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PREPARATION AND PHYSICOCHEMICAL CHARECTERIZATION OF MANDOOR BHASMA

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ABSTRACT

Mandoor bhasma is famous ayurved formulation. It also called as Iron slag. As it has iron as a main component it can be used in Anaemia. In herbomineral formulation such as Punarnava Mandoor, Taramandoor, Shatavarimandoor are some famous formulation of Mandoor bhasma. To have a standard quality of Mandoor bhasma and its mechanism of action we have to rule out its physicochemical properties so in present work preparation and physicochemical properties of Mandoor bhasma studied.

KEYWORDS: Mandoor bhasma, Anaemia, Punarnavamandoor, Taramandoor, Shatavarimandoor.

1. INTRODUCTION

Mandoor bhasma is prepared by various methods according to different granthadhar. In different process there is some different chemical characterization and action. So there is important to study to rule out chemical changes after shodhan and maran of Mandoor with particular method. During preparation there will be chances of contamination of various chemicals like Arsenic, Lead, Silica, Mercury etc. which causes toxic effect on body so there is need to take proper precaution during preparation of Mandoor Bhasma. Because of standard preparation methods, Mandoor Bhasma becomes harmless to body and it can be used in various therapeutic uses like *Anaemia, Shoth, Kamala, Plihavruddhi* etc. In combination with various herbal medicines in various formulations like *Punarnava Mandoor, Taramandoor, Sudhanidhi Ras* etc., it is effective in various diseases. So In present study three samples of Mandoor Bhasma prepared according to Rasatarangini Granthadhar and its detail study regarding its physical and chemical properties is carried out. Traditional and Modern analytical tests also applied during study.

2. AIMS AND OBJECTIVES

A. Aims

1. Preparation of Mandoor bhasma.
2. To study its physico-chemical analysis.

B. Objectives

1. To study physico-chemical properties of Mandoor Bhasma.

3. MATERIALS AND METHODS

Study design: The Prime aim of pharmaceutical study was to prepare standard quality of Mandoor Bhasma by stated method. Study design conducted in following steps.

1. Collection of Raw drugs
2. Authentication of Raw drugs
3. Proper methods of shodhan and Maran for Bhasma as per Rasatarangini.
4. Quality control and Analysis of Finished Product.

A) MATERIALS

3.1 Collection of Raw drugs

a) Major raw drug - Mandoor

b) Associated raw drugs - Gomutra (Fresh cow urine), Triphala Bharad

3.2 Authetication of Raw Drug

Major raw drug

Mandoor

Mandoor collected from local market and authenticated according to its Grahya agrahya lakshanas mentioned in Rasa text.[1]

- Grahya Lakshana of Mandoor- Snigdha, Guru, Drudha, Krishna Varna.
- It should not be porous.
- More than hundred year old.
- Collected from old place.

Physical properties of Mandoor

- Nature : Rough lumpy masses, exhibiting volds
- Colour: Black
- Streak: Black
- Cleavage:None
- Fracture: Conchoidal

- Lustre: Dull
- Tenacity: Brittle but hard
- Transparency: Opaque
- Magnetism: Non-magnetism

Chemical Properties of Raw Mandoor: Heavy metal % in Raw Mandoor by AAS (Atomic absorption spectroscopy) method.

Table no. 1: Heavy metal in Raw Mandoor.

Name of element	Iron% w/w	Arsenic in ppm	Cadmium in ppm	Zinc in ppm
Result	38 .97 %	6.29	1.26	44
As per AFI	>30 %	<6	<8	<50

Associate raw drugs

a) Gomutra

It was collected early in morning and filtered through cotton cloth and used within 6 hours for Shodhan of Raw Mandoor.

b) Triphala

Triphala Bharad collected from local market authenticate by Dravyaguna experts which were used for kwath preparation during Maran process. Foreign matter such as soil, stone, organic material removed from Triphala bharad.

B. METHODS

Schematic presentation of preparation of Mandoor bhasma

Raw Mandoor
|
Shodhan in Gomutra (Fresh cow urine)
|
Bhavana with Triphala Kwath
|
Chakrika preparation
|
Sharav sampootikaran
|
Gajputa
|
Mandoor Bhasma

3.3 Preparation of Mandoor bhasma

Practical no. 1

Mandoor shodhan[2]

Ingradients: Ashuddha Mandoor, Fresh Gomutra (Fresh cow's urine)

Equipments: Iron vessel, Iron laddle, stainless steel container, Spatula, Gas burner with L.P.G. cylinder.

Procedure

1. The Raw Mandoor (600 gm) in churna form was taken in a big Iron vessel.
2. It was heated till churna turned into red hot state.
3. Red hot Mandoor was carefully quenched into fresh Gomutra filled vessel.
4. Mandoor was kept in Gomutra upto swangshita.
5. After Swangshitikaran Gomutra was removed and Mandoor was kept in sunlight for drying in stainless steel container.
6. Above procedure was repeated for 7 times.

Precaution taken during Shodhan

- The Iron vessel was inert and clean.
- Iron vessel was not reacted with the material during heating.
- Heating was done upto complete red hot state of metals.
- Red hot material quenched immediately.
- After quenching, materials allowed to cool in liquid media for some time.
- Specified times of heating and quenching was followed.
- Amount of Gomutra was sufficient that the Mandoor dipped completely.
- Size and shape of equipments of heating and cooling was proper, Laddle for heating was flat, rounded and wide in shape, vessel for cooling were of wide mouth and deep enough.

Practical no. 2

Mandoor Maran[3]

Ingredients: Shuddha Mandoor, Triphala bharad, Potable water.

Equipments: Khalwayantra, weighing machine, Lauha patra (Iron vessel), Stainless steel container, Spatula, Measuring flask, Sharava, Vanyopala (Cow dung cakes), Glass vessels, Gas stove, Multani mitti, Muslin cloth, Knife, Sharavas, Stirrer, Pyrometer, Puta-yantra etc.

Procedure

Step 1 st

1. 500 gm Triphala Bharad soaked in potable water for overnight.
2. Triphala kwath prepared by boiling 4 litre potable water with 500 gm of Triphala bharad and boil till kwath becomes 1/8 th of water.
3. Kwath poured through Muslin cloth and collected.
4. Approximate 500 ml of Triphala kwath obtained.

Step 2 nd

1. Mixture of Triphala Kwath and Shodhit Mandoor taken in Khalwayantra for Bhawana.
2. For 500 gm of Shodhit Mandoor approximate 500 ml of Triphala kwath used.
3. Bhavana process given for 8 to 12 hours. When Mixture becomes paste like consistency Chakrikas were made from whole mixture.

4. Chakrikas of approximate 5 to 6 cm in diameter and 0.5 cm in thickness were made and kept for drying for 2 day.
5. Dried Chakrikas placed in Sharava and covered by another Sharava then Sandhibandhan was done with the help of Mat-kapad i. e. cotton cloth with lepan of Multani mitti. Mruttika lepan done all over sampoot. Sharava sampoot allowed for drying upto one day.
6. Tank measuring 75 cm (l x bxh) which considered as our Institutional standard for Gajputa was used. Average of 150 cow dung cakes, each weighing approximate 300 gm with approximate 20 cm diameter and 3 cm thickness at the centre were used.
7. Dried Sharava sampoot were placed in Puta having approximate 100 Vanyopalas below and approximate 50 Vanyopalas (approximate average wt. 300 gm each) above the Sharava Sampoot**.**
8. Then Fire was ignited from bottom. Time and temperature was recorded.
9. After Swangshitikaran the sharava was removed from Puta on next day.
10. Chakrikas placed in Sharava were collected carefully and taken in Khalwanyantra for next Bhavana of Triphala kwath and further maran process was carried out.
11. After each Puta Traditional method of Bhasma pariksha was carried out.
12. Maran process continued till Bhasmapariksha obtained.
13. This method was common for all three sample of Mandoor Bhasma.
14. Bhasma Pariksha occured in three sample of Mandoor Bhasma on average after 12th Puta.

Precautions

a) During Triphala Kwath

1. Foreign Matter removed from Triphala Bharad.
2. Triphala Bharad soaked for overnight in potable water.
3. Clean Stainless steel cointainer used for kwath preparation.
4. Mixture of potable water and Triphala bharad boiled till it becomes 1/8th of water.
5. Continuous stirring of kwath done to avoid burning of its Kwath Dravya.
6. Kwath removed carefully from container.

b) During Bhavana of kwath to Mandoor

1. Shodhit Mandoor and Triphala kwath were mixed properly.
2. Continuous bhavana of Triphala kwath given to Mandoor for 7 to 8 hours, upto its consistency becomes semisolid.

c) Put Procedure [4]

1. Vanyopala i. e. Cow dung cakes approximately of equal size and weight were used.
2. Vanyopala kept approximate 100 below sharav sampoot i. e. 2/3 and approximate 50 above sharav sampoot i. e. 1/3 of total vanyopala.
3. It was ignited from bottom.
4. Temperature of Put recorded carefully with the help of Pyrometer.
5. It was kept for 1 day for swangshit.
6. Material was collected carefully after incineration on next day.
7. Sharav from sampoot separated carefully to avoid mixing of foreign matter in incinerated matter.
8. Weight of Incinerated matter recorded carefully.

4. OBSERVATIONS AND RESULTS

4.1 Shodhan of Mandoor

a) Gomutra (Fresh cow urine)

1. When Mandoor became red hot it quenched in Gomutra.
2. Gomutra started to boil after quenching.
3. Gomutra Gandhi odour was smelt during quenching of Mandoor.
4. Colour of Gomutra changes from Light orange yellow to Brown during shodhan

b) In Mandoor

1. During heating Mandoor bursted and jumped out from laddle.
2. During red hot state small particle accumulate together to form mass which disintegrates after quenching.
3. Colour of Mandoor became brown to black.
4. It tooks average time 20 minutes for Red hot.

Table no. 2: Showing weight loss of Mandoor and physical changes in Mandoor during process of Shodhan

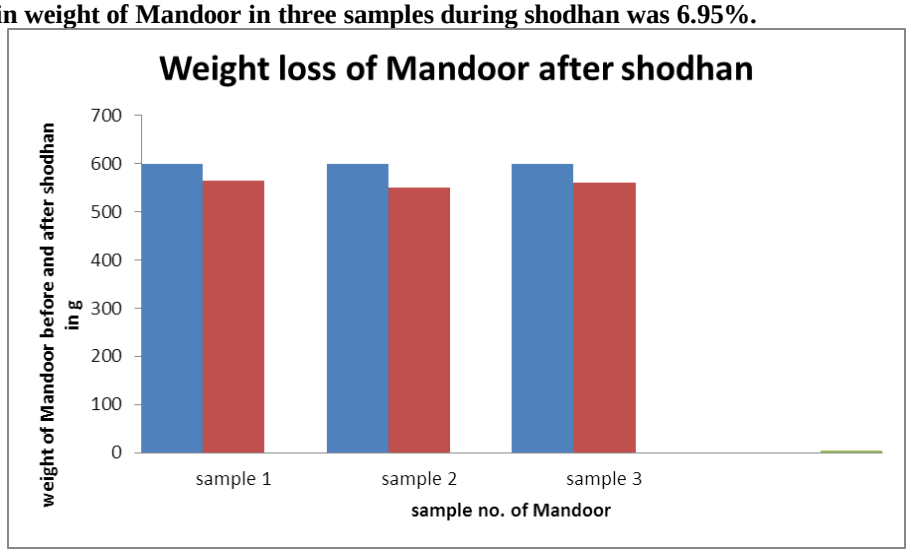
No. of Shodhan	Batch	Weight before shodhan in g	Weight after shodhan in g	Weight after drying in g	Colour before shodhan	Colour after shodhan	Consistency before shodhan	Consistency after shodhan
1.	S1	600	620	595	Brick red	Blackish red	Metallic solid	Metallic solid
	S2	600	610	590	Brick red	Blackish red	Metallic solid	Metallic solid
	S3	600	610	590	Brick red	Blackish red	Metallic solid	Metallic solid
2.	S1	595	610	590	Blackish red	Blackish red	Metallic solid	Metallic solid
	S2	590	600	585	Blackish red	Blackish red	Metallic solid	Metallic solid
	S3	590	595	580	Blackish red	Blackish red	Metallic solid	Metallic solid
3.	S1	590	605	585	Blackish red	Blackish red	Metallic solid	Metallic solid
	S2	585	590	580	Blackish red	Blackish red	Metallic solid	Metallic solid
	S3	580	585	575	Blackish red	Blackish red	Metallic solid	Metallic solid
4.	S1	585	600	580	Blackish red	Blackish red	Metallic solid	Metallic solid
	S2	580	590	570	Blackish red	Blackish red	Metallic solid	Metallic solid

	S3	575	585	570	Blackish red	Blackish red	Metallic solid	Metallic solid
5.	S1	580	590	580	Blackish red	Blackish red	Metallic solid	Metallic solid
	S2	570	575	565	Blackish red	Blackish red	Metallic solid	Metallic solid
	S3	570	580	565	Blackish red	Blackish red	Metallic solid	Metallic solid
6.	S1	580	595	575	Blackish red	Black	Metallic solid	Metallic solid
	S2	565	570	560	Blackish red	Black	Metallic solid	Metallic solid
	S3	565	570	560	Blackish red	Black	Metallic solid	Metallic solid
7.	S1	575	580	565	Black	Black	Metallic solid	Metallic solid
	S2	560	565	550	Black	Black	Metallic solid	Metallic solid
	S3	560	570	560	Black	Black	Metallic solid	Metallic solid

Table no. 3: Loss in Weight of Mandoor after shodhan process.

Sample. No.	Weight before shodhan in g	Weight after shodhan in g	Loss in weight of Mandoor in%
Sample 1	600	565	5.84%
Sample 2	600	550	8.34%
Sample 2	600	560	6.67%

Average of loss in weight of Mandoor in three samples during shodhan was 6.95%.



"Fig.1" Weight loss of Mandoor after shodhan.

Average of loss of weight in three sample of Mandoor in shodhan process was 6.95%.

4.1 MARAN OF MANDOOR

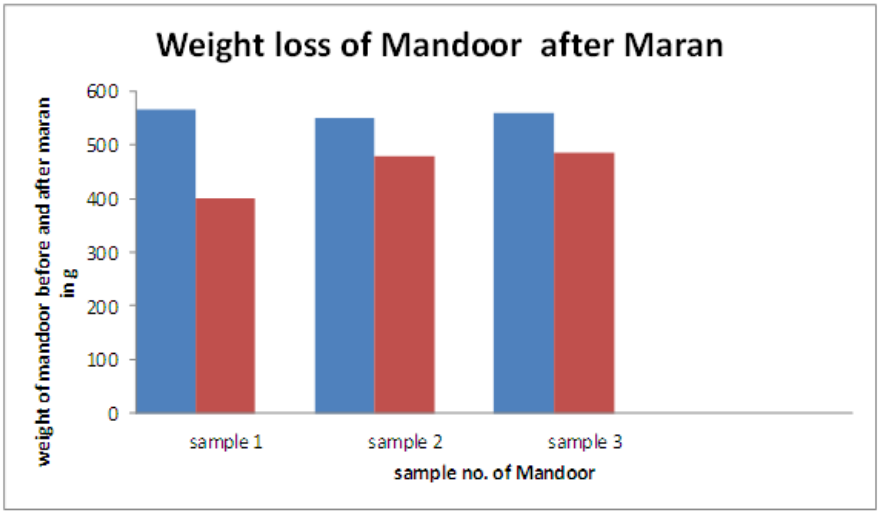
Table no. 4: Loss in weight of Mandoor in three samples after maran process

Sample no.	Weight before maran in g	Weight after maran in g	Loss of Mandoor after maran in %
Sample 1	565	400	29.21%
Sample 2	550	478	13.1%
Sample 3	560	485	13.4%

Table no. 5: Average of weight loss in three sample of Mandoor during Maran.

Sample No.	Loss in weight during maran of Mandoor
Sample 1	29.21%
Sample 2	13.1%
Sample 3	13.4%
Average of weight loss during Maran	18.57%

Average of loss in weight of Mandoor during maran in three samples was 18.57%.



"Fig. 2" Weight loss of Mandoor after Maran.

Average of loss in weight of Mandoor during maran in three samples was 18.57%.

4.3 Average Findings during each Put of three samples of Mandoor.

Puta -1 st

1. Blackish brown course powder of Mandoor became black paste after Bhavana.
2. No Course granules were observed after Bhavana.
3. Metallic shining was observed after Bhavana on the surface of Chakrika.
4. Colour of Mandoor became black after incineration.
5. Chakrika became hard after puta.

Puta – 2 nd

1. Colour of Mandoor becomes black after bhavana.
2. Mandoor became black after incineration.
3. Chakrika became hard after puta.

Puta – 3 rd

1. Colour of Mandoor became black after bhavana.
2. Shining still appeared.
3. Mandoor became black after incineration.
4. Chakrika were hard in consistency after incineration.

Puta – 4th

1. Colour of Mandoor became black after bhavana
2. Shinng still appeared.
3. Mandoor became blackish red after incineration.
4. Chakrika were hard in consistency.

Puta- 5th

1. Colour of Mandoor becames blackish red to black after bhavana.
2. Shining still appeared.
3. Mandoor became blackish red after incineration.
4. Chakrika were hard in consistency.

Puta – 6th

1. Colour of Mandoor became blackish red to black after Bhavana.
2. Mandoor became blackish red after incineration.
3. Metallic shining on the surface of Chakrika were still observed.
4. Chakrika were hard in consistency after incineration.

Puta – 7th

1. Colour of Mandoor became blackish red to black after bhavana.
2. Metallic shining observed.
3. Mandoor became brown after incineration.
4. Chakrika were hard in consistency after incineration.

Puta – 8th

1. Mandoor became light brown to black after bhavana.
2. Metallic shining disappeared.
3. Mandoor became light brown after incineration.
4. Chakrika became soft in consistency after incineration.

Puta – 9th

1. Mandoor became light brown to blackish red after bhavana.
2. No metallic shining observed.
3. Mandoor became brown after incineration.
4. Chakrika were soft in consistency after incineration.

Puta – 10th

1. Mandoor became brown to blackish red after bhavana.
2. No metallic shining observed.
3. Colour of Mandoor was remained dark red after incineration.
4. Chakrika become soft after incineration.

Puta – 11th

1. Mandoor became slight brownish in colour after bhavana.
2. No metallic shining observed.

3. Colour of Mandoor was remained brik red after incineration.
4. Chakrika become soft after incineration.

Puta – 12th

1. Mandoor became slight brownish after bhavana
2. No metallic shining observed.
3. Mandoor became brik red after incineration.
4. Chakrika became soft after incineration.

Temperature

Average of maximum temperature obtained during each Puta was 700^0 C.

Table no. 6: Putwise Bhasmapariksha during Mandoor Maran in three sample of Mandoor.

Puta no.	Batch	Chandrika	Rekhapurnatva	Varitartva	Niswadu
1.	S1	++++	-	-	-
	S2	++++	-	-	-
	S3	++++	-	-	-
2.	S1	++++	-	-	-
	S2	++++	-	-	-
	S3	++++	-	-	-
3.	S1	++++	-	-	-
	S2	++++	-	-	-
	S3	++++	-	-	-
4.	S1	+++	-	-	-
	S2	+++	-	-	-
	S3	+++	-	-	-
5.	S1	+++	-	-	-
	S2	+++	-	-	-
	S3	+++	-	-	-
6.	S1	+++	+++	-	-
	S2	+++	+++	-	-
	S3	+++	+++	-	-
7.	S1	++	+++	-	-
	S2	++	+++	-	-
	S3	++	+++	-	-
8.	S1	-	+++	-	-
	S2	-	+++	-	-
	S3	-	+++	-	-
9.	S1	-	+++	-	✓
	S2	-	+++	-	✓
	S3	-	+++	-	✓
10.	S1	-	++++	-	✓
	S2	-	++++	-	✓
	S3	-	++++	-	✓
11.	S1	-	++++	+++	✓
	S2	-	++++	+++	✓
	S3	-	++++	+++	✓
12.	S1	-	++++	++++	✓
	S2	-	++++	++++	✓
	S3	-	++++	++++	✓

Table no.7: Organoleptic properties of Mandoor Bhasma.

Sr no.	Parameter	Sample 1	Sample 2	Sample 3
1.	**Shabda**	No metallic sound on crushing between teeth	No metallic sound on crushing between teeth	No metallic sound on crushing between teeth
2.	**Sparsh**	Smooth (no coarseness)	Smooth (no coarseness)	Smooth (no coarseness)
3.	**Rupa**			
a.	Colour	brick red	brick red	brick red
b.	Nishchandratva	No metallic luster	No metallic luster	No metallic luster
c.	Rekhapurnatva	Fill the space in between the finger lines	Fill the space in between the finger lines	Fill the space in between the finger lines

d.	Varitartva	Floats on water	Floats on water	Floats on water
4.	**Ras**	Tasteless	Tasteless	Tasteless
5.	**Gandha**	Not specific	Not specific	Not specific

4.4 Comparative physical properties of Mandoor in different steps

Table no.8: Comparative Physical properties of Mandoor.

Sr. No.	Properties	Ashuddha Mandoor	Shuddha Mandoor	Mandoor Bhasma
1.	**Colour**	Brownish black	Black	Brick red
2.	**Form**	Oxide	Oxide	Oxide
3.	**Luster**	Metallic luster	Dull luster	Lusterless
4.	**Odour**	Odourless	Gomutragandhi	Odourless
5.	**Structure**	Hard massive	Course powder	Soft powder
6.	**Taste**	Metallic	Katu, Tikshna	Tasteless
7.	**Transparancy**	Opaque	Opaque	Opaque
8.	**Touch**	Hard	Hard	Smooth and soft

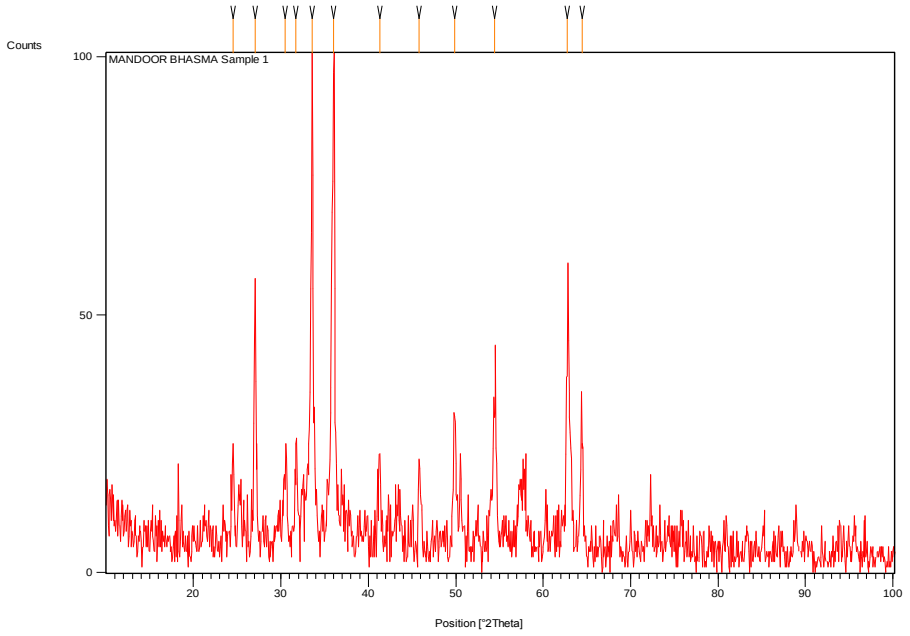
4.5 Analytical test of Mandoor Bhasma

Table no 9: Showing analytical tests of Mandoor Bhasma in three samples.

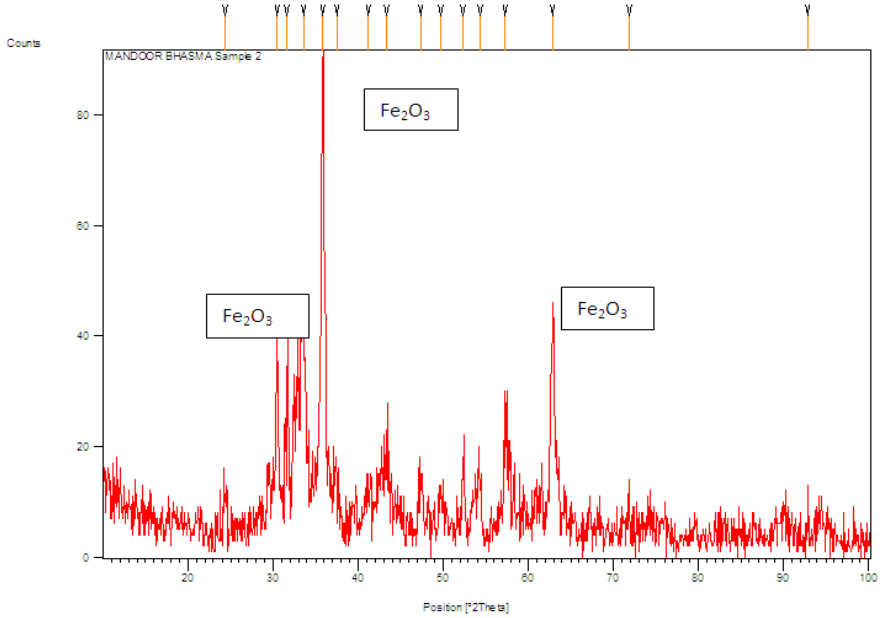
No. of Sample of Mandoor Bhasma	Loss on Drying at 110 ^{0} C	Ash value in %	Acid insoluble ash in %
Sample 1	0.5%	92.21%	37.12%
Sample 2	0.4%	91.42%	37.19%
Sample 3	0.2%	94.50%	37.10%

- **Showing results of X-ray diffraction of Mandoor bhasma in three samples.**

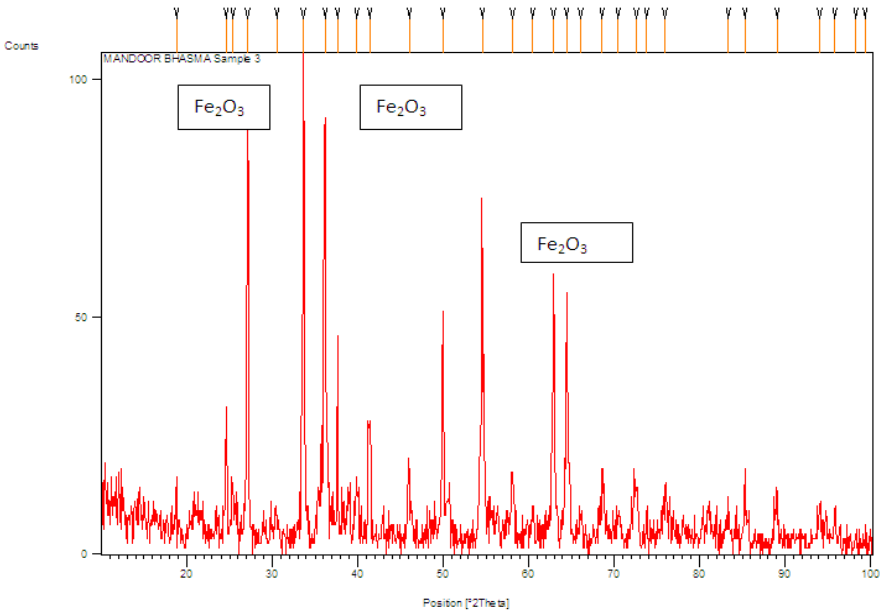
XRD graphs show that in all three sample of Mandoor Bhasma Ferrous oxide present. Peak of Fe_2O_3 present in major phase.



"Fig. 3": XRD of Mandoor Bhasma, Sample 1.



"Fig. 4": XRD of Mandoor Bhasma, Sample 2.



"Fig. 5": XRD of Mandoor Bhasma, Sample 3.

Table no. 10: Showing results of Heavy metals by AAS method in three sample of Mandoor Bhasma

Sample No.	Iron in %	Arsenic in ppm	Cadmium in ppm	Lead in ppm	Mercury in ppm
Sample 1	35.76%	1.8	0.3	8	0.995
Sample 2	39.96%	1.7	0.2	8.6	0.980
Sample 3	36.45%	1.8	0.2	8.4	0.970
As per API	35-40%	<3	<0.3	<10	<1%
Raw Mandoor	38.97%	6.29	1.26	-	-

5. DISCUSSION

5.1 Assessment of Mandoor shodhan in three samples. Reference from Rasatarangini was used for shodhan. Loss in weight of Mandoor during shodhan process in sample 1, sample 2 and sample 3 are 5.84%, 8.34%, 6.67% respectively. Its colour changed from brick red to Black. Due to Nirvapan in Gomutra after shodhan it has Gomutragandhi odour. After shodhan it has more brittleness. Results show in table no.12.

Role of Media: Shodhana of Mandoor in Gomutra is done according to Rasatarangini. It helps to remove unwanted properties of Mandoor that might be physical and chemical. It leads to purification and detoxification of metal and it becomes brittle.

Physical changes[5]: Metals are solid, crystal structure. Metals when heated, they tend to expand, so intermolecular spaces also increases, in this phase crystal structure lattice of the metals deform. The phenomenon in which a number of atoms occupy equilibrium positions of this kind in an aggregate form is known as the solid state of matter. The distance between such positions is called as inter atomic distance. Displacement of the equilibrium in either direction can be accomplished only by the application of force in some kind, and a solid structure resists either an inward force 'a compression' or an outward force 'a tension' to the extent that resistance to tension operates to prevent separation of the atoms of a solid, it is commonly known as the force of cohesions. By the application of force in the form of heat, the tension in matter is increased, causing increase in inter atomic distance. It is also called as linear expansion, immediate cooling in liquid media leads to decrease in tension and increase in compression force. Repeatition in heating and cooling results in compression tension equilibrium leads to increased brittleness. Reduction in hardness and finally reduction in the particle size. The sudden change in the temperature breaks the strong bonds to reduce the hardness and to increase the brittleness of Mandoor. During Red hot state some metals react with atmospheric oxygen and compounds are formed on the surface. Expansibility differs from metals to compounds on heating. So on repeated heating, cracks are seen on the surface leads to separation of compound part. The size reduction during shodhana by Nirvapa process, because all solids contain flaws and microscopic cracks. A flaw is any structural weakness that may develop into a crack under strain like heat. The weakest flaw in the particle determines its fracture strength. Usually the surface of particles is irregular. The applied force by the form of heat is initially taken on the high portion of the surface. As a result, high stress may be set up locally in the particles. The bonds at this place become weak, which may be responsible for creating flaws. The particle due to weakest flaw fractures most easily and produced largest possible pieces. In the next step by this way particle size is reduced.

Chemical changes: During red hot state of the metals and minerals volatile chemical impurities like Arsenic are removed completely. Some metals and minerals during red hot state react with atmospheric oxygen or steam and form chemical compound. So during red hot state immediate quenching in liquid media is important process, it provokes chemical reaction in the media whenever the materials remain red hot. As for examples iron when heated to red hot, reacts with atmospheric oxygen or steam to form ferroso-ferric oxide $(Fe_3O_4)_3$.

Highlights of shodhana of Mandoor

- During heating Mandoor bursted and jumped out from the laddle as Mandoor contain vacant space inside.
- Expansibility of air in Mandoor is not same on heating. Air expansion was more during heating and causes bursting of Mandoor pieces.
- Mandoor considered as rusted iron, which is Fe_2O_3 H_2O.
- When Mandoor was heated, it gets attached with the laddle, because evaporation of water portion from the surface of heating. Mandoor breaks into course particles and metallic iron part may be exposed. This iron part becomes ferroso-ferric oxide during heating i.e. red hot.
- On heating water part of the hydrated ferric oxide gets evaporated and only ferric oxide part remains, which is reddish brown in colour.
- Number of frequency of Nirvap procedure plays an important role in changing the form of Mandoor. Weight gain seen in Mandoor because of little amount of Gomutra is get absorbed in tapta Mandoor.
- Mandoor pieces became coarse powder after shodhan. After drying of shodhit Mandoor weight of Mandoor decrease.

5.2 Maran of Mandoor

- After the shodhan, Mandoor is subjected for Maran procedure.
- Maran was carried out with bhavana of Triphala kwath and the classical puta method of Gajputa.
- Metallic shining was observed on the surface of pellets upto 7 Puta on later Putas the shining disappeared.
- Mandoor is considered as rusted iron, it is already in compound form, yet the shinig observed because rust acts as a preventive measure also, oxide acts as a protective film, preventing further corrosion called passivity, so rusted iron is iron cover by a layer of hydrated ferric oxide.
- During shodhan, Mandoor broke into coarse powder so the iron part was exposed, causing shining in the pellets during Maran.
- Mandoor may be considered as a mixture of ferric oxide (Fe_2O_3) and other traces. Ferroso – ferric oxide was formed from the metallic iron part of Mandoor during Shodhana and Maran respectively, contribute a minute portion of Mandoor Bhasma.
- Presence of maximum portion of ferric oxide (red in colour) makes the Bhasma brick red in colour.
- During Putapaka the exposed metallic iron may be converted to ferroso-ferric oxide.
- Mandoor bhasma may be considered as combination of ferric oxide, ferroso ferric oxide, and other traces. Ferroso ferric oxide (Fe_3O_4) is strongly magnetic substances.

5.3 Assessment of putwise physical properties and weight loss in three sample of Mandoor Bhasma

Preparation of Mandoor Bhasma was done with the reference of Rasatarangini. In this study to prepare Mandoor bhasma in all three batch average 12 puta were required. Multiple changes were observed during this process. These changes were noted and analysed. Loss in weight of Mandoor during maran process in sample 1, sample 2 and sample 3 are 29.21%, 13.1%, 13.4% respectively. Colour of Mandoor bhasma changes from black to brick red. It has no metallic shinig. It becomes tasteless. Result shows in table no. 14, table no.15 and table no.16 respectively.

5.4 Matra(Dose) of Mandoor bhasma[6]

According to Rasatarangini (20/135).

Matra of Mandoor Bhasma: (1/4 ratti to 2 ratti (30-240 mg)). Variation in matra of Mandoor Bhasma given in many Granthas, hence due to inordinate variation of the dosage an average dose can be fixed on the basis of Dehabala, Rogabala, Agnibala and Doshabala etc.

Anupan: Generally it is given with Madhu but it may be given with suitable Anupanas according to disease.

5.5 Analytical study

5.5.1 Assessment of classical Bhasmapariksha in three sample of Mandoor Bhasma

In this research study three sample of Mandoor Bhasma prepared and was studied analytically. All three sample of Mandoor Bhasma follows classical parameter of Bhasma pariksha. Result shows in Table no. 19.

1. Rekhapurtva: This test signifies the particle size of Mandoor Bhasma. Mandoor bhasma passed this test in all three samples approximate after 9^{th} Puta. Due to procedure of Put it became very fine powder which entered into the furroes of finger easily.

2. Varitartva: By implementing this test we can know the absence of metallic part which might be left untreated during Maran procedure. Mandoor Bhasma in all three samples passed this test approximate after 12^{th} Puta. It shows that Mandoor bhasma is lighter than water.

3. Nishchandratv: This test was carried out for Mandoor bhasma. This test signifies the absence of any shiny metal particle in Bhasma. Mandoor bhasma in all three samples passed this test approximate after 6^{th} Puta.

4. Niswadu: This test shows absence of any organic material in Bhasma. Mandoor Bhasma in all three samples passed this test approximate after 9^{th} Puta.

5.5.2 Assessment of Loss on drying in three samples of Mandoor Bhasma.

The Value of loss on drying suggest of moisture content or amount of volatile content in given sample. Sample of Mandoor bhasma was tested for loss on drying. Very minute loss on drying of the Bhasma are indicated that presence of very little amount of moisture. Loss on drying value of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 0.5%, 0.4%, 0.2%. Result show in table no. 22. This shows that in all three samples of Mandoor Bhasma has less amount of moisture content.

5.5.3 Assessment of Ash value in three sample of Mandoor Bhasma

Ash value denotes presence of inorganic content of Bhasma. Very high Ash value in Bhasma is indicative of presence of very high inorganic content. Ash value of Mandoor Bhasma in sample 1, sample 2 and sample3 are 92.21%, 91.42%, 94.50%. Results show in table no. 22. Ash value denotes more % of inorganic content of Mandoor Bhasma in all three samples.

5.5.4 Assessment of Acid insoluble ash in three sample of Mandoor Bhasma

Acid insoluble ash is an indirect marker of digestibility of a substance. Lesser the Acid insoluble ash more is the digestibility of the substance. Thus, lower value of Acid insoluble ash implies higher bioavailability of the substance. Test for acid insoluble ash was carried out to evaluate the percentage of insoluble inorganic content of the Bhasma in dilute acid. Since a drug must first pass into solution before it can be absorbed, so the Acid insoluble ash test of Bhasma is therapeutically very important. It is intended to provide a step towards the evaluation of the physiological availability of the Bhasma. Acid insoluble ash of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 37.12%, 37.19%, 37.10%. Result show in table no.22. All three samples of Mandoor Bhasma show less value of Acid insoluble ash.

5.5.5 Assessment of XRD in three samples of Mandoor Bhasma.

All three samples of Mandoor Bhasma analyse by XRD method. On comparing XRD graph in three samples of Mandoor Bhasma with standard graph of Fe_2O_3 in literature results shows that in all three samples of Mandoor Bhasma peaks of Fe_2O_3 i. e. Ferrous oxide occurred in major phase. Which indicates oxidation process of iron occurs during Maran process which improves quality of Bhasma.

5.5.6 Assessment of heavy metals % by AAS method in three samples of Mandoor Bhasma.

In all three sample of Mandoor Bhasma Iron% is greater than 30%. Indicates it has more % of Fe_2O_3. The values of heavy metal % in all three sample of Mandoor Bhasma are less than heavy metals % value in Raw Mandoor. This indicates some chemical impurities removed in shodhan, maran samskara. Iron % of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 35.76%, 39.96%, 36.45% etc. Arsenic value in ppm of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 1.8 ppm, 1.7 ppm, 1.8 ppm. Cadmium value in ppm of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 0.3 ppm, 0.2 ppm, o.2 ppm. Lead value in ppm of

Mandoor Bhasma in sample 1, sample 2 and sample 3 are 8 ppm, 8.6 ppm, 8.4 ppm. Mercury value in ppm of Mandoor Bhasma in sample 1, sample 2 and sample 3 are 0.995 ppm, 0.980 ppm, 0.970 ppm. Result show in Table no. 23. All values are within limit as per API standard

6. CONCLUSIONS

The Overall analysis of physico-chemical characteristics in all three sample of Mandoor bhasma indicates that every step prescribed in classics for preparation of Bhasma is essential. In present study preparation and physicochemical analysis of Mandoor Bhasma with reference of Rasatarangini was done. In present research work on the basis of facts, observations and results of conceptual, pharmaceutical, analytical, pharmacological studies, it could be concluded that,

1. As per AFI, physico-chemical properties of Raw Mandoor analysed.
2. During procedure of Shodhan for Mandoor, Gomutra was used as Nirvapan media with the reference of Rasatarangini.
3. During shodhan process average of weight loss of Mandoor in three samples was 6.95%.
4. Colour of Mandoor changes from blackish red to black during Shodhan.
5. During Maran of Mandoor, Bhavana of Triphala kwath and Gajputa given to shodhit Mandoor with reference of Rasatarangini.
6. Average of loss in weight of Mandoor in three samples during Maran process was 18.57%.
7. As Mandoor was already formed by rusting of iron and due to shodhan, maran samskar it becomes more oxidized form i. e. Laghu so it becomes more effective in therapeutic uses.
8. All three sample of Mandoor Bhasma has less value of loss on drying which indicated in all three samples of Mandoor bhasma moisture content was in less quantity.
9. Ash value in all three sample of Mandoor bhasma was more which indicates it has more amount of inorganic content.
10. Acid insoluble ash values in all three samples of Mandoor bhasma was within range, which indicate it has good digestible property of GIT.
11. XRD analysis shows peaks of ferrous oxide were also more in numbers. XRD graph shows in all three samples of Mandoor Bhasma peaks of Fe_2O_3 in major phase. This indicates more oxidation process of iron takes place during Maran process.
12. In all three sample of Mandoor Bhasma Iron% greater than 30% which shows that it contain more % of Fe_2O_3.
13. On comparison of Heavy metal % value of all three sample of Mandoor Bhasma which are within limits as per API standards with heavy metal % value of Raw Mandoor shoes less value of heavy metal % in all three sample of Mandoor Bhasma than heavy metal % value of Raw Mandoor indicates that removal of Chemical impurities takes place during Shodhan and Maran Samskara.
14. All three sample of Mandoor Bhasma follows classical parameter of Mandoor Bhasma. Varitartva pariksha of Mandoor Bhasma indicates that it becomes more Laghu i. e. lighter than water.
15. Rekhapurnatva pariksha of Mandoor Bhasma indicates that the particle size of Bhasma so small that it accumulate in furrows of fingers. As lesser the particle size, action of molecule of drug is more effective in small doses. It made asseccible to GIT.
16. Nishchandratva pariksha of Mandoor Bhasma indicate abscence of metallic ion in Bhasma.
17. Niswadu pariksha of Mandoor Bhasma indicates absence of organic matter in Mandoor Bhasma.
18. Although classical parameters are fundamentally essential for assessment in quality of Bhasma, it also quantitatively evaluated by physico-chemical assessment as well.
19. This concluded that in present study “Preparation and Physico-chemical characterization of Mandoor bhasma” done with the reference of Rasatarangini to have a standard quality of drug of Mandoor bhasma.

7. REFERENCES

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