

A Pharmaceutico-analytical study of Tuttha Satva

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ABSTRACT

The knowledge of Tuttha (Copper sulphate) was known to Indians, since early ages of medical practice. It is having the Rasayana, Emetic, Purgative, Blood purifying properties. Ashodhita Tuttha causes Vanti (vomiting) and Bhranti (mental illusion). So it should be used after Shodhana only. Various pharmaceutical procedures i.e. Shodhana (Purification), Marana (Incineration), Satvapatan (Extraction of metal from mineral) etc. converts deadly toxic mineral, metallic substances into safe and potent therapeutic agent. Tuttha satva has been mentioned as a source of Tamra (Copper). This paper aims to make available standard manufacturing process of Tuttha satva-patana. Satvapatna process performed by method described in *Rasa Tarangini*. 20 gm of satva was obtained from 120 gm of Tuttha mixture compound (Shodhita, Nirmalikrita and Pindikrita Tuttha). The prepared Satva's were subjected to qualitative and quantitative analysis. Tuttha satva have higher percentage of Cu 89% & Mn₂O₃ 11%.

KEYWORDS: Bhunaga, Satva, Essence, Satvapatana

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Introduction

Rasashastra is a branch of Ayurveda, which deals with a knowledge of alchemy (Lohavada) and Pharmaceutical process. Satvapatana is the most important and widely described topic. Satva denoted "purity, literally, existence, reality" and brightness. Satvapatana is an important process which applies after Shodhana. So various trace elements are added and molecular changes have been seen in the particular drug during the procedure of Shodhana to Satvapatana. To obtain the metallic part from the Minerals/Ores/Compounds with the help of Dravaka gana by strong heating in Koshthi (Specially prepared Fired place), here Satvapatana is Smelting process [1]. (R.T.2/32). According to rasaratna samucchya any mineral compound, animal origin or any ore is mixed and rubbed with the drugs prescribed in Kshara varga, Amla varga and Dravaka varga. Then it is kept in a closed crucible and heated intensively, in a kosthi (furnace). By this, the metallic essence portion of that compound can be obtained, which is nothing but Satva [2]. (R.R.S. 8/34). After Satvapatana potency of these drugs remains for longer period. Satva requires minimal dose & easy for administration. More potent as compared to other preparations. Abhraka Satva form is eight time more potent than abhraka patra form [3]. (R.H.T.8/19). Rasakalpas containing Tuttha is used in treatment of various diseases. Tuttha is said to be very harmful if it's Shodhana and Marana is not done properly.

Tuttha is copper sulphate or blue vitriol and chemical formula is CuSO₄ .5H₂O. It is a blue coloured crystalline copper mineral. It is applied in indolent ulcers, exuberant granulation, sinuses and fistula in ano, eczema, impetigo and eye disorders. In classics of Rasashastra eight Doshas of Tamra have been mentioned. If source Tamra taken for preparation of medicine is not of good quality it may be poisonous. So in context of Tamra Rasatarangini and Rasaratnasamucchya have been mentioned about Sasyaka, mayurpiccha and Bhunaga Satvapatana. Their Satva may be used as a source of Tamra. In Satvapatana, time of heating, number of heating amount of fuel and temperature is not mentioned by Rasacharya may be due to variations in drugs but to observe of Satvapatna some features are clearly mentioned which indicates sign of obtaining Satva i.e. Bijavarta and Suddhavarta. In this present study Tuttha is subjected for mridu Satvapatana. To evaluate the temperature in which Tuttha gives the features of Bijavarta and Shuddhavarta, and to explore the temperature when obtain Satva from Tuttha. In this study required amount of heat and fuel for Mridu Satvapatana as Tuttha Satvapatana have been evaluated. The prepared Satva's were subjected to qualitative and quantitative analysis.

Aims and Objectives

1. To prepare the Satva of Tuttha by the nirmalikaarana, Shodhana and Satvapātana process according to Rasatarangini.
2. To evaluate the temperature in which Tuttha gives the features of Bijavarta and Shuddhavarta.
3. To explore the temperature when obtain Satva from Tuttha.
4. To evaluate the amount of fuel needed for mridu Satvapātana as Tuttha Satvapātana.
5. Qualitative and quantitative analysis of prepared Tuttha satva.

Material and Method

Raw Tuttha was procured by Govt. Ayurveda College, Chhattisgarh through demand letter. Other allied materials lemon juice, raw Tankana were collected from the local market.

The whole pharmaceutical work can be divided into three steps:

- A. Tuttha nirmalikaarana
- B. Tuttha shodhan
- C. Tuttha Satvapātana

Prepared satva was analyzed by employing various methods like organoleptic characters, Physio-Chemical parameters and X-Ray Diffraction (XRD) test in these parameters - Organoleptic Characters such as Colour, Odor, Taste, Touch, Loss on drying, Total ash, Acid insoluble ash, Water soluble ash, pH.

A. Tuttha nirmalikaarana

Tuttha nirmalikaarana was done according to Rasatarangini 21/73-75 [4]-

1. Ashuddha Tuttha is broken in small pieces or coarse powder by using mortar & pestle.
2. Now water was boiled in a Stainless steel vessel by using of heater.
3. Then coarse powder of Ashuddha Tuttha mixed in boiled water.
4. Now consistent heat was given and steered till Ashuddha Tuttha was properly dissolved in water.
5. Then solution was filtered by cotton cloth.
6. Now this filtered solution was kept in glass jar for crystallization.
7. Now crystals of Tuttha were dried by cotton cloth and preserved in glass jar.

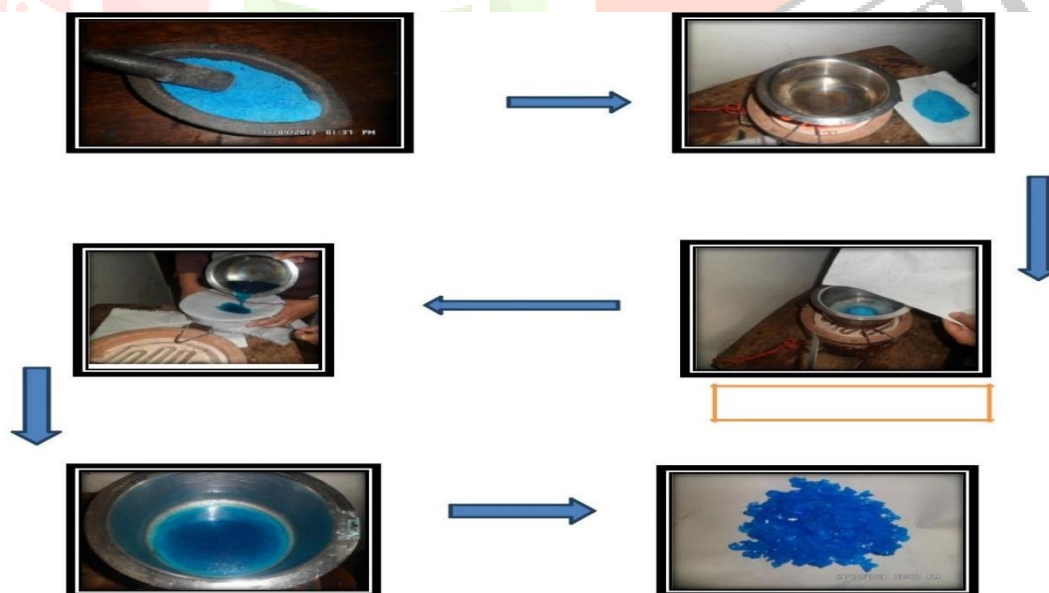


Fig.1: Procedure of Tuttha Nirmalikaarana

Observation

The coarse powder of Tuttha was light blue in colour. The colour of water was gradually turned into light bluish colour and at the end of process it became more darkened and bluish. After 4 hr. total solution converted into crystal form. Nirmalikrita Tuttha became dark blue in colour.

B. Tuttha Shodhana

Tuttha Shodhana was done according to reference of Rasatarangini 21/106-107 [5].

Procedure :-

1. Nirmalikrita Tuttha was weighed exactly 500 gm & triturated in stone mortar & pestle, to a fine powder.
2. In first day 370 ml of lemon juice was added. The quantity was sufficient to immerse Tuttha fine powder.
3. Cautiously, the paste was subjected for continuous trituration, till juice was completely absorbed.
4. As lemon juice, in the paste was completely absorbed, it was considered as the completion of process.
5. Then again sufficient quantity of juice was added & mixture was triturated.
6. The same process was repeated for 5 days (15 hr.).
7. Each time, fresh lemon juice was used.

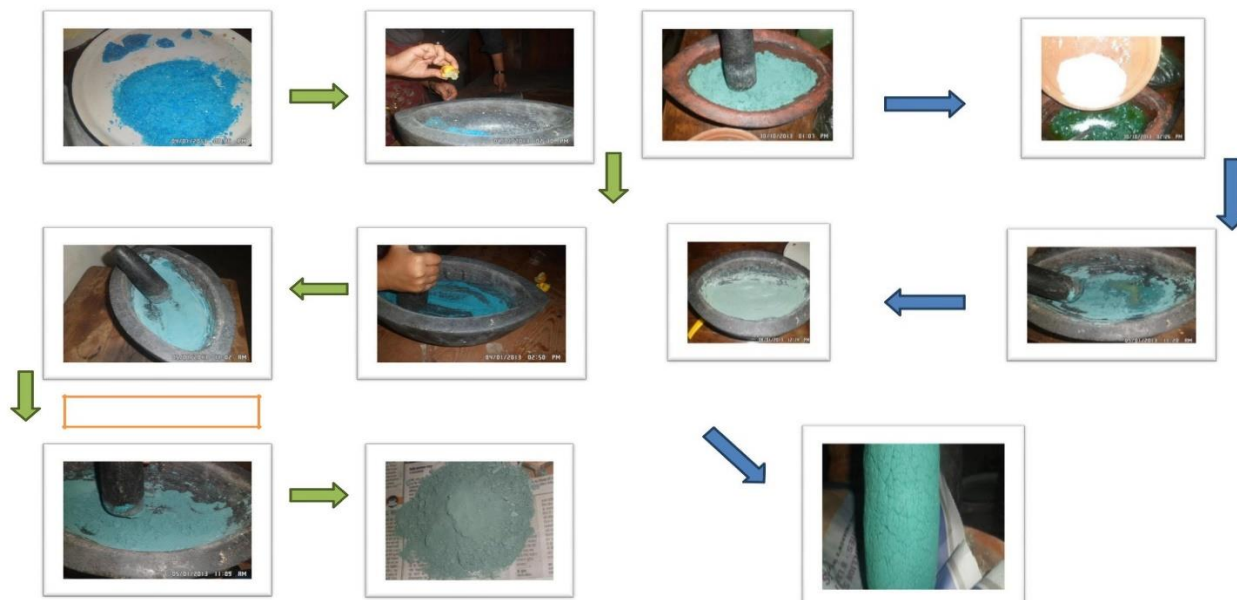


Fig.2: Procedure of Tuttha Shodhana

Fig.3: Procedure of Ball formation

Observation

The colour of Ashuddha Tuttha was deep blue which was changed after every bhavana. The colour of Tuttha became dull after each bhavana. The paste became smoother after each bhavana.

C. Tuttha Satvapatana

Tuttha Satvapatana was done according to Rasatarangini 21/137 [6]. The part is divided into 2 part: Ball (Pinda/Vataka) formation of Tuttha for Satvapatana and Tuttha Satvapatana.

(1) Ball (Pinda/Vataka) formation of Tuttha for Satvapatana

Procedure:-

1. Shuddha Tuttha was weighed exactly 300 gm & equal quantity of Ashuddha Tankana (300 gm) triturated in stone mortar & pestle, to a very fine powder.
2. In first day 400 ml of lemon juice was added. The quantity was sufficient to immerse above mixture.
3. Cautiously, the paste was subjected for continuous trituration, till juice was completely absorbed.
4. As lemon juice, in the paste was completely absorbed, it was considered as the completion of process.
5. Then again sufficient quantity of juice was added & mixture was triturated.
6. The same process was repeated for 3 days (9hr.).
7. Each time, fresh lemon juice was used.
8. On Last day ball was prepared by triturated mixture.
9. Ball was dried against direct contact of sunlight.

(2) Tuttha Satvapatana

Procedure:-

1. Crucible was prepared by wrapping 3 layers of cloth & clay on it, then drying in sunlight every time.
2. The crucible was filled with 1/2rd portion, i.e. 400 gm.
3. Crucible was closed by lid dish/pidhanaka having small hole in the centre of lid dish.

4. Sealing of joint of crucible with lid dish by wrapping cloth & clay and drying in sunlight.
5. In koshthi (Special prepared fire place) wood coal, cow dung and mine coal arranged in specific pattern. (In koshthi order of fuel arrangement was as follows below to above – wood coal, cow dung, mine coal, crucible, mine coal cow dung, wood coal)
6. Crucible kept in mid part of koshthi between fuels for getting proper heat.
7. After worshipping Lord Shiva and Nagarjuna heating was started with the help of continuous blowing by electric blower to make it intensive heat.
8. Temperature recorded after every 30 minute.
9. After 30 minute temperature in crucible were recorded 750°C.
10. After 5 hr. crucible seen red hot colour.
11. After 5.30 hour Tuttha started melting.
12. After starting of melting of Tuttha, process of removal of crucible and Abhisheka was done.
13. After Abhisheka crucible again kept in koshthi till total melting of ball was done.
14. Now crucible is left in koshthi for self-cooling.
15. Next day, when crucible became cool, then it was removed from koshthi.
16. Kapadamitti was removed & sealing of joint of crucible with lid dish was broken carefully.
17. Smelting material was carefully collected from crucible which was strongly adhered in bottom and surrounding of crucible.
18. Smelting material had crystalline (glass or plastic crystals) like appearance which contained shiny particle.
19. Now grinding of smelting material in stone mortar and pestle was done and Satva was identify as mentioned in conceptual study.

Observation

Fumes of sulphur (yellow colour with obnoxious odour) come out through centre hole of lid dish. That fumes gradually decreased and stopped to come out after 2hr of procedure. After 5hr. of procedure, crucible was seen with red hot colour and after it bluish colour flame appears. After this Tuttha started melting, blue flame increased (Bijavarta) & after then white flame appeared and gradually increased. After 2 hr. of bijavarta Tuttha completely melt and looked like lava. After self-cooling smelting material looked like glass/plastic were some bright shiny particle immersed, which was round and heavy in nature.

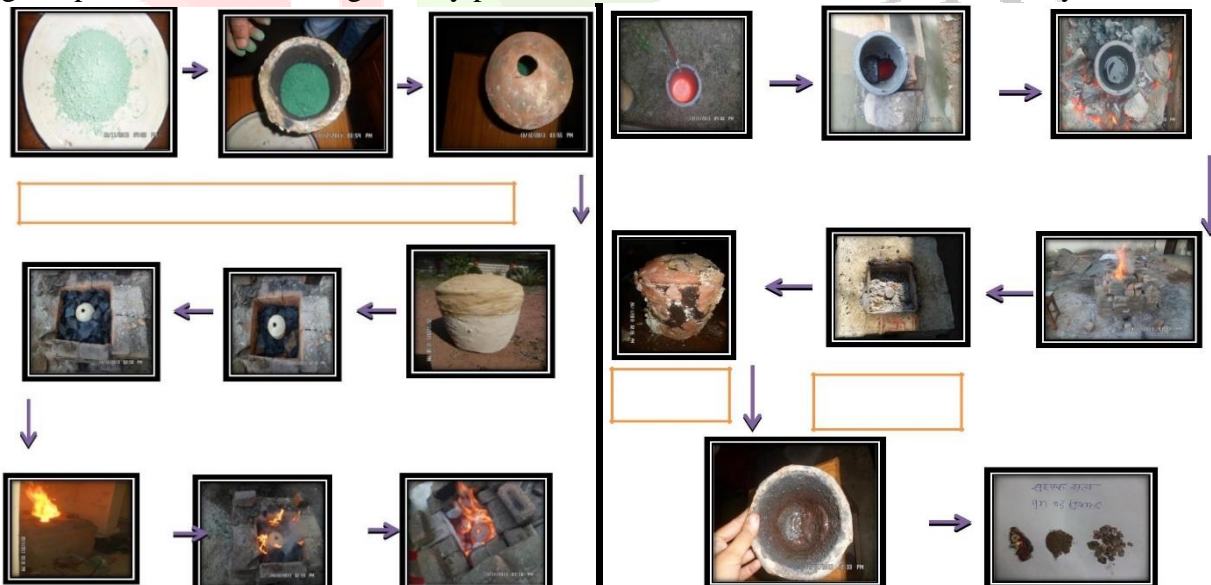


Fig.4&5: Procedure of Tuttha Satvapatan

Table No.1: Total fuel quantity used for Tuttha Satvapatana in one attempt of procedure

Types of fuel	Quantity used in Tuttha Satvapatana
Mine Coal	20 Kg
Cow dung	6 Kg
Wood Coal	4 Kg
Wood	4 Kg
Total quantity	34 g

Result and Discussion

For Nirmalikaran 1000gm Ashuddha Tuttha was taken and after process weight obtained 960 gm and Percentage yield was 96 %. Time taken for nirmalikaran - 5 hours.

For the process of Shodhana 500gm of Nirmalikrita Tuttha was taken and 640gm Tuttha yielded, which was 128%. Weight gain was 140 gm. Time taken for Shodhana 5 days.

For Ball formation 600 gm of mixture was taken. Quantity of mixture obtained after ball formation - 710 gm. Total weight gain was 110gm which is 118.33%. Time taken for ball formation 4 days.

For Satvapatana 120 gm of mixture/compound was taken. Temperature recorded & observations made during Tuttha Satvapatana are mentioned in Table No. 5. And Figure 6. Obtained Satva was 20gm. Percentage yield is 24%. Total time taken for preparation = 1 day (11.30 hr). Time required for swangasita was 1 day. Total fuel quantity used for Tuttha Satvapatana in one attempt of procedure is shown in Table No.1.

There are specific characters mentioned in the treatise of Ras Shastra to evaluate the quality of prepared various kalpanas. They are chiefly organoleptic characters; like colour, odour, taste, touch etc. The organoleptic characters of Tuttha satva is shown in Table No.2. Qualitative analysis was done only of raw samples while qualitative analysis of satva not done because they are in pure metallic form hard to convert ash.

Table No.2: Organoleptic character

Table No.3: Quantitative analysis of Raw drugs by XRD

Organoleptic character	Tuttha satva
Appearance	Metallic [Bright shiny and metallic lusture]
colour	Brown and little Grey
Touch	Hard
Odour	----
Taste	Metallic

Elements	Suddha tuttha
Cu or Cu in combined form	100% [Cooper Sulphate pentahydrate form]
Fe or Fe in combined form	-----
Zn or Zn in combined form	-----

Table No.4: Report of XRD analysis

NO.	Sample	Elements
1.	Shuddha Tuttha	Copper sulphate pentahydrate 100%
2.	Tuttha Satva	Cu 79% Mn ₂ O ₃ 11% Cu ₂ O 10%

Table No.5: Quantitative analysis of Satvas by XRD results

Satva	cu [pure & compound]	Fe	Zn	Mn ₂ O ₃	Si
Tuttha satva	89% [Cu-79% Cu ₂ O-10%]	---	-----	11%	----

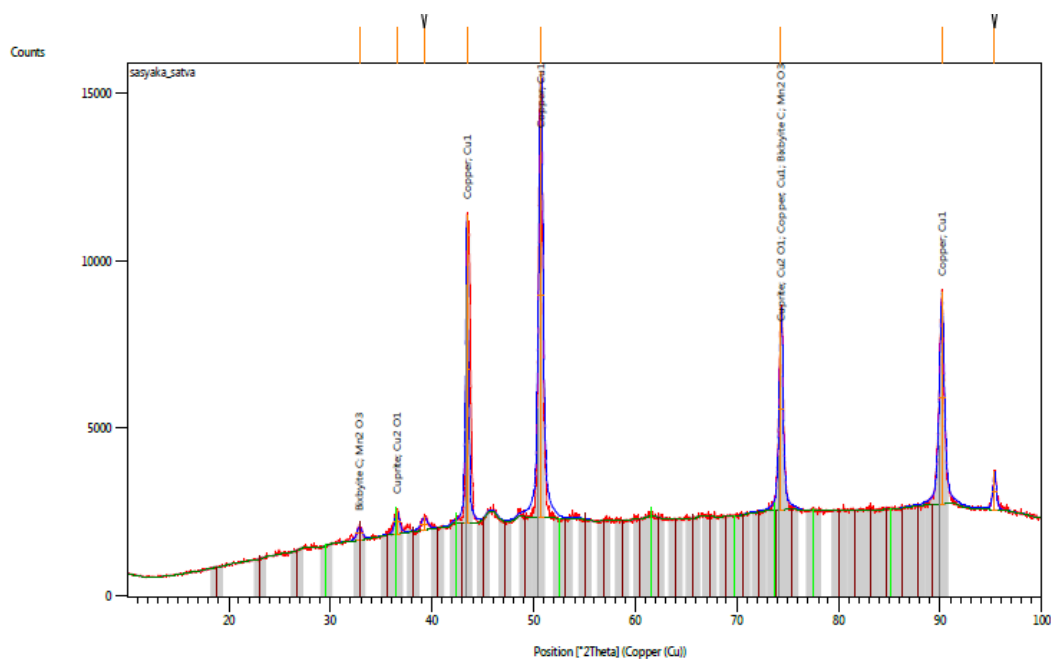


Fig.6: XRD Analysis of Tuttha satva

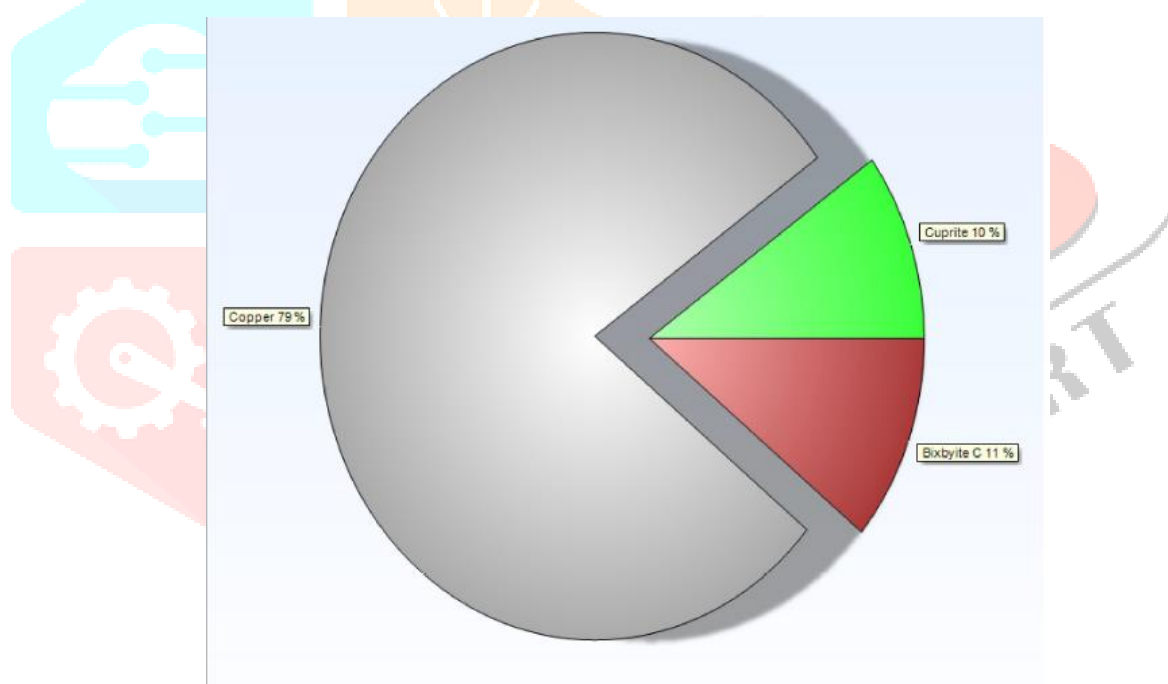


Fig.7: Result of XRD analysis of Tuttha satav

The organoleptic character was assessed for all 3 satvas the appearance of satva in metal form (bright, shiny and metallic lustre). Tuttha satva brown & little grey in colour. Satva is having metallic taste, touch was hard and odourless. As per classic the satva of Tuttha denoted as tamramayam & tamrasavatam.

Quantitative analysis (XRD reports) shows:-

- In shuddha Tuttha percent of Cu is 4% while, in present work Tuttha satva obtained by this shuddha Tuttha was 5%. It may be due to in satva Cu is along with other element Mn₂O₃.
- In shuddha Tuttha was no any percent of Mn₂O₃ while in Tuttha satva Mn₂O₃ was Present (11%), it may be due to interaction of Tuttha with satvapatana drugs during satvapatana procedure.
- Shuddha Tuttha was Copper sulphate pentahydrate form 100%.

Conclusion

Satvapatana is a process of obtaining bright, pure, real, dense part of substance in downward direction. Whole aspect of Satvapatana (Musha, Sandhilepana, Khara - Mridu Satva, Koshthi, Kokila, Vankanala, Bijavarta, Suddhavarta,

Ekkolishikha, Musha-Aapyayan, Abhishek and Procedure of Satvapatana including Satvanam Mridukarnam, and important of Satvapatana is described in Rasratna Samuchchya but exact time of heating, number of heating, amount of fuel and temperature is not mentioned. I found the appearance of essence~Satva same as per mentioned in different classics, which is discussed in Table No.6. In different text of Rasashastra Andha Musha (Blind crucible) is mentioned for Tuttha Satvapataan. But due to formation of Sulphur dioxide blind crucible get blast. So in Satvapatana procedure I have taken Andha Musha with a small hole in the center of lid dish which allows- (a) Observation of smelting process (b) Allow to Pass out of gases.

Table No.5: Temperature recorded & observations made during Tuttha Satvapatana

Time	Temp.	Observations
9.00am	30°c	Heating was started.
9:30	750°c	Mixture was dry & in ball form.
10:00	830°c	Mixture was dry & yellowish fumes started coming out.
10:30	900°c	Mixture was dry & yellowish fumes started coming out.
11:00	940°c	Yellowish fumes gradually decreased and stop to come out.
11:30	1150°c	Mixture became semi-liquid.
12:00	1200°c	Mixture still in semi-liquid state.
12:30	1250°c	Mixture still in semi-liquid state.
1:00	1250°c	Mixture still in semi-liquid state.
1:30	1250°c	Mixture still in semi-liquid state.
2:00	1260°c	Red hot of crucible.
2:30	1280°c	Smelting of mixture started & blue flame appear (Bijavarata) & fumes disappeared.

Crucible again kept on Koshthi

3:00	1280°c	Removal of crucible and Abhisheka samskara done
3:30	1320°c	Smelting of mixture.
4:00	1320°c	White Flames appeared
4:30	1350°c	White Flame increased (Shuddhavarta) and mixture completely melt.
5:00	1000°c	Decrease of temperature.
5:30	900°c	Decrease of temperature.
6:00	830°c	Decrease of temperature.
6:30	750°c	Decrease of temperature.
7:00	700°c	Decrease of temperature.
7:30	700°c	Left for self-cooling.

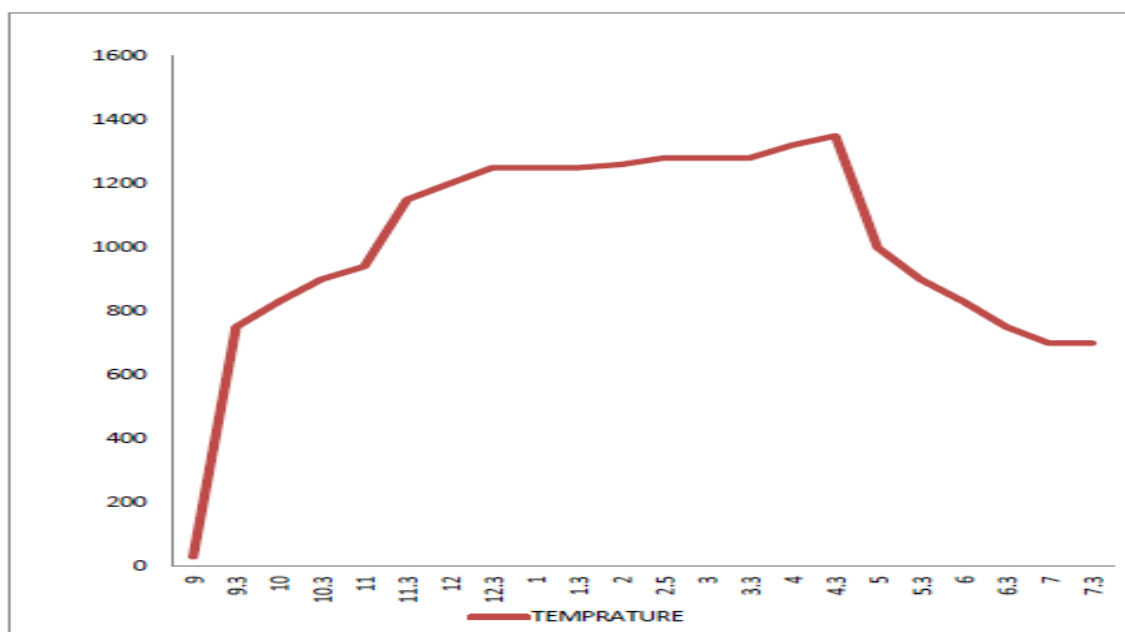


Fig.6: Graphical presentation of Temperature pattern of Satvapatana

Table No.6: Appearance & Color of essence of Tuttha

S. No.	Appearance & Color	References
1	Indragopasamkasham	R.A. 7/42, R.R. 13/74, R.R.S. 2/133, A.K. 2/255
2	Tamrarupam	R.P.S. 5/77, R.R.S. 2/134
3	Kinshukprabhama	R.R. 13/52
4	Kirtundasaprabhama	R.R. 13/55, A.T. 4/55, B.R.S.
5	Shobhanam	R.R. 13/74, B.R.S.
6	Tamrakam	A.P. 4/44
7	Tamramayam	B.R.R.S.
8	Tapayajsamam(Rakta & mridu)	R.H.T. 10/9 & 11
9	Shoditabindu	A.P. 4/56
10	Shukapicchanta	A.K. 2/251-252
11	Kanchanbindhubhi	A.K. 2/251-252

1. At 1280⁰C smelting of mixture started & blue flame appear i.e. Bijavarata.
2. At 1350⁰C white flame increased i.e. Shuddhavarta) and mixture completely melt.
3. After self-cooling smelting material looked like glass/plastic were some bright shiny particle immersed i.e. Satva.
4. Total yield of Satva was 24% from its raw material.
5. Weight gain after Shodhana was 28%.
6. Weight gain after ball formation was 18.33%.
7. Percentage yield of Satva was 24% after Satvapatana process.
8. Satva was bright, shiny particle were round in appearance.
9. Smelting material was obtained at bottom of crucible which was strongly adhered in bottom and surrounding of crucible.
10. Smelting material had crystalline (glass or plastic crystals) like appearance which contained shiny particle~Satva.

Tuttha satva have higher percentage of Cu 89% & Mn₂O₃ 11%. In Rasa classics indication of Tuttha satva after making of Mudrika, the touch of this Mudrika or internal application of water when boiled with Mudrika is subjected very effective in Prasuta (Post-partum period), Shoola (Pain), Vishanashaka (Antitoxic property), Bhutanashaka (Antimicrobial). The present study shows that the above three satvas contained Fe, Cu, Zn, Mn as major component in various percent along with other trace elements in minor percent. Various classical literature quoted the properties and karma of Cu, Fe and Zn which are as Pandu-Aamayaghanam param, Vranaropananch, Paridamashoolam, Udarshoolam, Ushnaviryam, Deepanam-uttamam, Vishaharam, Sarakam, Vishayakrita Krimihara, Kustha-Aamayadhwansanm.

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