarasa (Lemon juice) on Tamra patra is done followed by heating and quenching in Nirgundi Swarasa (Juice of leaves of Vitex negundo) or Kanji for seven times. In yet another method, boiling of Tamra patras in cow’s urine continuously for nine hours is also advocated. These methods are also called Vishesh shodhana of Tamra.

**Effect of shodhana on Tamra:**

During shodhana, Tamra metal changes and disintegrates into fine particles (due to heating and quenching of metal in liquids of various variable pH). It facilitates further marana (incineration). The liquid treatment being acidic, alkaline, oily or sometimes mixed in nature also helps in dissolving many impurities of raw material, while the heat treatment removes the volatile and thermolabile impurities. Impregnation of organic substances in the raw material is also achieved by shodhana by which it becomes more suitable for human use.
Marana

It is the next step in conversion of metal/mineral in to fine ash (Bhasma) form, suitable for systemic absorption in human body. To achieve this, the drug of metal and mineral origin is first added with some marana drugs (drugs helpful in conversion of metal and mineral in to ash) and then it is subjected to bhawana (trituration with some juices, decoctions and acidic liquids) and then to heating through a fixed heating pattern known as Putapaka[16]. This total procedure is repeated several times till the metal/minerals attains the quality of Bhasma.

Metals were used in fine powder form during the time of Samhita (Charaka17 and Sushruta). They were heated to red hot and quenched in to some vegetable extractives or in some other liquids for their complete conversion in to fine powder form. But this is not considered as a proper state for making metals suitable for internal use. With the development of Rasa-Shastra much better pharmaceutical processes were developed and different Yantras (special apparatuses) and putas (heat devices) were employed to achieve the process of marana. The bhawana (trituration of mineral and metals with different herbal, juices, decoctions) is done to obtain the organometallic compound and to make it in to the pillette form. After bhawana, the drugs are dried and after closing them in an earthen pot (Sarava Samputa) or in a crucible (Musha) they are subjected to heat treatment (Putapaka).

Different types of putas are developed for the heat treatment of different metal and mineral drugs. The putas are selected on the basis of heat tolerance capacity of particular metal or mineral. Selection of suitable puta for conversion of metal and mineral in to ash form is desirable for better results. These puta having variable dimension are able to provide different grades of temperature to the material which is under the process of putapaka. For most of the putas cow dung is used as fuel. Temperature pattern of different Putas is shown in Table 1.

Marana of Tamra

In different methods described for marana of Tamra various supporting materials like Parad (Mercury), Gandhaka (Sulphur), Hingula (HgS-cinnabar), Hartal (As2S3–orpiment), Manahshila

<table>
<thead>
<tr>
<th>Name of puta</th>
<th>Peak temp. of puta in °C</th>
<th>Total duration of puta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahaputa</td>
<td>800</td>
<td>4 hours and 30 minutes</td>
</tr>
<tr>
<td>Gajaputa</td>
<td>785</td>
<td>3 hours and 30 minutes</td>
</tr>
<tr>
<td>Varahaputa</td>
<td>780</td>
<td>2 hours and 30 minutes</td>
</tr>
<tr>
<td>Kukkutaputa</td>
<td>760</td>
<td>1 hour and 30 minutes</td>
</tr>
<tr>
<td>Kapotpata</td>
<td>740</td>
<td>1 hour</td>
</tr>
</tbody>
</table>

(As$_2$S$_2$-realgar) with the bhawana of Nimbu Swarasa (lemon juice) are indicated to be used. Heat treatment for Tamra is Varaha Pita which is sufficient for the marana of Tamra to make the proper Bhasma$^{18}$.

**Bhasma Pariksha**

Following parameters have been setup in classical texts to ensure that the processing of Bhasma is complete for internal use with no untoward effects.

All the following tests are not applicable for checking every Bhasma. But according to nature of the raw material used for incineration appropriate test should be selected to test the final product.

1. **Varitara** : Bhasma should be so light in weight that when sprinkled on stagnant water in a pot, it should freely float on the surface of water.

2. **Rekhapurna** : Bhasma should be so fine that when rubbed in between the two fingers, it should be able to impregnate the finger lines.

3. **Nirdhuma** : Bhasma placed on mild heat should not produce fumes.

4. **Nihswada** : Bhasma should be free from any taste.

5. **Nischandra** : Bhasma should be lustureless.

6. **Avami** : Ingestion of Bhasma should not induce nausea or vomiting.

7. **Apunarbhava** : If Bhasma mixed with Mitrapanchaka (1. Gunja- seeds of Abrus precatorius, 2. Guggulu- latex of Commiphora mukul, 3. Madhu- honey, 4. Ghrit and 5. Tankan-Borax) is heated, its compounds should not be reduced in to free metal form.

8. **Nirutha** : If Bhasma is heated with a piece of silver, weight of silver should not increase.

**Bhasma Parikshas of Tamra Bhasma**

The following Bhasma parikshas are useful in determining the quality of Tamra Bhasma.

Varitara, Rekhapurna, Nirdhuma, Nihswada, Avami, Nirutha. Along with these Amla pariksha and Dadhi pariksha are also useful in the case of Tamra Bhasma; they are as follows:

(a) **Amla Pariksha** : Tamra Bhasma after mixing with lemon juice should not produce bluish colour in the solution even after twelve hours.

(b) **Dadhi Pariksha** : Tamra Bhasma when sprinkled on curd should not produce blue colour on curd surface even after hours.

**Amritikarana of Tamra Bhasma**

In the schedule of pharmaceutical processing this specific process is described to rule out any undesirable effect which might be present in the Bhasma even after the process of shodhana and marana.$^{19}$

As implied in the definition of the process, every Bhasma after the processing of Amritikarana becomes Amrit (Nector) i.e. free from any sort of possible undesirable effect and becomes highly efficacious therapeutically.

For the Amritikarana process again putapaka of Tamra is done with/without Gandhaka (Sulphur) after triturating it with different liquids like Nimbu Swarasa, Kumari Swarasa (Aloe vera juice), Panchamrit (cow’s milk, curd.
ghriti, honey and sugar) either keeping in simple crucible or in midst of Suran (Amorphophallus campanulatus).

Thus it is observed that even in ancient period (i.e. Samhitā period, 2nd century B.C. to 2nd century A.D.) many preparations and their method of preparation have been mentioned but after 8th century A.D. this development found further elaboration which is in practice even today. If these methods are altered by any means the drug may lose its therapeutic value and may have some injurious effect on the patients.

References

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