

PHARMACEUTICAL AND ANALYTICAL STUDY ON LOHA BHASMA

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Abstract

Rasashastra is a subject which deals with metals and its therapeutic effect. It mentions the use of metals in a refined form as *bhasma*. Loha is used extensively in the Ayurvedic literature for the management of various diseases like *Pandu (Anemia)*, *Shotha (Oedema)*, *Kamala (Jaundice)* etc. It is very hard metal hence it should be made into *bhasma* for using it for medicinal purposes. Iron fillings are subjected to *samamnya shodhana and vishesha shodha* to prepare the *bhasma*. Pharmaceutical and analytical studies were conducted during the process of preparation of the *Loha bhasma* to know the changes in the chemical composition at various stages. Namburi Phased Spot Test was done to prove the fineness of the *bhasma*. In this study an attempt has been made to standardize the process of the preparation of the *Loha bhasma* and to establish chemical standards like iron content in the *bhasma* and the Namburi Phased Spot Test.

Key words: Loha, Trivida paka, Loha bhasma, Qualitative & Quantitative analysis.

Introduction:

The basic purpose of this science is to keep the human beings free from disease, old age & death. Rasashastra is one of the branches of Ayurveda which has a rich knowledge of mineral and metallic preparations. The minerals and metals were used in the form of *Rajah* (mineral waste during the processing of the minerals and metals). During the 8-9th century A.D, the *Ayurvedics, Siddhas, Nath yogis and the Tantrikas* developed the medicinal uses of metals and minerals which ultimately attained the name Rasashastra or Rasatantra.

Rasashastra is a subject which deals with metals and its therapeutic effect. It mentions the use of metals in a refined form as *bhasma*. Their use reduced the quantity of the dose administered and increased the palatability, tissue availability and shelf-life of the drugs.

Loha is used extensively in the Ayurvedic literature for the management of various diseases like *Pandu (Anemia)*,

Shotha (Oedema), *Kamala (Jaundice)* etc. It is very hard metal. In the *samhitas* it was mentioned to use it in the form of powder. But in the texts of Rasashastra loha is mentioned in the form of *shodhita bhasma* (Purified form of *bhasma*) for the medicinal uses. Administration of impure form of the Loha leads to many medical problems which may damage the kidneys, liver etc. This can be achieved by *shodhana* followed by *Trivida paka* (*Sthali paka, Bhanu paka and Puta paka*) to convert Loha into *Bhasma*. To know the changes that occur after *shodhana, Trivida paka* of loha & also to bring to the lime light the pharmaceutical & analytical changes that occur during preparation of Loha bhasma this study is intended.

Aims and objectives:

- * To conduct *shodhana* of Loha
- * To conduct *Trivida Paka* of Loha in order to prepare *Lohabhasma*

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- * Physical & chemical Analysis of Lohabhasma in different stages of shodhana and preparation of bhasma.

Materials and methods:

Selection of Raw Materials:-

Loha collected from Sri Venkatesha Engineering Works', Gandhi Square, Mysore, by identifying the Grahyalakshanas of Loha mentioned in the classics.

Methods:

Preparation of the Loha bhasma involves two stages.

1. Shodhana
2. Trividha paka

Shodhana: (RRS 5/29)

This is of two types. Samanya shodhana and Vishesh shodhana.

Samanya shodhana:

Materials: Loha - 1, 500 gm, Tila Taila - 7000 ml, Takra - 7000 ml, Gomutra - 7000 ml, Kanji - 7000 ml, Kulatha Kwatha - 7000 ml

Instruments: Steel Vessels, Cloth, Gas Stove, Big Iron pan, Stirrer

Method: 1500 gm of Loha is heated until it become red hot & immediately it is quenched into 1000 ml of Tila taila kept in a wide mouthed vessel & left for 5 min for self cooling. After self cooling of Loha, it is taken out and again heated till red hot and again quenched in taila. Each time the taila or the liquid used should be changed. This procedure is called as Nirvapa and it is repeated for 7 times each in *Taila, takra, Gomutra, Kanji and Kulatha kwatha*.

Vishesh shodhana: (R.R.S 5/102-103).

It is also similar in procedure to the samanya shodhana but the drava dravya should be Triphala kwatha. And the nirvapa is done in Triphala kwatha for 7 times.

Trivida Paka of Loha:

After the shodhana process, loha is subjected to trividha paka. This includes Banupaka, Sthalipaka and Putapaka.

Banupaka: (RSS 1/302-304)

Materials: Loha- 500 gm, Triphala Kashaya Curna

Instruments: Steel plate

Method: 500 grams of Shuddha Loha was taken in steel plate. 500 grams of Triphala kashaya Churna was taken in steel Vessel, to this 2 times water was added & kept on Mandagni. It was boiled until it reduces to 1/4th. After preparation of Triphala kwatha it was put into steel plate which contains Shuddha Loha. This was exposed to sunlight & left it until it dries completely. This procedure was repeated for 3 times.

Sthalipaka: (RSS1/309-310) This is done after banupaka.

Materials: Mula of Palasha, Eranda, Shatavari & Panchanga of Bringaraja – together 500 gm; Loha: 500 gm

Instruments: Steel Vessel

Method: In a vessel 500 grams of Loha was taken which has undergone Banupaka and the kwatha, prepared by Palasha, Eranda, Shatavari mula and Bringaraja, was added & boiled in sthali (dish), until kwatha was evaporated completely. This was repeated for 3 times.

Putapaka: (RSS 1/343)

Materials: - Loha which was undergone Shodhana, Banupaka & Sthalipaka - 200 grams (coarse powder) Shudha Hingula, Kumari

Instruments: - Khalva yantra, Earthen sharavas, Multani soil, Cow dung cakes - 1,000

Method: Shuddha Hingula was taken in Khalwa & made into fine powder. To these 12 parts of Shudha Loha curna was added & mardana was done to mix properly. After that this was given bhavana with Kumari & chakrikas were prepared and dried. These dried chakrikas are kept in Sharava & Sandhibandhana was done properly using multani soil. Then again the sharava was kept for drying. After drying, 700 cowdung cakes was arranged in pit and the Sharava was kept on it. Then it is

covered by 300 more cowdung cakes. Then the cowdung cakes are ignited. After the complete burning and self cooling of the kiln the sharava samputa is taken out and opened. The charred chakrikas are collected, ground and again the same procedure is repeated for 7 times to get Loha bhasma. After completion of puta

paka process, Loha bhasma was collected & made into fine & smooth by grinding.

Assessment criteria:

The proper formation of the Loha bhasma is assessed both in Ayurvedic and analytical ways. Ayurvedic tests for the bhasma are Apunarbhava and Nirutta bhasma. Analytical tests conducted are Namburi Phased Spot.

Observation and results:

Table 1: Showing observations made during the Shodhana of Loha.

Table 1: Nirvapa with Taila

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Tila Taila	50 min	Ad. Grey	Nil
2	Tila Taila	45 min	Ad. Grey	Nil
3	Tila Taila	45 min	Ad. Grey	Nil
4	Tila Taila	45 min	Ad. Grey	2
5	Tila Taila	40 min	Ad. Grey	2
6	Tila Taila	40 min	Ad. Grey	2
7	Tila Taila	40 min	Ad. Grey	4 gms

Table 2: Nirvapa with Takra

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Takra	50 min	Ad Grey	Nil
2	Takra	45 min	Ad Grey	Nil
3	Takra	45 min	Ad Grey	Nil
4	Takra	40 min	Ad Grey	Nil
5	Takra	40 min	Ad Grey	2
6	Takra	40 min	Ad Grey	4
7	Takra	40 min	Ad Grey	4

Table 3: Nirvapa with Gomutra

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Gomutra	50 min	Ad. Grey	Nil
2	Gomutra	45	Ad. Grey	Nil
3	Gomutra	45	Ad. Grey	Nil
4	Gomutra	40	Ad. Grey	2
5	Gomutra	40	Ad. Grey	2
6	Gomutra	40	Ad. Grey	2
7	Gomutra	40	Ad. Grey	4

Table 4: Nirvapa with Kanji

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Kanji	50 min	Ad. Grey	Nil
2	Kanji	45	Ad. Grey	Nil
3	Kanji	40	Ad. Grey	Nil
4	Kanji	40	Ad. Grey	4
5	Kanji	40	Ad. Grey	2
6	Kanji	40	Ad. Grey	2
7	Kanji	40	Ad. Grey	2

Table 5: Nirvapa with Kulatha Kwatha

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Kulatha Kwatha	50 min	Ad. Grey	Nil
2	Kulatha Kwatha	45	Ad. Grey	Nil
3	Kulatha Kwatha	45	Ad. Grey	Nil
4	Kulatha Kwatha	40	Ad. Grey	4
5	Kulatha Kwatha	40	Ad. Grey	2
6	Kulatha Kwatha	40	Ad. Grey	2
7	Kulatha Kwatha	40	Ad. Grey	2

Table 6: Banupaka of Loha

Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Triphala Kwatha	5 hrs.	Royal Blue	Nil
2	Triphala Kwatha	5 hrs.	Royal Blue	Nil
3	Triphala Kwatha	5 hrs.	Royal Blue	Nil

Table 7: Sthalipaka of Loha

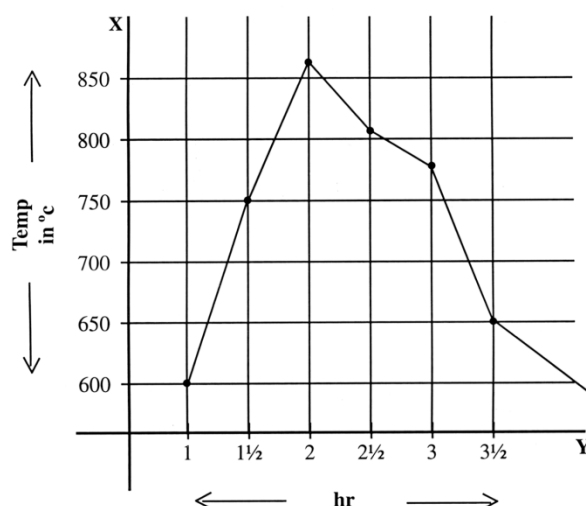
Nirvapa	Dravya	Duration of heat (in min)	Colour after nirvapa	Quantity of Loha reduced (in gm)
1	Kwatha of Bringaraja, Eranda mula, Shatavari, Palasha mula	25 min	Royal Blue	Nil
2	Kwatha of Bringaraja, Eranda mula, Shatavari, Palasha mula	25min	Royal Blue	Nil
3	Kwatha of Bringaraja, Eranda mula, Shatavari, Palasha mula	25min	Royal Blue	Nil

Observations:

Time taken for complete burning of cowdung cakes was 8 hrs. Loss of weight was 50 grams in 200 grams [25%]. After 1st Puta Lohabhasma turned to brown colour. After 7th Puta Loha bhasma turned to Pakwa Jambu pala varna.

No. of Times	Drava Dravya	Duration of Grinding (hr)	No. of Cowdung cakes used	Weight reduced of Lohabhasma (gm)	Colour change of Lohabhasma
1	Kumari	3	1000	20 gms	Brown
2	Kumari	3	1000	10	Brown
3	Kumari	3	1000	5	Brown
4	Kumari	3	1000	5	Brown
5	Kumari	2	1000	5	Wild Purple
6	Kumari	2	1000	5	Wild Purple
7	Kumari	2	1000	0	Pakwa Jambu Pala varna

TEMPERATURE RECORDED OF GAJA PUTA IN LOHA BHASMA PREPARATION SHOWING IN GRAPH



ANALYTICAL STUDY:-

Table 8: Physical Analysis of Lohabhasma

Sl. No.	No. of Puta	Colour	Taste	Touch	Odour	Lustre
1	After 1 Puta	Brown	Metallic & Sour	Slight Rough	Pungent	More
2	After 2 Puta	Brown	Metallic & Sour	Slight Rough	Pungent	More
3	After 3 Puta	Brown	Slight Metallic & Sour	Little Smooth	Pungent	Less
4	After 4 Puta	Brown	Slight Metallic & Sour	Smooth	Pungent	Less

5	After 5 Puta	Wild Purple	Slight Metallic & Sour	Smooth	Pungent	No
6	After 6 Puta	Wild Purple	No. Taste	Smooth	Odour less	No
7	After 7 Puta	Pakwa Jambu Pala varna	No. Taste	Very Smooth	Odour less	No

Table 9: Analysis of Physical tests of Lohabhasma

Sl. No.	No. of Puta	Varitaratwa	Uttama	Rekhapurnatwa
1.	After 1 Puta	Not present	Not present	Not present
2.	After 2 Puta	Not present	Not present	Not present
3.	After 3 Puta	Not present	Not present	Not present
4.	After 4 Puta	Some particles are floating	Not present	Bhasma filled the lines of the fingers but fell down after sometime
5.	After 5 Puta	Increased floating particles	Not present	Bhasma filled the lines of the fingers but fell down after sometime
6.	After 6 Puta	Increased floating particles	Grain did not sink	Bhasma filled the lines of the fingers but fell down after shaking
7.	After 7 Puta	Most of the bhasma was floating	Grain was floating but fell down after shaking	Bhasma filled the lines of the fingers but fell down after shaking

QUANTITATIVE ANALYSIS

Raw sample of Iron			Iron After Shodhana		
Sl. No.	PARAMETERS	RESULTS	Sl. No.	PARAMETERS	RESULTS
1	Iron as Fe	96.82 %	1	Iron as Fe	96.80 %
2	Manganese as Mn	0.83 %	2	Manganese as Mn	0.82 %
3	Chromium as Cr	1.03 %	3	Chromium as Cr	1.02 %
4	Carbon as C	0.25 %	4	Carbon as C	0.23 %
5	Silicon as Si	0.22 %	5	Silicon as Si	0.235 %
6	Nickel as Ni	0.32 %	6	Nickel as Ni	0.39 %
7	Phosphorus as P	0.02 %	7	Phosphorus as P	0.016 %
8	Sulphur as S	0.08 %	8	Sulphur as S	0.07 %
9	Molybdenum as Mo	0.15 %	9	Molybdenum as Mo	0.14 %
10	Magnesium as Mg	0.08 %	10	Magnesium as Mg	0.08 %
11	Calcium as Ca	0.05 %	11	Calcium as Ca	0.09 %
12	Potassium as K	0.06 %	12	Potassium as K	0.05 %
13	Sodium as Na	0.08 %	13	Sodium as Na	0.04 %

After Banupaka & Sthalipaka			After Puta Paka		
Sl. No.	PARAMETERS	RESULTS	Sl. No.	PARAMETERS	RESULTS
1	Iron as Fe	96.67 %	1	Silica as SiO ₂	9.07 %
2	Manganese as Mn	0.75 %	2	Iron as Fe ₂ O ₃	89.48 %
3	Chromium as Cr	1.11 %	3	Calcium as CaO	0.11 %
4	Carbon as C	0.22 %	4	Magnesium as MgO	0.88 %
5	Silicon as Si	0.29 %	5	Sodium as Na ₂ O	1.01 %
6	Nickel as Ni	0.44 %	6	Potassium as K ₂ O	0.17 %
7	Phosphorus as P	0.015 %	7	Chlorides as Cl	0.05 %
8	Sulphur as S	0.06 %	8	Sulphates as SO ₄	0.02 %
9	Molybdenum as Mo	0.15 %	9	Ash Value	98.24 %
10	Magnesium as Mg	0.08 %	10	Water Soluble	1.56 %
11	Calcium as Ca	0.09 %	11	Water insoluble	
12	Potassium as K	0.05 %	12	Acid Soluble	98.44 %
13	Sodium as Na	0.04 %	13	Acid insoluble	

QUALITATIVE ANALYSIS: - 1. Apunarbhava Test, 2. Nirutta Test, 3. Namburi Phased Spot Test

I. APUNARBHAVA TEST OF LOHA BHASMA

5 grams of loha bhasma was mixed with 5 grams of Mitrapanchaka and kept in sharava and sandhibandana was done. This

was subjected to gajaputa. After Swangasheeta it was collected.

Observation:- Absence of shining particles, this indicates there was no free metal & hence passed Apunarbhava test

I. NIRUTTA TEST OF LOHA BHASMA:

- 1 gram of loha bhasma was mixed with 1 gram of Shudda Rajata individually, kept in sharava and

sandibandana was done and subjected to gajaputa. After Swangasheeta it was collected.

OBSERVATION: - Weight of Shudda Rajata was same after puta. This indicates loha bhasma not mixed with rajata and hence passed nirutta bhasma pareeksha.

III. NAMBURI PHASED SPOT TEST (N.P.S.T)

Chromatography is relatively a new technique which was first invented by M. Tswett, a botanist in 1906, for the separation of coloured substances into individual components. Since then, the technique has undergone tremendous modifications so that now a days various types of chromatographies are in use to separate almost any given mixture, whether coloured (or) colour less, into its constituents and to test the purity of these constituents. Paper chromatography one of the varieties of chromatographies in a special case of partition chromatography in which the absorbent column in a paper strip. Namburi phased spot test (N.P.S.T.) is known as circular paper chromatography (variety of paper chromatography) which is called also radial paper chromatography. N.P.S.T. was introduced by Dr. Namburi Hanumantha Ro in the year 1970. The author has taken up the project of quality control of bhasmas and sinduras along with other projects to meet the challenges thrown both by the public and press about 32 years back.

Definition of N.P.S.T.:- When a drop of clear solution of a substance that is under examination is put on one of the chemical reacting papers, a spot with a series of changes in colour and pattern will appear. It is the study of this spot and colour at three successive phases spreading over three different time intervals in known as the "phased spot test".

Advantages of N.P.S.T.:- This technique is very helpful for quality assessment of

bhasmas as per the standards of Rasasasthra. The study of differential identification of various bhasmas is made possible by N.P.S.T. This test has an advantage of measuring the sensitivity of reactions at different time intervals. This is a method to study or detect continual chemical changes (reaction) that take place gradually between two chemical substances on static media at very second or even at a fraction of a second. Some initial (or) intermediate reactions (or) changes which occur before culminating it to a major chemical reaction can be detected by the present technique.

N.P.S.T. OF LOHA BHASMA:-

Sample used for Present study: 0.25 gms (Loha Bhasma)

Chemical used in the study: 5% HCl V/c, 2.5% potassium ferrocyanide paper.

Equipments: Test tube holder, Test tube stand, three test tubes, 5 ml Graduated pipette, Bunsen burner, Dropper.

Procedure: - 0.25 gms of sample was taken into test tubes. Test tube was heated till the bottom appears and with the help of Bunsen burner & it was allowed to self cool for some time 0.5 ml of 5% HCl was taken in a graduated pipette and slowly dropped in the test tube. Now again test tube was heated for a while. The sample was allowed to stay for 24 hours without shaking. Two hours before treating with a chemical reaction paper, the test tube was shaken and kept as it. Then a drop of supernatant (clear) solution of sample was dropped on the 2.5% potassium ferrocyanide paper with the help of dropper carefully. No sooner the drop came in contact with the 2.5% potassium ferrocyanide paper an instantaneous characteristic spot began to form & changes rapidly & continually for some time.

Observations: - I Phase: The first phase of reaction extends from the very movement of formation of spot till the end

of 5th minute. This phase is called "Immediate reaction". II Phase: The second phase of reaction extends there after upto 20th minute. This phase is called "Delayed reaction". III Phase: The third phase extends from end of 20th minute to 24th hour or above. This phase is called as "Late reaction".

Sl.no	I Phase	II phase	III phase
1	Central Deep Blue spot with light blue, white colour and brown thin circles in periphery	Expanded blue spot	No other changes

DISCUSSION: -

The iron fillings used in the study can be compared with the teekshna loha. This metal is used for to make sharp instruments, bolts etc. As the metal is very hard it is made into powder form by making it into the bhasma. This can be achieved by subjecting iron to samanya and vishesha shodhana procedures. The two procedures were done according to the classical literature available.

Physical and chemical analysis was carried out at various stages of preparation of the drug purification, such as Analysis of the raw material (Iron), Analysis of Iron after samanya and vishesha shodhana and Analysis of completely formed loha bhasma was analyzed chemically for percentage of Iron & other metals. Iron was 96.82% in steel chip. After samanya & vishesha shodhana, only 0.2% of Iron was reduced. There were no much changes in chemical analysis. After Banupaka & sthali paka 2% of Iron was reduced. It was in Fe form only. After puta paka, Iron was 89.48% there was absence of other metals like chromium, Nickel, Manganese, Molybdenum & phosphorus. Ash value

was 98.24%, Acid insoluble ash - 1.56% & water insoluble ash - 98.44%.

In Loha bhasma formed contains Iron in the form of Ferrous or in oxide form which are considered to be the most compatible forms of iron supplementation in the body. The rate of the absorption of the iron depends on the fineness of the powder. Bhasma process makes the metal into very minute particles which are easy to absorb. NPST done on the bhasma prepared proved the fineness of the powder by developing the single expanded blue spot.

CONCLUSION

From the above pharmaceutical and analytical study on the loha bhasma it can be concluded that Loha should undergo samanya shodhana and vishesha shodhana for the proper formation of the bhasma. They help for the purification of iron and make the metal brittle.

Trividha paka process for Loha bhasma enhances the guna of it and reduces the size of the particles facilitating easy absorption into the body.

Tests of the ayurvedic parameters of bhasma like Apunarbhava, Nirutta and the Namburi Phased Spot Test proved the fineness of Lohabhasma and also help for the quality standardization of the Loha Bhasma.

Acknowledgements:

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Raw sample of Fe



Loha Shodhana



Nirvapa with Taila



Nirvapa with Takra



Nirvapa with Gomutra



Nirvapa with Kanji



Nirvapa with Kullatha Kwatha



Nirvapa with Triphala Kwatha

Trivida Paka - Banupaka



Triphala Kwatha added to Loha churna & kept under Sun for evaporation of Kwatha



After 3 hours partial evaporation of Kwatha

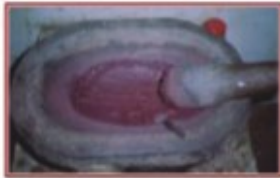


After 5 hours complete evaporation of Triphala Kwatha

Sthalipaka



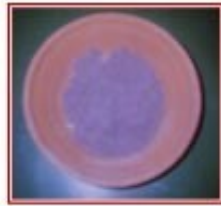
Putra Paka



Apunarbhasa test



Nirutta test



Physical test



NPST