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Research Article

PHARMACEUTICAL AND ANALYTICAL STUDY OF SOMANATHI TAMRA BHASMA

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ABSTRACT

To provide standard parameters for the procedures followed for the processing of formulation is very essential criteria now days to meet the demands of modern scientific world. Somanathi tamra bhasma is a simple and special method of preparation of tamra Bhasma in which shudha parada, gandhaka, haritala and manashila were used as media drugs. In this study somanathi tamra bhasma was prepared by authentic method and analyzed to provide standard parameters for the assessment of quality, each step of processing was studied, documented and analyzed well to get complete information. From 2138 g of tamra along with media drugs, 1360 g of somanathi tamra bhasma was obtained. X - Ray diffraction suggests somanathi tamra bhasma was the mixture of copper sulphide (CuS), copper oxide (CuO) with the combination of some other elements. Particle size analysis suggests, most of the particle lays between 4 to 5.6 µm and presence few nano particles. Elemental analysis by ICP-AES revels that somanathi tamra bhasma includes the elements like Cu, Fe, Al, S, As and Hg.

Keywords: Somanathi tamra bhasma, pharmaceutical study, SEM, X-RD, ICP-AES.

INTRODUCTION

The demand of Ayurvedic formulations has been increased globally due to increased response towards Ayurvedic system of medicines, on the other side lots of blames were also noted on Ayurvedic formulation because of substandard quality products, therefore certain things like quality control during the processing of formulation and standardization with sophisticated analytical instrumentation and methodology are essential to establish quality and standards of Ayurvedic drugs. Thus the production of standard effective, genuine and safe drugs of good quality should be given high importance by Ayurvedic pharmaceutical companies. Good and genuine quality medicines can be prepared by following correct references and by maintaining the quality of processing at each and every stages of processing along with analysis of the different samples. Somanathi tamra bhasma[1] is a special method is a special method of tamra bhasma preparation, in which parada, gandhaka, manashila and haritala were used as media drugs. Moreover tamra was considered even more toxic than poison itself as it possess eight doshas and certainly improperly prepared tamra bhasma will produce adverse effects, therefore it is very important to prepare good quality tamra bhasma by following genuine classical methods, which includes samanya shodhana, vishesha shodhana and marana. This study is honest effort made in the development of standard parameters in the development of pharmaceutical standards of somanathi tamra bhasma and for same purpose the samples of each step of processing were submitted for physico- chemical analysis with advanced analytical techniques.

MATERIALS AND METHODS

Tamra patras (flakes) of 0.2 mm thickess, tila taila (sesame oil), gomutra, shali, kulatha, yava, saindhava lavana, parada (mercury), gandhaka (sulfur), haritala (orpiment) and manashila (realgar) and other required materials were procured from the SDM Ayurveda pharmacy Udupi, Karnataka, India and somanathi tamra bhasma was prepared in rasashastra and bhaishajya kalpana practical hall of SDM College of Ayurveda Udupi, Karnataka, India.

Samanya shodhana of tamra

Samanya shodhana of tamra was carried out as per the reference of Rasa ratna samuchchaya[1] by following Nirvapa process (heating and quenching). Kanji (sour gruel), kulatha kashaya (decoction of horse gram), were prepared as per the reference of Sharanghadhara Samhita[2] and Takra was prepared as per the reference of Sushruta Samhita[3]. The flakes (patras) of tamra were heated in an iron caldron to red hot and quenched in Tila taila, this procedure is repeated for seven times and again same procedure id repeated by using Takra, Gomutra, Kanji and Kulatha kashaya liquid medias.

Vishesha shodhana of tamra

Vishesha shodhana of tamra was carried out as per the reference of Rasa ratna samuchchaya[1] and suoveeraka was prepared as per the reference of Sharanghadhara Samhita[2]. Saindhava lavana equal to the quantity of Samanya shodhita tamra was triturated with Nimbu swarasa and paste is prepared, the paste was then smeared on samanya shodhita tamra patras and dried well and then

were heated in an iron caldron to red hot and quenched in suoveeraka, this procedure is repeated for eight times each time fresh souveeraka was used.

Parada samanya shodhana

Parada samanya shodhana was done as per the classical reference of Ayurveda prakasha[4], Ashudha parada (impure mercury); 700 g Nistusha lashuna (garlic) 700 g and Saindhava lavan 350 g were taken as ingredients, triturated in tapta khalwa for 7 days, then it was washed with hot water and filtered through a cloth, weight was recorded and stored in glass bottle.

Gandhaka shodhana

The classical reference of Ayurveda prakasha[4] was followed throughout the procedure. Ashudha Gandhaka 600 g, Godugdha (cow milk) 1.2 liter × 3 times = 3.6 liters, goghrita (cow ghee); 150 g × 3 times = 450 g were taken for the shodhana process. In the reference, volume of godugdha was not mentioned. Here the volume was considered so as to dip the melted Gandhaka completely. Powdered gandhaka was healed with goghrita over mandagni (mild heating), after melting it was poured into godugdha through cotton cloth. A solid slab with some granular gandhak was taken out and washed with hot water. The procedure was repeated for two more times, after drying, it was powdered, weighed and kept in a glass bottle.

Haritala shodhan

Haritala shodhana was done as per the classical reference of Rasaratna samuchchaya[1], Ashudha haritala 300 g converted in to a coarse powder form, tied inside a cotton cloth and pottali was prepared and steam heated in churnodaka for 3 hours, then pottali was opened, coarse powder of haritala was dried and stored in glass bottle.

Manashila shodhana

Manashila shodhana was done as per the classical reference of Rasaratna samuchchaya[1]; Ashudha manashila 200 g was taken in khalwa yantra and triturated with ardraka swarasa (200 ml, gravimetrically equal to the manashila quantity to get samyaka pluta state) and bhavana was given to manashila, this procedure was repeated for six more times.

Preparation of kajjali for somanathi tamra bhasma

The Kajjali for the preparation of Somanathi Tamra Bhasma was prepared as per the reference of Rasaratna samuchchaya[1]. Shudha parada 570 g, shudha gandhaka 570 g were taken in khalwa yantra first and trituration was made until the powder became black, smooth and lusterless. Then to this prepared kajjali, 285 g finely powdered shudha haritala was added and trituration was made for 1 more day till lusterless powder obtained and at last, 143 g of finely powdered shudha manashila was added and triturated for one more day to complete the kajjali preparation for somanathi tamra bhasma.

Preparation of garbha yantra

Garbha yantra was prepared for the processing of Somanathi Tamra Bhasma as per the reference of Rasaratna samuchchaya[1] with few modifications, 1000 g Saindhava lavana, 500 g Yellow colored multani mitti (mud) and 50 g of Guggulu were taken in khalwa yantra and triturated along with water and paste was prepared, two sharavas of identical size and shape were taken, the bhasma preparation material was added inside as per the textual reference, samputikarana was made and joint was sealed, on the sharava samputa the above prepared paste was smeared uniformly and dried well under sunlight, like this totally seven layers of above prepared paste were applied and dried well.

Preparation of somanathi tamra bhasma (marana process)

Somanathi Tamra Bhasma was prepared as per the reference of Rasaratna samuchchaya[1], two medium sized sharavas were taken, previously prepared kajjali was sprinkled at the base inside the sharava on that kajjali layer shodhita tamra patras were placed, again upon the tamra patras kajjali was added, like this one on another, kajjali and tamra were added in side sharava, sharava was closed with identical sharava and sandhi bandhana was made and subjected for application of paste, as mentioned in garbha yantra preparation. A small underground pit was prepared, at the base of this pit tusha (husk) was added, on this tusha bed sharava samputa was placed, again surrounding of sharava samputa tusha was added and agni was given intensively for 3 hours. After swangasheet sharava samputa was removed from pit, layers were removed, carefully the black colored brittle tamra patras were added to khalwa and triturated smoothly, then filtration was made through three folded cloth and the resultant bhasma was subjected for bhasma siddhi pareekshyas[5], after getting the positive results the bhasma was stored well.

Analysis of the samples collected at different stages of processing of somanathi tamra bhasma

To lay down the standards, raw tamra, in process material and final product were analyzed physic- chemically. Final product (Somanathi Tamra Bhasma) was analyzed by using different organoleptic parameters like color, odor, taste etc. physic- chemical parameters like loss on drying[6], ash value[6], acid insoluble ash[6] and water soluble ash[6] etc were performed on Somanathi Tamra Bhasma. The important elements of Raw Tamra, Shodhita Tamra and Somanathi Tamra Bhasma were analyzed by using inductively coupled plasma- atomic emission spectroscopy; the particle size of Somanathi Tamra Bhasma was analyzed by using scanning electron microscope (SEM) and structural study of somanathi tamra bhasma was performed by using X-RD.

OBSERVATION AND RESULTS

During samanya shodhana, tamra took approximate 2 hour to become red hot, as soon tamra tamra patras were quenched in liquid media typical 'hissing' sound was produced. After every quenching some residue in the form of powder was observed, after completion of shodhana tamra turned into a mixture of black coarse powder and pieces of tamra. The color change and weight variation during the procedure was depicted in Table 1. During vishesha shodhana of tamra, it took 2 hours 20 minutes to become red hot for first time, greenish blue

flame was noted, when tamra was subjected for heating process, the color of suoveeraka was greenish after completion of vishesha shodhana, the weight variation in tamra during vishesha shodhana procedure was shown in Table 2. In Parada samanya shodhana procedure, white lashuna kalka changed to black within 2 hours of trituration and then slowly parada completely mixed with lashuna kalka; after washing with hot water shudha parada was procured and 30 g wt. loss was observed in parada. During the gandhaka shodhana procedure, gandhaka melted in 15 minutes. Crystalline dark yellow gandhaka turned to granular and dull yellow, after shodhana process 20 g decrease in weight of gandhaka was observed. During Haritala shodhana, the liquid in dolayantra started to boil after 35 minutes and fumes started to come out at the time of boiling are irritating, after 3 hours of boiling another 1 hour pottali was kept in side churnodaka and after swangsheeta of liquid pottali was removed from dolayantra and haritala was dried well and stored. After shodhana process 295 g of haritala was obtained and 5 g of wt. loss was observed. During manashila shodhana, it took 3 hours to complete one bhavana process and pleasant smell was noted while giving bhavana, after the completion of shodhana process (after 7 bhavanas) 210 g of manashila was obtained, 10 g of wt. gain was observed after the completion of shodhana process. During Kajjali preparation color of the mixture started to become black after 2 hours of trituration, which turned to dark black after 6 hours of trituration, rekha purnata (filling the furrows when rubbed between two fingers) and nischandratwa (lusterless) were found after 6 days of trituration. Shudha haritala was added in kajjali and triturated, it took 6 hours to mix homogenously and then shudha manashila was added and triturated again it also took 6 hours to mix homogenously in kajjali. 1548 g of kajjali was obtained and 20 g loss in weight was observed. During marana process, totally 20 kg of danya tusha was utilized for 3 hours of heating, maximum temperature reached to 605^0C after 4 hours and sharava samputa took 4 days to become swangasheeta (self cool). 1360 g wt loss was noted after marana process.

Table 1: Variation in color and weight of Tamra during Samanya shodhana

	Weight	Wt loss/gain	Color	Form
Raw tamra	600 g	-	Reddish shiny	Patra (flake)
In tila taila	630 g	30 g (gain)	Reddish	Patra
In takra	595 g	5 g (loss)	Reddish black	Patra
In gomutra	586 g	14 g (loss)	Reddish black	Patra
In kanji	583g	17 g (loss)	Reddish black	Patra
In kulath kwath	575 g	25 g	Blackish red	Small pieces

Table 2: Variation in weight of Tamra after vishesha shodhana

Intial weight of Tamra	575 g
Weight after vishesha shodhana	570 g
Weight loss	5 g

Table 3: Materials used in the Preparation of Somanathi Tamra Bhasma during marana process

Materials	Quantity
Shudha Tamra	570 g
Shudha Parada	570 g
Shudha Gandhaka	570 g
Shudha Haritala	285 g
Shudha Manashila	143 g

Table 4: The Temperature pattern noted during Bhasmikarana process

Time	Temperature
10.00 am	110^0C
10.30 am	190^0C
11.00 am	260^0C
11.30 am	408^0C
12.00 Noon	416^0C
12.30 pm	580^0C
01.00 pm	598^0C
2.00 pm	605^0C
3.00 pm	564^0C
4.00 pm	545^0C
5.00 pm	510^0C
6.00 pm	430^0C
7.00 pm	422^0C
10.00 pm	402^0C

Table 5: Organoleptic characters of Somanathi Tamra Bhasma

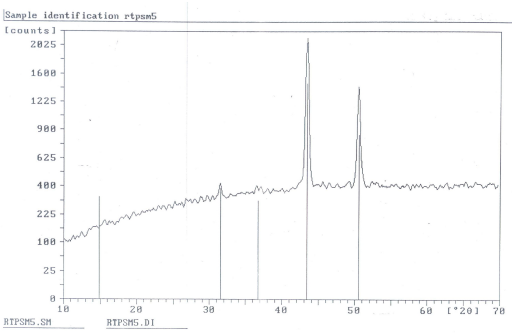
Colour	Black
Odour	Odourless
Touch	Soft
Taste	Tasteless
Appearance	Powder form

Table 6: Physical constants of Somanathi Tamra Bhasma

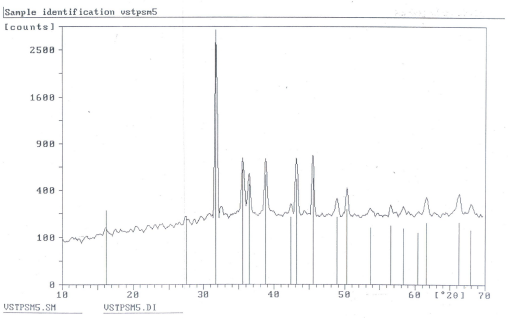
Ash value	51.40 %
Acid insoluble ash	7.16 %
Water soluble ash	19.96 %
Loss on drying	1.4
pH	5.33
Specific gravity	1.002

Table 7: Elemental analysis of Somanathi Tamra Bhasma by using ICP-AES

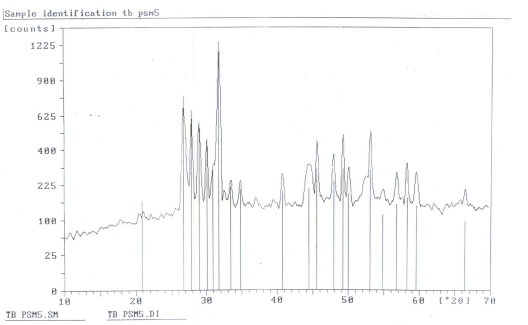
Samples	Cu	Fe	Pb	Al	S	As	Hg
	%	%	%	%	%	%	%
Somanathi Tamra Bhasma	12	0.54	0.0084	0.06	32.43	10.9	33.59
Vishesha shodhita Tamra	42.8	0.53	0.022	0.0087	0.058	0.0035	0.023
Samanya shodhita Tamra	62.61	1.05	0.027	0.014	0.017	0.0037	0.0071
Raw Tamra	84.93	0.25	0.102	0.0011	0.025	0.0159	0.00464



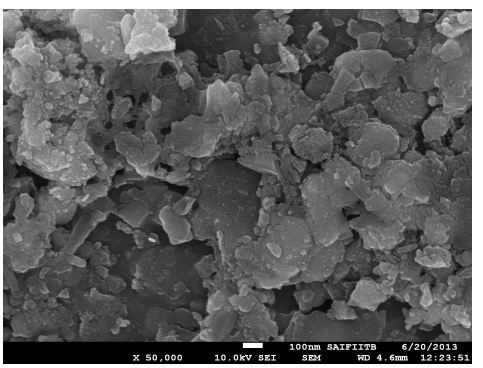
Raw Tamra

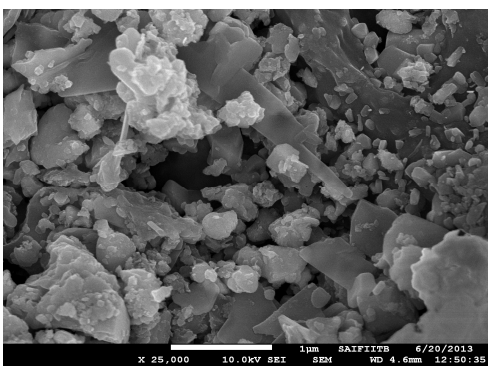


Vishesha shodhita Tamra



Somanathi Tamra Bhasma





Reports of particle size assessment of somanathi tamra bhasma

X-RD graphs of tamra, shodhita tamra and somanathi tamra bhasma

DISCUSSION

The objective of this study was to standardize the preparation method of somanathi tamra bhasma by considering pharmaceutical and analytical parameters; somanathi tamra bhasma was prepared by following special method of preparation where shudha parada, gandhaka, manashila and haritala were used. Thin sheets of tamra were used for the present study, which were satisfying almost all the. In samanya shodhana of tamra, it was heated till red hot and then immediately quenched for 7 times in Tila taila, Takra, Gomutra, Kanji and Kulatha kashaya in order. These are acidic, basic, acidic and basic media in order. This specific order breaks the internal structure of Tamra during the process and converts tamra into soft and brittle form. During samany shodhana the color of tamra became black, this is because during red hot state, tamra reacts with atmospheric oxygen and steam to form cupric oxide (CuO) which is black in color and reaction of tamra occurs mainly on surface. It was observed that as shodhana procedure advances tamra takes comparatively more time to get complete red hot, conductivity of heat is more in metallic form than compound state. So at later state of shodhana, tamra and its compound (CuO which is formed on the surface of tamra flakes) took more time to become complete red hot. At early stage of shodhana, cracks were noted at the surface of tamra flakes and finally some coarse powder was observed. Repeated heating and cooling of tamra flakes causes disruption in compression- tension equilibrium leads to cracks on the flake surface (stress corrosion theory) so on repeated heating cracks are seen on the surface leading to breaking of tamra flakes into

coarse and some fine powder. After seven nirvapas this powder was found as sediment in media[7]. In Tila taila media 30 g weight gain was observed inspite of wt. loss after nirvapa process this may be because of the adhered tila taila; which could not be removed even after thorough wash with hot water. Out of 5 medias used for shodhana procedure, three were acidic and others were basic, the alternative heating and quenching in these media leads to corrosive changes in the metal and may also cause removal of acidic and alkali soluble impurities from metal. In vishesha shodhana of tamra, saindhava lavana was triturated with nimbu swarasa, resultant paste was mixed with samanya shodhita tamra, then dried and then subjected for heating till red hot and quenching in souveraka (acidic), here saindhava lavana and nimbu swarasa again helps to disintegrate the particles of tamra and heating and dipping in acidic media again leads for cracking and breaking of tamra in finer subdivision. In parada samanya shodhana; the mardana of the parada with nistusha lashuna kalka and saindhava lavana proceeded, the color turned to brownish in the beginning, then it turned to black in tapta khalva. This colour change might have occurred due to the contact of mercury with the sulphur content of lashuna. In tapta khalva the mixing of Parada with Lashuna Kalka and Saindhava Lavana was found to be quicker. In the presence of heat parada might easily release the impurities into the mixture of lashuna and saindhava. But the temperature of tapta khalva should be maintained properly or it leads to evaporation of parada which is called as dhuma gati in classical texts. Totally 7 days were required for the release of impurities into the lashuna mixture. The prakshalana with ushna jala was done. Here the saindhava lavana got dissolved in water; lashuna kalka being light in weight floated on the surface of water and parada gets settled at the base due to its high density. There was 20 g loss of parada after samanya shodhana which could be due to various gatis of parada. In the process of gandhaka shodhana, powdered gandhaka was taken for the sake of easy melting, mandagni was given to avoid burning of gandhaka and cloth was smeared with ghee, pouring through cloth separates physical impurities. After each dhalana gandhaka was thoroughly washed with hot water to remove fat contents of milk and ghee. In shodhana of haritala it was boiled in dola yantra in presence of churnodaka for 3 hours. It may be predicted that churnodaka helps to reduces toxicity of harital when it was boiled together in dola yantra. 5 g of weight reduction was noted after shodhana procedure, this may be because of removal of physical impurities from haritala. During the shodhana of manashila it was given bhavana of ardraka swarasa for seven times, it may be believed that ardraka swarasa reduces toxicity of manashila to the remarkable extent. The weight of manashila was increased by 10 g after shodhana process; this was may be because of addition of solid particles from the ardraka swarasa to manashila during bhavana process. Loss in the weight of kajjali was observed because of dusting of mixture during trituration and some of it remained adhered to khalwa which was difficult to collect. In the preparation of somanathi tamra bhasma, the special arrangement of placing tamra and kajjali on one another may help to disintegrate tamra and make it more brittle, which ultimately facilitates bhasmikarana process. During marana process, after ½ an hour temperature reached to 110^0C, after 2 hours 408^0C, and at the completion of 4 hours temperature reached to highest of 605^0C and then started to reduce gradually, at the completion of 7 hours temperature remained at 402^0C. Sharava samputas took 4 days to become swanga sheeta (self-cool) this might be because of dhanya tusha which was used as a fuel for puta, after 4 days sharavas were opened and brittle, burnt black coloured tamra patras were transferred to khalwa, triturated and filtered. Totally 2138 g kajjali plus shudha Tamra were used for the preparation and 778 g of weight loss was noted, this may be the effect of puta and bhasmikarana process. The prepared somanathi tamra bhasma sample was subjected for bhasma siddhi pareekshyas like, varitara, rekhapoorna, nichandrata, dadhi pareekshya, kamsya patra pareekshya, apunarbhava and nirutha and all the tests were positive, suggestive of the bhasma was properly and completely prepared. The somanathi tamra bhasma recorded 5.53 pH, this may be because of ushna veerya and Amla rasa of Tamra. Test for physical constants of somanathi tamra bhasma were carried out, physical constants of somanathi tamra bhasma, ash value 51.40, acid insoluble ash 7.16, water insoluble ash 19.96, specific gravity 1.002 and moisture content 1.4 were noted. Elemental Analysis reports of somanathi tamra bhasma were obtained by using Inductively coupled plasma atomic emission spectroscopy, from IIT Pawai, Mumbai, Maharashtra, India. Cu, Fe, Pb and Al elements were noted in raw tamra, samanya shodhita tamra, visesha shodhita tamra and somanathi tamra bhasma. S, As and Hg were noted in Somanathi Tamra Bhasma, may be because of use of parada, gandhaka, haritala and manashila in the preparation of bhasma. There was decrease in the percentage of Copper from raw tamra to shodhita, shodhita to visesha shodhita and so on till bhasma, this may be due to shodhana and marana procedures suggestive of conversion of metalic forms. (RT- 84.93, SST- 62.61, VST- 42.8 and STB/TB- 12) Particle size assessment was done at IIT Pawai, Mumbai, India by using Scanning electrone Microscope. The results suggest most of the particles were less than 5.6 µm and maximum particles measures from 4 µm to 5.6 µm and also report indicates the presence of nano particles in the somanathi tamra bhasma sample which were measured 50.6 nm, 80.7 nm, 93.8 nm, 122 nm and 124 nm. X-RD Analysis were done at Regional Research Laboratory Bhuvaneshwar, India and the interpretations of the reports were made at department of Physics, Manipal Institute of Technology Manipal, and to index the peaks and evaluate the structur and parameter of the unit cell Mc Millaine soft ware was used. In raw tamra X-Ray diffraction graph 5 peaks were noted, which represents the crystallography of raw tamra and also indicates the presence of other elements along with copper and Shape of the unit cell is – Hexagonal. In shodhita tamra X-Ray diffraction graph 18 peaks were noted which indicates the series of conversion and formation of different compounds in the sample, which are not noted in raw tamra sample, shape of the unit cell is – Monoclinic. In somanathi tamra bhasma X-Ray diffraction graph 21 peaks were noted, prominent peaks resembles with the peaks of CuS (Copper Sulphide)

and few peaks resembles CuO (Copper oxide), therefore Somanathi tamra bhasma may be considered as a mixture of copper sulphide (CuS), copper oxide (CuO) and the combination of some other elements. And Shape of the unit cell is – Triclinic. The copper has been canverted in to copper sulphide and copper oxide due to the action of shodhana and marana procedures. The cell type in case of raw tamra was Hexagonal, and the cell type of shodhitha tamra was Monoclinic, this indicates that when raw tamra was converted in to shodhita tamra there was change in the cell type, it changes from Hexagonal to Monoclinic. Shodhita tamra has been converted in to somanathi tamra bhasma with mercury, sulphur and arsenic media (parada, gandhaka, manashila and haritala), during the course of conversion the type of unit cell undergo change from Monoclinic to Ttriclinic which strongly suggest shodhanadi procedures modify structural configaration of element.

CONCLUSION

In tamra samanya and vishesha shodhana, tamra lost 25 g and 5 g weight respectively. Temperature raised maximum up to 605^0C during marana process. In total 2138 g kajjali and shodhita tamra were subjected for marana process, 778 g of weight loss was noted after marana process and 1360 g of black coloured somanathi tamra bhasma was obtained. The Bhasma siddhi pareekshyas applied on somanathi tamra bhasma were positive suggestive of completeness of bhasmikarana process. Cu, Fe, Pb and Al elements were noted in raw tamra, samanya shodhita tamra, visesha shodhita tamra and somanathi tamra bhasma. There was decrease in the percentage of copper from taw tamra to shodhita, shodhita to visesha shodhita and so on till bhasma. The particles of somanathi tamra bhasma measures less than 5.6 µm and most of the particles lie in between 4 µm to 5.6 µm and few particles indicates the presence of nano particles in the somanathi tamra bhasma sample. The unit cell shape of raw tamra was hexagonal, shodhita tamra was monoclinic and somanathi tamra bhasma was triclinic. Somanathi tamra bhasma may be considered as a mixture of copper sulphide (CuS), copper oxide (CuO) and the combination of some other element.

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Abbreviations

R.T -Raw Tamra
S.S.T. -Samanya shodhita Tamra
V.S.T. -vishesha shodhita Tamra
X-RD -X-Ray Diffraction
ICP-AES - Inductively coupled plasma atomic emission spectroscopy.
SEM - Scanning electron microscope

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