

Preparation and Analytical Study of *Rasa Marit Tamra Bhasma*

Research Article

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Abstract

Tamra Bhasma (TB) is an Ayurvedic medicine, prepared from Copper. It is used in Ayurvedic treatment for various diseases. Though several methods of preparation of *Tamra Bhasma* are found in Rasashastra classics, several difficulties occur during the preparation of a good-quality *Bhasma*. Aims and Objectives: To study the process of *Tamra Maran* by using *Rasa Bhasma(kajjali)* as intermediray media. To analyze the constituents of *Tamra Bhasma*. Materials and Methods: Pharmaceutical study- TB was prepared as per the classical guidelines. Analytical study- TB was subjected to various analytical tests like X-ray Diffraction. Results: Copper % was approximately 64% in Rasa maarit Tamra bhasma. Copper was present in sulphide form. Conclusion: *Rasa bhasma (kajjali)* is good media for maran of Tamra.

Keywords: Maran, Tamra, Rasa Bhasma, Tamra Bhasma, X-ray diffraction.

Introduction:

Science is a gradual evolution. It is not a sudden invention and Ayurveda as a science, is not an exception for it. The imperishable fundamentals of Ayurveda, which were laid down by the great acharyas of the olden days are still applicable because of their scientific eternal background. Such fundamentals must be subjected to scientific research not only to prove it's certainty but also to add something new to the existing knowledge.

Rasa kalpa have shown a miraculous effect even there, where the other medicines fail to provide remedy. Depending upon the various types of preparation, *Dhatu Bhasma* have been proved to be one among the most important and foremost type.

Tamra Bhasma (TB) is an Ayurvedic medicine, prepared from Copper. It is used in Ayurvedic treatment for various diseases. Though several methods of preparation of *Tamra Bhasma* are found in Rasashastra classics, several difficulties occur during the preparation of a good-quality *Bhasma*. In this study, TB was prepared by using *Rasa Bhasma*[1](*kajjali*) as an intermediary media and analyzed to develop the standard manufacturing procedure. After *maran* the prepared *Tamra Bhasma* was subjected to various analytical tests like X-ray diffraction

In this commercial world it is necessary to check the superiority/ inferiority of the *bhasma*. Accordingly a practical chemical knowledge is required to overcome this lacuna. Therefore a chemical analysis of *Rasa Marit Tamra Bhasma* is ultimately proposed here.

Aims and Objectives:

To study the process of *Tamra Maran* by using *Rasa Bhasma (kajjali)* as intermediary media.

To analyze the constituents of *Tamra Bhasma* prepared by using *Rasa Bhasma* as intermediary media.

Material and Methods:

The experiment was worked out as follows:

Pharmaceutical Study:

1. Collection of Raw materials
2. Preparation of Kanji
3. Preparation of Kulattha Kwatha
4. Shodhan – Parad, Gandhak, Tamra(samanya and vishesh)
5. Kajjali Preparation
6. Maran

Collection of Raw materials

All the ingredients were collected from the local market.

Preparation of Kanji [2]:

Reference	Sharangdhar Samhita Madhyam Khanda 10/12
Type of Procedure	Fermentation
Purpose	Samanya Shodhan of Tamra

Preparation of Kulattha Kwatha [3]:

Reference	Sharangadhara Samhit Madhyama Khanda 2/1
Type of Procedure	Kwatha (boiling)
Purpose	Samanya shodhan of Tamra

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4) Shodhan of Drugs:

Sr. no	Parad shodhan[4]	Gandhak shodhan[5]	Samanya shodhan of Tamra [6]	Vishesh shodhan of Tamra[7]
1.Reference	R.T. 5/31	R. T. 8/7-11	R.R.S 5/13	R.R.S 5/51
2.Type of procedure	Mardan	Dhalan	Nirvapa (heating and quenching)	Nirvapa (heating and quenching)
3.Purpose	For removing the impurities	For removing the impurities	For removing the impurities	Preparation of Tamra for Marana
4.Ingredients	Ashuddha parad- 750 gm Kumari Swaras- 750 gm Chitraka moola- 750 gm Raktasarshapa- 750 gm Brihati - 750 gm Triphala- 750 gm Water for decoction	Ashuddha Gandhak- 1000 gm Gogrit-250 gm Godugdha-q.s.	Raw Tamra – 300 gm Media : Til tail Takra Gomutra Kanji Kulatha kwatha q.s.	Samanya shodhit Tamra- 275 gm Saindhav – 150 gm Nimbu swarasa – q.s.

5] Preparation of Kajjali [8]:

Reference	Rasa Tarangini 6/107
Type of Procedure	Mardan
Purpose	for Maran of Tamra

6]Maran of Tamra [9]:

Sr. no	Rasa Marit Tamra Bhasma
Reference	R.R.S5/53
Type of procedure	Putapaka (incineration)
Drug for incineration	Kajjali
Ingredients	Shudha tamra – 200 gms Kajjali – 200 gms Bhavana dravya for marana - jambira nimbu swarasa
Groups	RMTB1 RMTB2 RMTB3

B] Analytical Study:

Ayurvedic parameters [10, 11]:

1.	Varitar	Floats on surface of water
2.	Rekhapurna	Fills the spaces in between finger lines
3.	Nischandra	Without metallic lustre
4.	Avami	Doesnot cause nausea
5.	Nirdhum	Burns without fumes
6.	Unnam	Rice grains floats on bhasma which is floating on water surface
7.	Sookshma	Very fine
8.	Shlakshna	Smooth
9.	Mridu	Soft
10.	Laghu	Light in weight
11.	Amla pariksha	Curd test

Physicochemical Study [12]:

- 1) Description
- 2) Identification/ Detection of elements
- 3) Successive Solubility in CS_2 , H_2O , HCl , Dilute HNO_3 , Aquaregia
- 4) pH in 1% and 10% sol
- 5) Conductivity in 1% and 10% sol
- 6) Loss on drying at $105^\circ C$
- 7) Loss on Ignition
- 8) Elemental Assay for S, SO_4 , Cu, Hg
- 9) XRD

1. Description:

Sr. No.	Samples	Colour	Odour	Taste	Texture
1	RMT B1	Bluish black	Odour-less	Taste-less	Smooth
2	RMT B2	Bluish black	Odour-less	Taste-less	Smooth
3	RMT B3	Bluish black	Odour-less	Taste-less	Smooth

2. Identification / Detection of Elements

a) Test for Sulphate:

About 0.5 gm of sample was taken into test tube and shake well. Then it was centrifuged and upper solution was treated with Barium chloride solution. White precipitate was obtained in all the three samples confirming the presence of sulphate.

b) Test for Sulphide:

About 0.5 gm of sample was taken in the test tube and was treated with dil HCl and little zinc dust. Evolution of the gas which turns lead acetate paper black confirms the presence of sulphide.

c) Mercury:

Filtrate obtained after treatment of the sample with Bromine and Nitric acid was treated with Charcoal. Filtered portion of the filtrate was treated with little aqueous Ammonia. Very little quantity of granular precipitate appeared which showed the presence of mercury in minor quantity.

3. Successive Solubility Determination:

a) Solubility in CS_2 :

Accurately weighed 500 mg of sample was taken in tarred sintered glass crucible. The crucible was kept in a 100 ml beaker. Ice was taken in 500 ml beaker and 100 ml beaker containing sintered glass crucible was kept in it. 4 to 5 ml of CS_2 was poured in the sintered glass crucible and covered with watch glass. Then it was shaken gently for few minutes and then sucked by filtration pump. It was dried in air and finally in oven at $105^\circ C$ and weighed. The process was repeated to constant weight.

b) Solubility in H_2O :

After above operation the crucible was kept again in 100 ml beaker and 20 ml of water was added in the crucible and 10 ml outside the crucible in the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Finally it was dried at $105^\circ C$ and weighed. The process was repeated till constant weight.

c) Solubility in dil. HCl:

After determination of solubility in water the crucible was kept in a 100 ml beaker and 10 ml of dil HCl was added in the crucible and 10 ml of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at $105^\circ C$ and weighed. The process repeated up to constant weight.

d) Solubility in dil. Nitric acid:

After above operation the crucible was kept in 100 ml beaker and 10 ml of dil Nitric acid was added in the crucible and 10 ml. of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at $105^\circ C$ and weighed. The process was repeated up to constant weight.

e) Solubility in Aquaregia:

After determination of solubility in dil Nitric acid the crucible was kept in 100 ml beaker and 5 ml of Aquaregia was added in the crucible and 10 ml. of water was added to the beaker. Then it was boiled for 10 minutes and sucked by filtration pump. Then dried in oven at $105^\circ C$ and weighed. The process was repeated up to constant weight.

4. pH (1%, 10% filtered solution)

0.5 gm and 5 gm of the samples were shaken gently in 40 ml of water for about $\frac{1}{2}$ hour, and then filtered. Thus filtrate of 1% and 10 % suspension was obtained. pH of filtrate was measured by pH meter after calibration of the electrode (Toschon – C154 instrument).

5. Conductivity (1%, 10% filtered solution)

0.5 gm and 5 gm of the samples were shaken gently in 40 ml of water for about $\frac{1}{2}$ hour, and then filtered. Thus filtrate of 1% and 10 % suspension was obtained. Conductivity of filtrate was measured by standardized electrode of conductivity meter (Systronic Conductivity Bridge 305).

6. Loss on Drying at $105^\circ C$

About 1 gm of sample was weighed in LOD crucible and dried at $105^\circ C$ and thereafter cooled in desiccators. Weighing, drying and cooling were repeated to constant weight. Percentage of Loss on drying was calculated.

7. Loss on Ignition:

About 1 gm of sample was weighed in tarred silica crucible and heated at temperature not exceeding $450^\circ C$, cooled it in desiccators and weighed. Heating and cooling was repeated to constant weight. Percentage of Loss on Ignition with reference to the air dried drug was calculated.

8. Elemental Assay:

A) Estimation of Sulphur:

Accurately weighed about 500 mg of Bhasma was treated with 3 ml mixture of Bromine in carbon tetra chloride (2:3). After 5 min. 5 ml of Nitric acid was added to it. Beaker covered with watch glass was allowed to stand for 15-20 min. The covered

beaker was then heated to 100°C till cessation of the action, then the cover was slightly displaced and it was heated to dryness. 5 ml of conc. HCl was added and heated to dryness in water bath. Then again 5 ml HCl was added and 40 ml warm water was added to it. It was again heated in water bath cooled for 5 min then it was filtered through cotton, rinsing the cover. Supernatant was separated and residue was washed repeatedly and was pooled together with the initial supernatant. Charcoal was added to it and warmed slightly with stopper at the mouth of flask. It was cooled. Then it was filtered and volume was made 100 ml with washings. 50 ml of the clear Blue solution was treated with 5 % Barium Chloride and HCl in excess. It was stirred well. The solution was allowed to stand and ppt obtain was filtered through Whatman number 42 paper and was washed thoroughly to remove Barium chloride. Then filter paper with residue was dried and ignited at 700 to 800°C in tarred Silica crucible to constant weight.

B) Estimation of Copper:

0.4 ml of the solution was taken from the solution left behind in sulphur estimation. 4.1 ml of water was added to it followed by addition of 0.5ml of Ammonia solution (1:1) and its O.D. was measured as 660nm.

1% Copper sulphate solution was used as standard the aliquot of 0.3, 0.4, 0.5, 0.6, 0.7 ml with water to make the volume 4 ml and followed by addition of 0.5ml of Ammonia solution (1:1) using water as blank.

C) Estimation of Sulphate:

About 5 gm each sample was taken. 25 ml water and 0.5 ml HCl was added to it. It was allowed to stand for 5- 10 mins with intermittent shaking. Then it was filtered and the residue was washed several times so that the volume goes to nearby 150-200 ml. Then add conc. HCl 1 ml and 200- 300 mg Alumimum powder. Shake well and then fioter it with washing 45 times. Add 2 ml conc. HCl and 5 % warm Barium chloride sol to the filterate in excess . it was allowed to settle down and clear supernatant was obtained and ppt was obtained. It was then filtered through Whatmaan no. 42 paper and washed thoroughly to remove BaCl₂. The paper was dried and ignited upto constant weight.

D) Estimation of Mercury:

A Trial of estimation of mercury in Rasa maarit Tamra Bhasma by H₂S gas did not leave behind any black ppt. After its treatment with hot dil Nitric acid shows that mercury is not present in sufficient quantity to be estimated in general.

9. XRD (X-ray diffraction or crystallography):

X-ray diffraction patterns were obtained using Shimadzu XRD 6000 diffractometer with Cu-KX a target with 40 KV voltage and 30 MA current. The X-ray diffraction of sample was matched against the standard reference spectra library.

Observation and Results:

Table 1: Puta wise observation of Rasa Marit Tamra Bhasma

No. of Pu-ta	Material added to Sh. tamra (kajjali) gandhak)	Colour	Con-sistancy	Chan-drika	Rek-hapurna tva	Varitar	Amla Parik-sha	Wt. ob-tained (g)	No. of cow dung cakes
1	Equal kajjali	Reddish black	Hard	++++	++	-	-	249	56
2	Equal kajjali	Reddish black	Hard	++++	++	-	-	235	50
3	Equal kajjali	Black	Brittle & smooth	+++	++	+	++	220	43
4	½ kajjali	Bluish black	Brittle & smooth	++	+++	+	++	205	30
5	½ kajjali + ½ gandhak	Black	More brittle	++	+++	++	++	199.8	23
6	¼ kajjali + ¼ gandhak	Bluish black	More brittle	++	+++	+++	+	206.4	15
7	¼ kajjali + ¼ gandhak	Bluish Black	More brittle & smooth	+	++++	+++	-	217	8

No. of Pu-ta	Material added to Sh. tamra (kajjali) gandhak)	Colour	Con-sistency	Chan-drika	Rek-hapurna tva	Varitar	Amla Pariksha	Wt. ob-tained (g)	No. of cow dung cakes
8	¼ kajjali + ¼ gandhak	Bluish Black	More brittle	+	++++	+++	-	222	10
9	¼ gandhak	Bluish black	More brittle & smooth	-	++++	++++	-	232	4
10	¼ gandhak	Bluish black	More brittle & smooth	-	++++	++++	-	217	4

++++ 100% +++ 75% ++50% +25% -0%

Table 2: Puta wise observation of Rasa Marit Tamra Bhasm2

Pu-ta no.	Material added to Sh. tamra (kajjali/ gandhak)	Colour	Con-sistency	Chan-drika	Rek-hapurn atva	Varitar	Amla Pariksha	Wt. ob-tained (g)	No. of cow dung cakes
1	Equal kajjali	Reddish black	Hard	++++	++	-	-	238	56
2	Equal kajjali	Reddish black	Hard	++++	++	-	-	224	50
3	Equal kajjali	Black	Brittle & smooth	+++	++	+	++	208	43
4	½ kajjali	Bluish black	Brittle & smooth	++	+++	+	++	214	30
5	½ kajjali + ½ gandhak	Bluish Black with yellowish tinge	More brittle	++	+++	++	++	220	23
6	¼ kajjali + ¼ gandhak	Bluish black	More brittle	++	+++	+++	+	229.4	15
7	¼ kajjali + ¼ gandhak	Bluish Black	More brittle & smooth	+	++++	+++	-	237	8
8	¼ kajjali + ¼ gandhak	Bluish Black	More brittle	+	++++	+++	-	251	10
9	¼ gandhak	Bluish black	More brittle & smooth	-	++++	++++	-	235	4

Table 3: Puta wise observation of Rasa maarit Tamra Bhasm3

Pu-ta no.	Material added to Sh. tamra (kajjali/gandhak)	Colour	Consistency	Chandrika	Rek-hapurna tva	Varitar	Amla Pariksha	Wt. obtained (g)	No. of cow dung cakes
1	Equal kajjali	Reddish black	Hard	++++	++	-	-	249	56
2	Equal kajjali	Reddish black	Hard	++++	++	-	-	235	50
3	Equal kajjali	Black	Brittle & smooth	+++	++	+	++	220	43
4	½ kajjali	Bluish black with yellow tinge	Brittle & smooth	++	+++	+	++	205	30
5	½ kajjali + ½ gandhak	Black	More brittle	++	+++	++	++	199.8	23
6	¼ kajjali + ¼ gandhak	Bluish black	More brittle	++	+++	+++	+	206.4	15
7	¼ kajjali + ¼ gandhak	Bluish Black	More brittle & smooth	+	++++	+++	-	217	8
8	¼ kajjali + ¼ gandhak	Bluish Black	More brittle	+	++++	+++	-	222	10

Analytical Study:
Organoleptic Parameters:
Rasa maarit Tamra Bhasma:

Parameter	RMTB1	RMTB2	RMTB3
A] Shabda	No metallic sound when crushed between teeth	No metallic sound when crushed between teeth	No metallic sound when crushed between teeth
B] Sparsha	No coarse particles by touch (Shlakshna)	No coarse particles by touch (Shlakshna)	No coarse particles by touch (Shlakshna)
C] Rupa 1. Colour 2. Susnigdham 3. Nishchandravam 4. Rekhapurnatva 5. Varitar 6. Unnam	Bluish Black Oleated in consistency No metallic lustre Filled the fine spaces between finger lines Floats on surface of water Grains of rice float on the Bhasma floating on water.	Bluish Black Oleated in consistency No metallic lustre Filled the fine spaces between finger lines Floats on surface of water Grains of rice float on the Bhasma floating on water.	Bluish Black Oleated in consistency No metallic lustre Filled the fine spaces between finger lines Floats on surface of water Grains of rice float on the Bhasma floating on water.
D] Rasa	Tasteless (Niswadu)	Tasteless (Niswadu)	Tasteless (Niswadu)
E] Gandha	No Specific	No Specific	No Specific
F] Curd Test	Passed after 72 hours	Passed after 72 hours	Passed after 72 hours

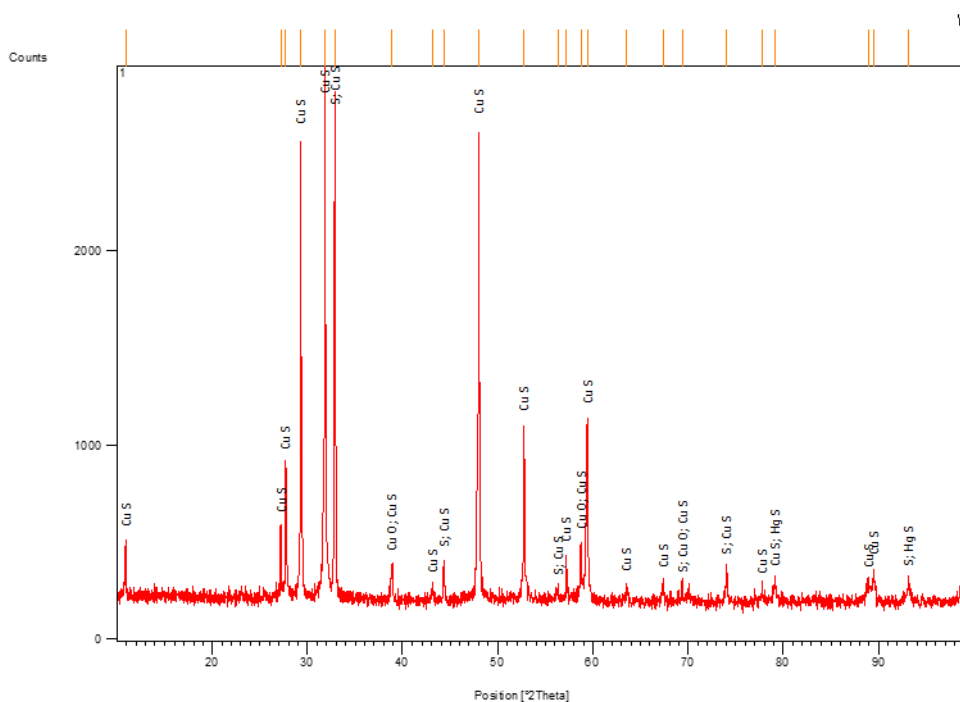
**Physiochemical Study:
Description of Rasa Marit Tamra Bhasma Samples:**

Sr.No.	Samples	Colour	Odour	Taste	Texture
1	RMTB1	Bluish black	Odourless	Tasteless	Smooth
2	RMTB2	Bluish black	Odourless	Tasteless	Smooth
3	RMTB3	Bluish black	Odourless	Tasteless	Smooth

Results:

Sr. no.	Analytical Tests	RMTB1	RMTB2	RMTB3
1.	solubility			
	<i>CS₂</i>	5.4%w/w	4.00%w/w	7.00%w/w
	<i>H₂O</i>	1.54%w/w	1.40%w/w	2.00%w/w
	<i>HCl</i>	3.06%w/w	4.60%w/w	6.00%w/w
	<i>HNO₃</i>	85.00%w/w	80.00%w/w	79.20%w/w
	<i>Aquqregia</i>	3.80%w/w	8.00%w/w	4.80%w/w
2.	pH			
	<i>1% solution</i>	3.81%w/w	3.61%w/w	3.72%w/w
	<i>10% solution</i>	3.14%w/w	2.77%w/w	3.10%w/w
3.	Conductivity			
	<i>1. 1% solution</i>	409.6 x 10 ² μmhos	608 x 10 ³ μmhos	531.2 x 10 ²
	<i>2. 10% solution</i>	2592 x 10 ³ μmhos	4288 x 10 ³ μmhos	3264 x 10 ³ μmhos
4.	Loss on drying	0.88%w/w	1.50%w/w	1.96%w/w
5.	Loss on Ignition	-2.20 %w/w	-2.70 %w/w	-0.50 %w/w
6.	Elemental Assay			
	<i>Estimation of S</i>	28.51%w/w	28.70%w/w	28.43%w/w
	<i>Estimation of Cu</i>	68.86%w/w	63.73%w/w	63.55%w/w
	<i>Estimation of SO₄</i>	0.3626%w/w	0.2549%w/w	0.3132%w/w

μmhos- micro mhos (unit of conductivity)

Qualitative tests:


Discussion:

During pharmaceutical study all the process involved in preparation were manual. Hence slight batch to batch variations were observed. Changes were made in the number of cow dung cakes, amount of kajjali and gandhak to be added as per requirement.

Parad maarit tamra bhasma :

Maran was done by using kajjali as media. The amount of kajjali was changed as per requirement. Changes were made in the number of cow dung cakes as per requirement. Colour variations were also observed in each puta. Colour difference was also seen in the same sharava due to temperature difference in the sharava samputa. Hence it is necessary to cover the sharavas uniformly with cow dung cakes to avoid such variations.

“Lohanam Maranam Srestham Sarvesham Rasa Bhasmanaj[13]”

The word *Rasa Bhasma* has always been in controversy. It is difficult to prepare the *Bhasma* of Hg (*Rasa*). Keeping in mind the sayings of Dr. D. A. Kulkarni, many *Rasa* preparations are considered as *Rasa Bhasmas*; such as –*Kajjali, Rasa Sindura, Rasakarpura, Hingula*, etc.

Here in the present context – *Kajjali* was taken, and considering this as *Rasa bhasmas*, the preparation of *Tamra Bhasma* was done.

Conclusion:

The following conclusions were made on the basis of observations and results obtained..

- Copper % was approximately 64% in Rasa maarit Tamra bhasma.
- Kajjali can be a better media for the preparation of Bhasma.
- Rasa maarit tamra bhasma requires less number of putas.
- Rasa maarit Tamra Bhasma can be prepared in relatively less duration.

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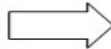
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PHARMACEUTICAL STUDY

1. PARAD SHODHAN:



i) ASHUDHA PARAD



ii) PARAD DURING SHODHAN



iii) PARAD AFTER SHODHAN

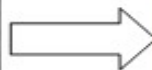
2. GANDHAK SHODHAN:



i) ASHUDHA GANDHAK



ii) DHALAN OF GANDHAK



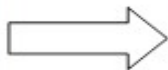
iii) SHUDHA GANDHAK

IN GODUGDHA

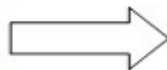
3. TAMRA SHODHAN:



i) ASHUDHA TAMRA



ii) NIRVAPAN OF TAMRA



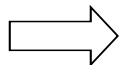
iii) SHUDHA TAMRA

TAMRA MARAN

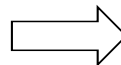
RASA MAARIT TAMRA BHASMA:



i) SHUDHA TAMRA



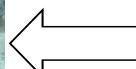
ii) JAMBIRA NIMBU
SWARAS BHAVANA



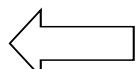
iii) CHAKRIKA
BEFORE PUTA



iv) SHARAVA



v) PUTA VIDHI



vi) CHAKRIKA AFTER PUTA

ANALYTICAL STUDY

AYURVEDIC PARAMETERS:



i) VIRITAR



ii) UTTAM



iii) REKHAPURNA



iv) NIRDHUM



v) CURD TEST

MODERN PARAMETERS:



i) L.O.D



ii) L.O.I



iii) SOLUBILITY



iv) pH



v) ASSAY FOR SULPHUR



vi) ASSAY FOR Cu



vii) ASSAY FOR SO₄
