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Research Article

PHARMACEUTICO-ANALYTICAL STUDY OF *LOHA BHASMA* AS DESCRIBED IN RASA RATNA SAMUCHCHAYA

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KEYWORDS: *Lohabhasma, Lohachurna, Shodana, Marana*, SEM-EDAX.

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ABSTRACT

Rasaushadis play an important role by exerting a quick action which streamlines its role in the field of medicine. *Bhasmas* are one among the unique preparations told in the field of *Rasashastra*. They tend to be more bio-available in the body as they are in the form of a nanoparticle. *Loha Bhasma* is abundantly used in the management of various diseases like *Kaamala*, *Pandu* etc. *Loha* in the form of a raw material is very hard and toxic, hence it has to be subjected to primary processes like *Shodana* and *Marana* to obtain nectar like substance in the form of a very fine powder called *Loha Bhasma*. In this study Iron fillings where used to prepare the *Bhasma* by subjecting it to *Samanya* and *Vishesha Shodana* and later on doing the procedure of *Marana* according to *Rasa Ratna Sammuchchaya*. During the process of *Shodana* care has to be taken while heating the iron fillings throughout the procedure and measured quantity of liquid media for quenching has to be maintained for doing *Shodana* in bulk. During the process iron fillings tend to flush over the face during each *Nirvapa* which has to be dealt with precaution. *Marana* was done by subjecting *Loha* for 20 successive *Putas*. Thereafter analysis of the *Lohachurna* and *Bhasma* (8th & 20th *puta*) was analysed using SEM-EDAX. It was observed that the percentage of oxygen content in *Loha Bhasma* increased thereby stating it to be in Oxide form and the percentage of iron was reduced. The particle size ranges in nanometre scale of around 34.16nm which facilitates it being in its minute form.

INTRODUCTION

The main aim of Ayurveda is to prevent the onset of diseases and cure the existing issues by rendering a person to faster treatment protocols. This can be achieved by the use of *Rasaushadis*.

Bhasmas have shown a great and faster recovery rate in ailments thereby proving it to be efficacious and hence be the supreme mode of medicine in the field of *Rasashastra*. In order to render such an effective outcome, *Bhasmas* have to be prepared cordially according to the classical methods and pass certain criteria in order to state it as a completed *Bhasma*. Hence, it follows a common protocol such as *Samanya*[1] and *Vishesha Shodana*[2], followed by *Marana*. *Loha Bhasma* taken up in this article has been subjected to the same and exposed to basic analytical parameters to analyse the compounds present and to measure the particle size.

AIMS AND OBJECTIVES

1. To conduct *Samanya Shodana* of *Loha*[3]
2. To conduct *Vishesha Shodana* of *Loha*[4]
3. To Conduct *Marana* of *Loha*[5]
4. Analysis of *Loha Bhasma*

MATERIALS AND METHODS

a) *Samanya Shodana*

Apparatus used: Iron pan, Spatula, Cloth, Gas stove, Strainer etc.

Ingredients: *Ashuddha Loha* (Iron fillings): 2kgs

Liquid Media: Q.S (Approximately 9 liters each)

Media: *Kanji, Takra, Kulatthakwatha, Gomutra, Tilataila*

Procedure

- *Ashudda Loha* (Iron fillings) was taken on ladle and was heated in *Teevra Agni*, till it became red hot. Fig. 1
- It was then quenched in specific liquid media placed in a stainless steel vessel.
- After cooling down, *Loha* was taken out from the vessel and again put in the iron pan and heated till it becomes red hot. This process was repeated 3 times in each media.
- Temperature of *Loha* during red hot state was noted.
- Weight of the *Loha* was measured repeatedly.
- Time taken for each process was noted.

Observations

During *Shodhana* in *Kanji*

1) Changes in *Loha*

- Colour of *Loha* turned brown to blackish brown.
- Fillings turned brittle, when compared to the original form.
- Slight loss of iron fillings as vapour happened during quenching in *Kanji*.
- It took 30 minutes for *Loha* to become completely red hot.

2) Changes in media

- Colour of *Kanji* was brownish after quenching the iron fillings in it.
- *Kanji* started boiling while iron fillings were quenched into it.
- A specific smell comes out while quenching.
- *Kanji* became viscid and slimy after *Shodhana*.

During *Shodhana* in *Takra*

1) Changes in *Loha*

- Colour of *Loha* turned black.
- *Loha* turned brittle.
- Some part of *Loha* turned into coarse powder form.
- Prominent cracks were observed on the surface of iron fillings.
- *Loha* took 24 minute to get complete red hot.

2) Changes in media

- *Takra* started to boil during quenching process.
- *Takra* came out from the vessel while quenching.
- *Takra* split into solid and liquid parts during quenching and solid part settled down at the bottom of the vessel.
- Smell of burnt milk came out during quenching.

During *Shodhana* in *Kulattha Kwatha*

1) Changes in *Loha*

- Colour of *Loha* turned from blackish brown to deep brown.
- Iron fillings were more brittle.
- *Loha* turned more into coarse powder form.
- *Loha* started getting stuck to the ladle.
- Some powder flew away from the vessel as vapour while quenching.
- It took 16 minutes to get completely red hot.

2) Changes in media

- *Kulattha Kwatha* became brown to bluish brown in colour.
- Its consistency became thicker.
- It started to boil during quenching.
- A specific obnoxious smell was coming out during the process of quenching.

During *Shodhana* in *Gomutra*

1) Changes in *Loha*

- Colour of *Loha* turned Jet black in colour.
- Brittleness of *Loha* pieces increased after *Shodana*.
- More parts of *Loha* turned into coarse fine powder.
- Some part of *Loha* was lost as fine powder as vapour while getting quenched.
- *Loha* took 12 minutes to get completely red hot.

2) Changes in media

- Colour of *Gomutra* turned brownish in colour.
- A pungent smell was coming out during quenching.
- *Gomutra* started to boil during quenching.

During *Shodhana* in *TilaTaila*

1) Changes in *Loha*

- Colour of *Loha* was completely black.
- Metallic lustre of *Loha* was lost.
- *Loha* got fire while heating. Fig. 2
- Cracks were seen on the surface of *Loha*.
- Brittleness was increased.
- *Loha* turned completely into coarse powder form.
- It took 10 minutes to get completely red hot.

2) Changes in media

- Colour of oil turned light brown in colour.
- Oil became viscid after *Shodana*.

- A pungent smell and black fumes was observed after quenching.

Precaution

- *Loha* had to be heated in *Teevra Agni*, in order to become red hot.
- The red hot state had to be perceived accurately.
- It was poured carefully into each media to prevent loss.
- *Loha* was allowed to cool down after quenching.
- After quenching, collection of *Loha* was done carefully.

Result

Weight of *Loha* after *Samanya Shodana*: 1890gm

b) *Vishesha Shodana* of *Loha*

Apparatus used: Iron pan, Spatula, Cloth, Gas stove, Strainer etc.

Ingredients: *Shoditha Lohachurna*: 400 gm

***Triphala Kashaya*:** 6 liters

Procedure:

Same as *Samanyashodana* of *Loha* (*Nirvapa* in *Triphala Kashaya* 7 times)

Observations

1) Changes in *Loha*

- A reddish texture was observed over *Loha* during red hot state.
- A crackling sound came out while heating till it became red hot.
- Small particles of *Loha* got attached to the iron pan.
- Powder of *Loha* was formed as vapour while quenching.
- Colour of *Loha* turned blacker.
- It took 15.12 minutes to make it get completely red hot.

2) Changes in media

- Colour of decoction turned blackish brown.
- *Kashaya* started to boil during quenching.
- *Kashaya* overflowed from the vessel.

Precautions

- Similar to *Samanya Shodana* of *Loha*

Result

Weight of *Loha* after *Visheshashodana*: 350gm

c) *Marana* of *Loha*

Apparatus used: *Khalva yantra, Sharavas*, etc

Ingredients: *Shodita Loha churna*: 1part

Shudda Gandhaka: 1part

Kumari swarasa: Q.S Fig. 3

Procedure

- *Shudda Loha* and *Shudda Gandhaka* was taken in equal quantity and triturated with *Kumari swarasa* for 3 hours.
- *Chakrikas* were made and kept to dry.
- These *Chakrikas* were then placed in *Sharavas*.
- The *Sharava* was covered by another *Sharava* and the junction was sealed by double folded mud smeared cloth and again allowed for complete drying. (5 times).
- Then this was subjected for *Puta*.
- After *Puta* the material was collected and ground again with equal quantity of *Gandhaka* and *Kumari swarasa*. This process was repeated for 20 times.

Observation

- After each successive *Puta* the colour of *Loha* changed drastically. Fig. 4
- There was drastic change in the consistency of the material after each *Puta*.
- While giving *Bhavana* there was self-generated heat noticed.
- All *Bhasmalakshanas* was observed by the end of 20th *Puta*. Fig. 5

Precautions

- *Shuddha Loha* and *Shudda Gandhaka* have to be triturated well with *Kumariswarasa* as *Gandhaka* takes time to mix homogenously.
- Continuous 3 hr trituration has to be given for the proper disintegration of the particles with the media.
- After each *Puta* in the end stages, the material started becoming *Rekhapurna* and there seemed to be more wastage while preparing *Chakrikas*.
- Hence, once *Rekhapurnata* was observed *Chakrikas* wasn't made to avoid wastage.

Table 1: Change in weight of *Lohabhasma* before and after *Puta*

Number of *Putas*	Media (*Kumari swarasa*) ml	Initial weight (g)	Final weight(g)	Loss(g)
1	165	350	304	46
2	165	304	301	3
3	164	301	297	4

4	161	297	295	2
5	165	295	282	13
6	150	282	280	2
7	152	280	278	2
8	150	278	277	1
9	150	277	274	3
10	142	274	254	20
11	140	254	250	4
12	150	250	247	3
13	156	247	243	4
14	143	243	240	3
15	154	240	230	10
16	158	230	227	3
17	160	227	224	3
18	132	224	223	1
19	132	223	213	10
20	130	213	208	5

Result:

Weight of *Lohabhasma*: 208 gm

Analytical Report

a) *Bhasma Pareeksha*

Table 2: *Bhasmapareeksha* done for *Loha*

Bhasmas	*Varna* Fig. 4	*Nischandratvam* Fig. 5	*Varitara* Fig. 6	*Rekhapurna*	*Unama* Fig. 8	*Slakshnatvam*
Loha Bhasma	Dark brownish grey with a purple tinge	+	+	+	+	+

- *Lohachurna* after 8 *Putas* (Classical reference)
- *Lohabhasma* after 20 *putas*

b) SEM-EDX

- ***Lohachurna* (after 8 *Putas*)**

Table 3: Results *Lohachurna* by SEM-EDX: Fig. 9

Element	Weight%	Atomic%
C	16.57	32.72
O	29.75	44.11
Mg	0.00	0.00
Cl	1.45	0.97
Fe	52.24	22.19
Zn	0.00	0.00
As	0.00	0.00
Ag	0.00	0.00
Cd	0.00	0.00

- SEM –EDX showed the presence of Carbon, Oxygen, Chlorine and Iron.

- There was no presence of heavy metals.
- Particle shape was clearly distinctive.
- Particle size couldn't be analysed.

b) *Loha Bhasma* (after 20*putas*)

Table 4: Results *Lohabhasma* by SEM-EDX

Element	Weight%	Atomic%
O	30.73	59.35
Mg	0.00	0.00
Al	1.91	2.19
Si	2.16	2.38
Fe	45.20	24.04
Zn	0.00	0.00
As	0.00	0.00
Ag	0.00	0.00
Cd	0.00	0.00

- *Lohabhasma* showed the presence of Oxygen, Aluminium, Silica and Iron.
- No presence of heavy metals.
- Particle shape and size could be analysed.
- Size of the particle:

34.16 nm at a magnification of 50.00 K X. Fig. 7

265.3 nm to 588.3 nm at a magnification of 20.00 K X.

519 to 1.373 µm at a magnification of 10.00 K X.

DISCUSSION

Discussion of *Shodana* of *Loha*

a) *Samanya Shodana*

- Easier when compared to other methods as *Nirvapa* is done 3 times each.
- The product at the end stage tends to be brittle perfectly thereby helping in reducing the loss.
- During *Shodana* of *Loha*, care has to be taken at the end stages, as *Loha* tends to get very brittle and the small particles flush over the face during *Nirvapa*.

b) Visesha sodhana

- *Loha Churna* will be very fine after subjecting it to *Samanya Shodana*, hence care has to be taken to avoid wastage.
- Particles of *Loha Churna* flush over the face during this procedure.
- *Lohachurna* has to be completely immersed in the *Triphala Kashaya* as the *Churna* tends to stick at the bottom of the iron vessel and thereby leading to wastage.
- After *Nirvapa*, Filtration has to be done careful to obtain maximum yield.

Discussion of *Marana* of *Loha*

- *Marana* of *Loha* had to be done by giving a maximum of 20 *Putas*.
- Increase in the number of *Putas* might be because in the variation of size of cow dung cakes, time duration for *Bhavana* after each *Puta*, *Sandhibandana*, thickness of cowdung cakes and quantity of cowdung cakes.

Discussion on Analytical Data

a) SEM-EDAX of *Loha* by classical and in house method

- There was reduction in some of the elements present in the drug after giving successive *Putas*, till the formation of each *Bhasma*.
- The atomic percentage of oxygen increased when *Bhasma* was formed, hence suggesting it to be in oxide form.
- There was absence of heavy metals after giving *Puta* according to the classical reference.
- Microscopic images of the *Churna* and *Bhasmas* could be analysed via SEM.
- Particle size of *Bhasmas* could be analysed.
- Particle sizes of *Bhasmas* were in the range of nanometers to micrometers.

Loha churna* and *loha Bhasma

- Significant variation in *Lohachurna* and *Bhasma*.
- There is presence of Carbon in *Lohachurna* and its absence in *Loha bhasma*.
- The oxygen level in *Loha Bhasma* is more i.e., weight % 30.73 and atomic % 59.35 indicating it to be in oxide form.
- Percentage of Fe content in *Bhasma* is weight % 52.24 and Atomic % of 11.19.

- The particle size of *Lohachurna* couldn't be analysed.
- Particle size of *Bhasma* could be analysed :

34.16 nm at a magnification of 50.00 KX.

265.3 nm to 588.3 nm at a magnification of 20.00 KX.

519 to 1.373 µm at a magnification of 10.00 KX.

b) Discussion on *Bhasma Pareeksha* [6]

Bhasmas are unique preparations in *Rasashastra*, for its preparation *Marana* has to be done. Before the process of *Marana*, *Shodana* of the metal has to be done. For the obtainment of a pure *Bhasma*, *Bhasmapareeksha* plays an important role.

1) *Rekhapurna*

This *Pareeksha* mainly deals with the particle size of the *Bhasmas* and also deals with is softness. The *Bhasma* can only pass this *Pareeksha* when the diameter of the particles is less than the breadth of grooves on the finger surface. Also, deals with the consistency of the particles. The particles of the *Bhasma* only get entangled over the fingers if they are smooth and soft. If they are hard in consistency they will not get adhered to the finger surface though they are sufficiently small.

2) *Varitara*

The probable cause behind floating of *Bhasma* over water can be described as the atoms of water are bounded with each other due to an attractive force in between them due to which they remain in contact with each other forming a flat surface. When a fine powder is spread on its surface tension of the water doesn't allow the particle to enter/ sink thus, keeping them floating. Hence, can be considered as *Laghu* (particles having light weight). *Bhasma* particles which are *Laghu* will float on water and if it contains any unconverted heavy particles of metal it tends to sink. Acharya Vagbhatta states that *Bhasma* becomes ready for consumption only if it's *Varitara*.

3) *Unama*

Additional test is done to confirm the *Varitara Pareeksha*. It is similar to that of *Varitara* test but further on stating the *Laghutva* of the particle which will not allow the grain to sink.

4) *Nischandratva*

Test is carried out to check the presence of free metal, if its present there will be presence of lustre.

CONCLUSION

Loha Bhasma has to be prepared by subjecting it to proper *Shodana* prior to its *Marana.* Iron fillings can be used to prepare *Loha Bhasma*. Careful observation has to be made throughout the process of preparation of *Bhasma*. Once the *Bhasma* has passed the tests of perfectness it can be sent for analysis and then used as a medicine.

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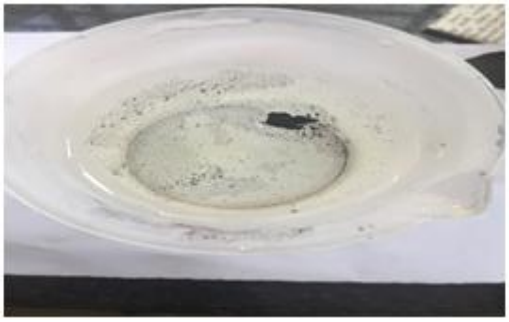
Heating of Iron Fillings

Loha* after *Nirvapa* in *Tila Taila

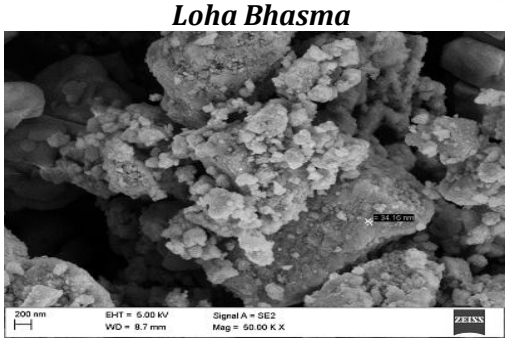
Ingredients for *Loha Marana*

Loha* Turning into *Bhasma

Loha Bhasma

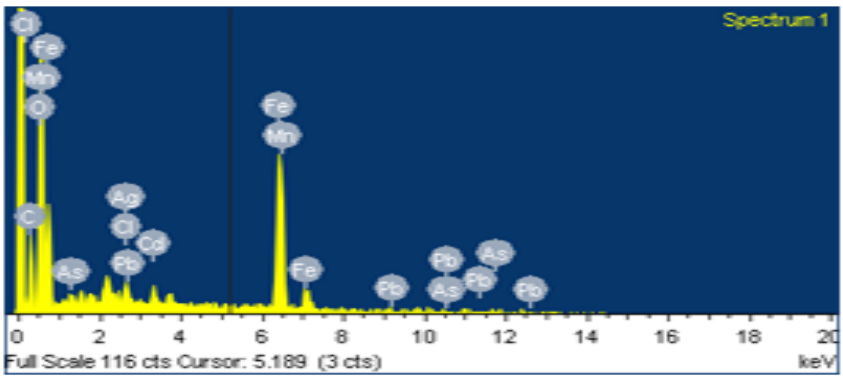


Varitara Pareeksha



SEM-EDAX of *Lohabhasma*

Unnama Pariksha



SEM-EDAX of *Loha Churna*