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ICP-OES Analysis of *Samanya* and *Vishesha Shodhita Loha*

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ABSTRACT

Rasashastra is a science which deals with metals and minerals and their therapeutic effects. These can cause hazardous effects if not purified. Purificatory procedures can be generally classified into two, namely – *Samanya Shodhana* and *Vishesha Shodhana*. In this study, reference from *Rasatarangini* was adopted for *Samanya* and *Vishesha Shodhana* of *Loha*. The Analysis of Raw sample of iron, *Samanya Shoditha Loha* and *Vishesha shoditha Loha* was done to analyse the difference physically and chemically by ICP-OES method. The discussions are made on the *Shodhana* procedures and results obtained with giving probable reasons. From *Samanya* and *Vishesha Shodhana* of *Loha* it is evident that the particle size was reducing drastically after each procedure making it more brittle and fine. There were many changes observed from the raw sample of *Loha* to the *Vishesha shodhita Loha* physically and analytically. Thus we can adopt *Samanya Shodhana*, *Vishesha Shodhana* or together depending on the requirement.

Key words: *Samanya Shodhana, Vishesha Shodhana, Loha Shodhana.*

INTRODUCTION

Rasashastra is a science which deals with metals and minerals and their therapeutic effects. It can cause hazardous effects if not purified. *Shodhana*[1] is one such procedure which is capable of removing impurities from the drug making it more efficacious and fit for consumption. After specific purificatory procedures, these can be further processed and utilized.

There are 2 purificatory procedures explained namely,

1. *Samanya Shodhana* (General) - As the word indicates *Samanya Shodhana* is the general method of purification which can be done for set of drugs.
2. *Vishesha Shodhana* (Specific)- *Vishesha Shodhana* is the purification method specific to the drug.

Loha is a metal explained extensively in *Rasashastra* classics which is included under *Dhatuvarga*. This metal is very hard and mainly available in the form of fillings. This should be subjected to specific purificatory measure so that it can be further processed.

In this study, *Samanya* and *Vishesha Shodhana* of *Loha* was carried out and analysis was done to note the differences. Many references are available in classics for *Shodhana* of *Loha*. Here the reference from *Rasatarangini* was adopted for *Samanya* and *Vishesha Shodhana* procedures.

MATERIALS AND METHODS

This involves the following procedures;

a) *Samanya Shodana* of *Loha*.[2]

b) *Vishesha Shodana* of *Loha*.[3]

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Name of the Practical: *Samanya Shodana* of *Loha*.

Reference: *R.T 15/4-6*

Date of preparation: 10/12/2018

Date of completion: 09/01/2019

Instruments

- Iron vessel
- Steel vessel
- Spatula
- Cloth
- Gas stove
- Strainer

Ingredients

Ashuddha Loha (Iron fillings): 750g

Liquid Media: Q.S

Media

- *Kanji*
- *Takra*
- *Kulattha Kwatha*
- *Gomutra*
- *Tila Taila*

Procedure

- *Ashudda Loha* (Iron fillings) was taken in an Iron vessel and was heated in *Teevra Agni*, till it became red hot.
- 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 vessel 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

Table 1: Tabulation of changes observed during the *Nirvapa* in *Kanji*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Kanji*	750g	30 min	Took long duration for heating. Colour of *Loha* changed from brown to black. *Loha* became little brittle.	The smell of *Kanji* was evident during quenching. Colour of *Kanji* changed from white to brown. The temperature of *Kanji* was increased after quenching of Iron fillings into it. *Kanji* became viscid and slimy after *Shodana.*
2.	*Kanji*	748g	30 min		
3.	*Kanji*	745g	28 min		

Table 2: Tabulation of changes observed during the *Nirvapa* in *Takra.*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Takra*	745g	28 min	*Loha* took comparatively less time to become red hot. Colour of *Loha* turned black. *Loha* turned brittle. Some part of *Loha* turned into coarse powder form. Prominent	Foul smell was felt during quenching. Colour of the media changed from white to greyish. *Takra* came out from the vessel while quenching. *Takra* split
2.	*Takra*	740g	26min		
3.	*Takra*	738g	24min		

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				cracks were observed on the surface of Iron fillings.	into solid and liquid parts during quenching and solid part settled down at the bottom of the vessel.

Table 3: Tabulation of changes observed during the *Nirvapa* in *Kulatha Kwatha.*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Kulatha Kwatha*	738g	20 min	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.	*Kulatha* smell was appreciated during quenching. Sound and fumes were more observed during *Nirvapa.* *Kulatha Kwatha* became brown to bluish brown in colour. Its consistency became thicker.
2.	*Kulatha Kwatha*	735g	20min		
3.	*Kulatha Kwatha*	729g	16min		

Table 4: Tabulation of changes observed during the *Nirvapa - Gomutra*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Gomutra*	725g	14min	Iron filings were turned in to *Loha Churna, Churna* turned finer. *Loha* was dark brown in colour *Loha* took considerably less time to become red hot. *Gomutra* smell was appreciated in *Loha.* *Loha* was more brittle	*Gomutra* colour changed from light yellow to dark brown. Comparatively more Sparkles were observed during quenching. A pungent smell was coming out during quenching. Media took longer time for cooling.

Table 5: Tabulation of changes observed during the *Nirvapa-Tila Taila*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Tilataila*	719g	10 min	Colour of *Loha* was completely black. Metallic lustre of *Loha* was lost. *Loha* got	Colour of oil turned light brown in colour. Oil became viscid after *Shodana*. A pungent smell and
2.	*Tilataila*	744g	13min		

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3.	*Tilataila*	742g	16min	fire while heating. 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.	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.

Results

- Total Quantity - 750g.
- Loss - 180g.
- Quantity after *Shodana* - 600g.

Name of the Practical: *Vishesha Shodana* of *Loha*

Reference: *R.T 20/15*

Date of Preparation: 01/02/2019

Date of Completion: 15/02/2019

Instruments

- Iron vessel
- Steel vessel
- Spatula
- Cloth
- Gas stove
- Strainer

Ingredients

- *Shoditha Loha Churna : 600* gm
- *Triphala Kashaya :* 14 liters

Procedure

- Same as *Samanya Shodana* of *Loha* (*Nirvapa* in *Triphala Kashaya* 7 times)

OBSERVATIONS

Table 6: Tabulation of changes observed during the *Nirvapa - Tripahala Kwatha*

SN	*Nirvapa Dravya*	Loss after each *Nirvapa*	Time taken for red hot	Changes in *Loha*	Changes in media
1.	*Triphala*	600g	17m	A reddish texture was observed over *Loha* during red hot state. A crackly 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 decoction turned blackish brown. *Kashaya* started to boil during quenching. *Kashaya* overflowed from the vessel.
2.	*Triphala*	593	15m		
3.	*Triphala*	587	12m		
4.	*Triphala*	574g	10m		
5.	*Triphala*	560g	10m		
6.	*Triphala*	542g	8m		
7.	*Triphala*	536g	7m		

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				Colour of *Loha* turned blacker.	

Precautions

- Similar to *Samanya Shodana* of *Loha*.

Results

Total Quantity - 600g.

Loss - 64g.

Quantity after Vishesha *Shodana* - 536g.

Results

Physical changes observed in *Loha*

Table 1: Changes observed in *Loha*

SN	Properties	*Samanya Shodhana*	*Vishesha Shodhana*
1.	Colour	Black	Brown
2.	Touch	Softer	Softest
3.	Nature	Brittle	More brittle
4.	Consistency	Fine powder	Very fine
5.	Total no. of *Nirvapa*	15	15+7

Analysis of Iron

Table 2: Analysis report of Raw iron by ICP-OES

SN	Parameters	Values(%)
1.	Carbon	0.18
2.	Silica	0.20
3.	Sulphur	0.07
4.	Manganese	0.05
5.	Iron	99.5

- The raw Sample of Iron had Carbon, Silica, Sulphur and Manganese as an impurity in a trace quantity.

Table 3: Analysis report of *Samanya Shodita Loha* by ICP-OES

SN	Parameters	Values(%)
1.	Carbon	0.57
2.	Silica	0.12
3.	Sulphur	ND
4.	Manganese	0.03
5.	Iron	99.28

- The *Loha* After *Samanya Shodhana* had Carbon, Silica, Manganese as a trace elements.

Table 4: Analysis report of *Vishesha Shodita Loha* by ICP-OES

SN	Parameters	Values(%)
1.	Carbon	0.61
2.	Silica	0.12
3.	Sulphur	ND
4.	Manganese	0.02
5.	Iron	99.25

- The *Loha* after *Vishesha Shodana* had Carbon, Silica, and Manganese as trace elements.

The Process of Loha Samanya Shodhana

Media - Kanji

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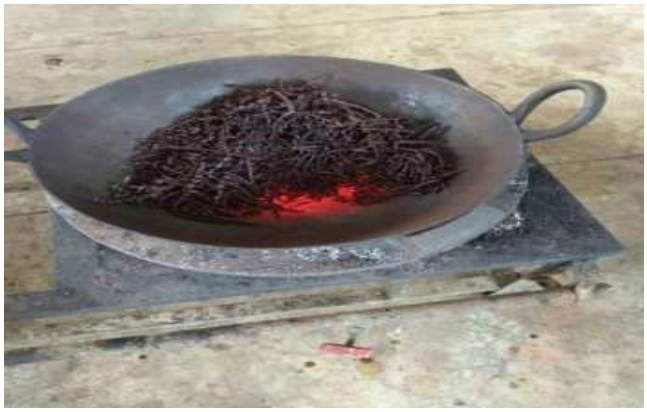

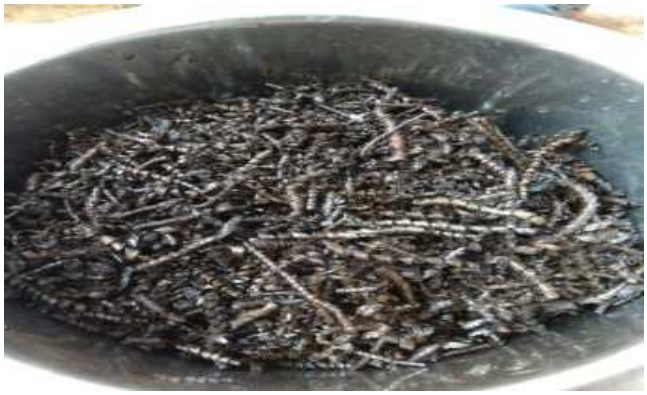

Media - Takra

Media - Kulatta Kwatha

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Media - Gomutra

Media - Tila Taila

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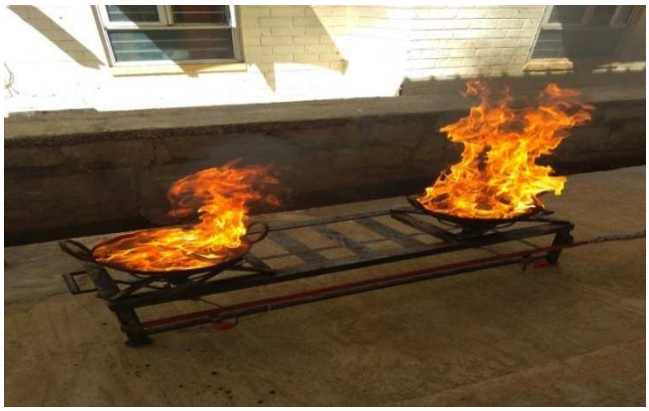
The Process of Loha Vishesha Shodhana - Triphala

Media - Triphala Kwatha



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DISCUSSION

Role of *Nirvapa* Procedure

This process was performed in two phases, in first phase Iron was heated up to red hot state on strong heat, and in second phase, the red hot iron was quenched in liquid media. These heating and quenching are repeated for specific times and in particular media.

First Phase: Phase of heating

In this phase, iron fillings were heated in a iron vessel on a high temperature to the complete red hot state of the metal. Heat is the most important phenomenon. Because, for the transformation of state of matter heat is most essential for every processing, a particular heating pattern is indicated. This pattern of heating must be followed to achieve the desired change in the matter.

Second phase: Phase of quenching

In this phase, the red hot filings of the iron are quenched in specific liquid media. The quenching must be immediate, because to achieve the desired changes in the metal sudden cooling in needed. The change in the structure of the matter depends on intensity of heat and mode of cooling. The changes in instant cooling must happen faster than that of slow cooling. So after heating of the metal, it should be quenched in the particular liquid media instantly.

Role of Media

Particular liquid media are used in *Shodhana* process of specific materials. For the *Shodhana* of *Dhatus* generally *Tila taila, Takra, Gomutra, Arnal / Kanji* and *Kulatha Kwatha* are used. These media may have particular functions in purification and detoxification of metals. All these liquid medias act as cooling media during process of *Nirvapa*, this may serve a favourable atmosphere to the material for occurrence of particular chemical reaction and compound formation. These may enter through the cracked surface of the material and cause film coating and further heating leads to breaking of the material. They may also act as source of inorganic traces.

Discussion on Results

- From table no 1, 2 and 3, it was observed that carbon percentage was increased after each *Shodhana*.
- It was evident from the results obtained that sulphur was not detected after *Samanya Shodhana*. This might be because sulphur might have oxidized due to repeated heating procedure.
- The trace elements like silica and manganese were persisting even after the *Vishesha Shodhana* but with gradual decrease in percentage.
- Percentage of Iron was almost constant throughout the *Shodhana* procedures.

CONCLUSION

Shodhana plays a pivotal role in removing the impurities and imparting qualities to the drug. From *Samanya* and *Vishesha Shodhana* of *Loha* it is evident that the particle size was reducing drastically after each procedure making it more brittle and fine. The evident colour change was observed during *Vishesha Shodhana* of *Loha* which was done with *Thiphala Kwatha*. There were many changes observed from the raw sample of *Loha* to the *Vishesha Shodhita Loha* physically and analytically. Thus importance of *Shodhana* is apparent.

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