Research Article

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PREPARATION AND CHARACTERISATION OF TALAKA RASAYANA

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ABSTRACT

Talaka Rasayana (TR) is one of the unique Sagandha Bahirdhooma Kupipakwa Rasa yoga. The key ingredients are Parada, Gandhaka and Haratala, taken in the ratio of 1:2:1 and is prepared by kupipaka method in Lavanayantra. The indications of Talaka rasayana are Jwara, Sheetaroga, Sannipata & Vishamajwara, Jeernajwara, Kasa, Shwasa. Purified Mercury and Sulphur were triturated, followed by addition of purified Orpiment and levigated with juice of Aloe vera to obtain the kajjali for Talaka Rasayana. The kajjali was processed by kupipaka method using Lavana yantra (with common salt) in gas furnace and Vertical Muffle furnace. The study revealed completion of Kramagnipaka is impossible in Lavana yantra using common salt in gas furnace due to failure in rise of temperature in lavana. As a result the kupi was shifted to VMF and the procedure was completed. The total time taken for the completion of procedure was 42hours and TR1 with 27.33% of yield was obtained.TR2 using VMF was prepared in 22 hours with 38.4% of yield. Analytical tests revealed the resultant products were HgS, Cinnabar of hexagonal crystal structure (by XRD). SEM revealed the mean particle size of TR1 was 23.89 and TR2 was 23.82. EDAX showed Hg, S, As the major elements and Mg, C, Ca, P as minor elements. FTIR confirmed the presence of organic functional group alkenes, alkynes, carboxyls, phenols, alcohols, nitro groups in both the resultant products.

Keywords: Kupipakwa Rasa, Lavana yantra, Vertical muffle furnace, Bhavana

INTRODUCTION

Rasashastra defines the advanced Ayurveda that covers the entire field of Organo-Inorganic Pharmaceutical preparations using different Plant, Animal and Mineral compounds and converting them into potent medicinal formulations that are absolutely safe to the body. Rasoushadhis are considered to be superior because of their innate qualities like quick action, lesser dose, prolonged shelf life, better palatability. **Kupi pakwa raskalpas** are one among such Rasoushadhis known for their unique method of preparation and wide therapeutic utility. These are formulations obtained when Parada and other ingredients are kept inside the glass bottle smeared with mud cloth and placed in sand bath and heat is applied for specified duration[1].

Talaka Rasayana is one such classical Sagandha Bahirdhooma Kupipakwa rasayana with Parada (Mercury), Gandhaka (Sulphur) and Haratala (Orpiment)as the ingredients taken in the ratio 1:2:1 prepared by giving agnisamskara in lavanayantra[2,3]. The procedure converts the fore said mixture into a complex compound form possessing wide range of therapeutic utility. There are only two classical references for Talaka rasayana. It was first described in the text Rasayana sangraha. Talasindoora[4] is a similar yoga described in various texts with similar ingredients. The key difference between them is, Talasindoora is processed in Valukayantra while Talaka rasayana is processed in Lavanayantra. In the present study, an effort is made to prepare Talaka rasayana with Lavana yantra with common salt using gas furnace and by VMF. The resultant products were characterized by subjecting to various physical, chemical and instrumental analyses.

MATERIALS AND METHODS

Selection Of Raw Materials: All the major raw drugs Hingula (Cinnabar), Gandhaka (Sulphur) and Haratala (Orpiment) which satisfied all the classical graahya lakashanas were procured from different reliable sources. The authentication was done by chemical and instrumental analysis and then used in the preparation.

Methods

Preparation of Talaka Rasayana involves the following steps:
Purva karma: purification of Raw materials, preparation of kajjali and Bhavana (levigation)
Pradhana karma: includes processing of drugs in Lavana yantra and Vertical Muffle furnace
Paschat karma: involves breaking of kupi and collection of the final products.

Purva karma
Shodhana (Purification) of raw drugs

Hingula shodhana was done by levigating with lemon juice for seven times[5]. Gandhaka shodhana was done by Bhudhara yantra method [6]. Haratala shodhana was done by subjecting to levigation with lime water for 7 times[7].

Hingulottha Parada (Extraction of Mercury from Cinnabar)

It was obtained by Urdhwa patana method[8]. A fine paste of Hingula was made using lemon juice and applied to the inner surface of an earthen pot and dried completely. Another large sized earthen pot was placed over it inversely. Upper pot was made with an adjustment, Jaladhara to ensure continuous flow

of water. Both the pots were sealed using a paste of multani mitti, cora cloth and water. The upper pot and Jaladhara were sealed with m-seal.The apparatus was kept on gas burner and heated for 12 hours. Next day the Parada was extracted from the soot collected in the upper pot by scraping and filtered with double folded cora cloth. Then the obtained Mercury was triturated with Haridra churna (Turmeric powder) for two days and again filtered to obtain Shuddha Parada (purified Mercury)

Kajjali for Talakarasayana

Initially **Dwiguna bali jarita kajjali** was prepared by triturating Shuddha Parada and Shuddha Gandhaka in the ratio of 1:2 in khalwayantra for 190 hours till the mixture attained Nishchandratwa (absence of lustre). Shodhita Haratala was further added to prepare Kajjali and triturated for 8 hours to obtain homogenous mixture. Kumariswarasa bhavana (levigation with the juice of Aloe vera) was given for 8 hours and thus Kajjali for Talaka rasayana was prepared.

Pradhana karma

The obtained Kajjali was filled into a glass (beer) bottle wrapped with 7 consecutive layers of mud smeared cloth and subjected to heat in the Lavana Yantra placed on the big sized Gas burner. Kramaagni that is gradual rise in temperature was tried to maintain and temperature was recorded with the help of Pyrometer placed in the furnace. Observations were noted accordingly. It was noted that the temperature rise in Lavana yantra after the stage of madhyamagni was not enough for the formation of product even after continuous heating. There after the kupi was slowly and carefully removed from lavana yantra and shifted to Vertical Muffle furnace where the last stage of heating (teevragni) was carried out. In the second procedure entire kramagni paaka was carried out using VMF, observations were noted. After the siddhi lakshanas were observed corking was done and heating was continued for complete sublimation of the product. The apparatus was allowed for self-cooling

OBSERVATIONS AND RESULTS

The changes observed at different phases of heating were recorded and are tabulated as below.

Table 1(a): Day One Observations during preparation of Talaka Rasayana1

Time	Temperature (in ^{0}C)	Observations
9.00 am	22	Agni started
10.00 am	100	No fumes seen Kajjali in the bottle clearly visible with torch Kajjali dried Salt in the lavana yantra could be touched with bare hand
10.30am	122	Slight white fumes was seen
11.00 am	143	White fumes seen, irritating odour started
11.30 am	204	Slight yellow fumes seen. Thin layer of yellow deposit at the neck. Salt in the lavana yantra became hard lump and it was difficult to insert the pyrometer.
12.00 pm	236	Yellow fumes increased and the lavana on the surface turned to slight yellow colour in the yantra
12.30 pm	250	Yellow fumes increased, sheeta shalaka inserted,kajjali was soft
1.00 pm	263	Same as above
2.00pm	286	Kajjali sticking to the sheeta shalaka
3.00pm	312	Dense yellow fumes seen, bottom of kupi was not visible, kajjali completely melted
4.00pm	388	Same as above, also salt in the yantra was very hard. Even now the surface of lavana could be touched with bare hands
5.00pm	446	Yellow dense fumes, yellow powder deposit at the neck of the kupi
5.30pm	486	Yellow fumes seen
6.00pm	498	Same as above
6- 9.00 pm	498-488	Same as above
9.00 pm	489	Same as above

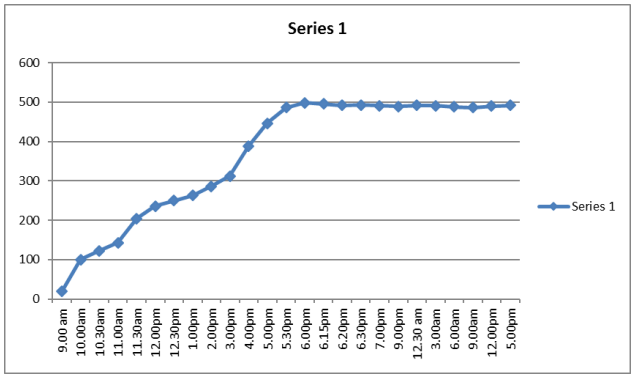
- From 9.00pm of Day 1 to 5.00pm of Day 2 the temperature in the Lavana yantra was varying between 480^{0}C- 496^{0}C even after raising the flame temperature periodically to 850^{0}C
- At 11.00 am of Day 2, the gas cylinder was changed
- After taking opinion of experts the kupi was slowly removed from the Lavana yantra. Lavana (salt) adhered to the bottle was carefully scraped using a knife without removing the layer of kapad mitti. Kupi was hot to touch.
- Now the kupi was carefully and slowly shifted to vertical muffle furnace.
- The observations in VMF are as follows

Table 1(b): Day Two Observations during preparation of Talaka Rasayana 1 in VMF

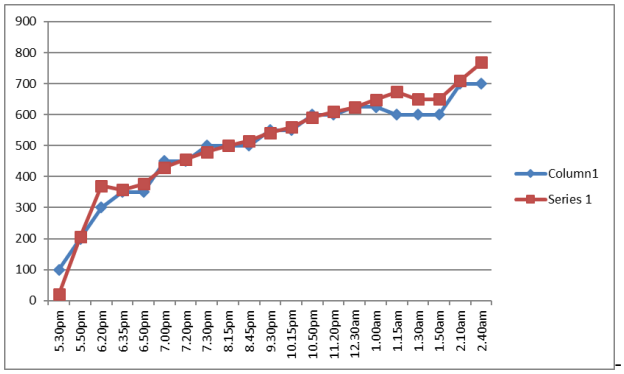
Time	Temperature set in the furnace (^{0}C)	Temperature inside furnace (^{0}C)	Observations
5.30pm	100	20	Kupi sthapana
5.45pm		106	-
6.00pm	200	205	Yellow fumes seen
6.20pm	300	303	Fumes increased, cleared with tapta shalaka
6.35pm	350	358	Same as above
7.00pm	450	430	Fumes slowly decreased
7.20pm		456	Kajjali boiling ascertained by torch
7.30pm	500	480	Blue Flame appeared
8.45pm		515	Blue flame increased to 5-6 inches
9.30pm	550	542	Flame gradually decreased to mouth of the kupi
10.15pm		560	Flame found at the neck of the kupi
10.50pm	600	592	Flame almost disappeared , seen on and off
11.20pm		609	Flame completely disappeared, yellowish fumes seen, bottom of kupi appears red hot
12.30am	625	623	Mercury deposition seen at the neck of the bottle, brownish yellow fumes appeared , suryodaya lakshana seen, copper coin test negative
1.00 am		648	Orange colour seen at the neck of the bottle. Brownish fumes seen, copper coin test positive.
1.15am	600	673	Mercury deposition reduced, brown fumes seen, sheeta shalaka inserted and part of the product collected at the neck, removed and triturated in the khalwa, it was orange red in colour.
1.30am		650	Corking done with the cloth smeared with gopi-chandana, which took 20 minutes
2.10am	700	710	Temperature maintained for half an hour.
2.40am		768	Furnace turned off.

Table 2: Observations during preparation of Talaka Rasayana 2

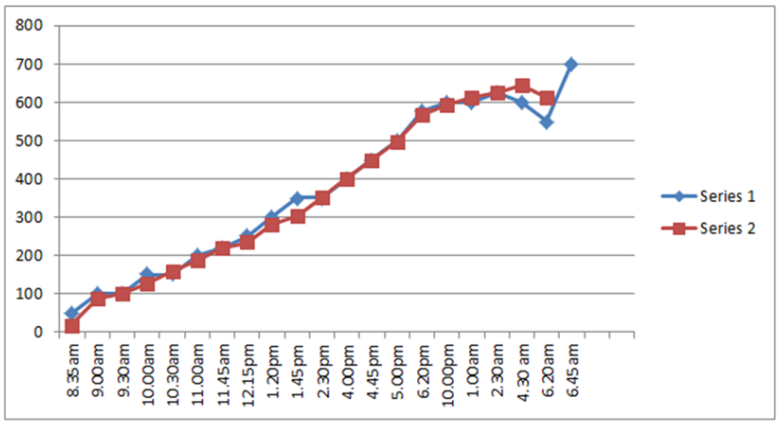
Time	Set Temp (In ^{0}C)	Temp Of Kupi (In ^{0}C)	Observations
8.35am	50	20	Kupi sthapana
9.00am	100	88	Kajjali in the bottle clearly visible with torch Kajjali dried
9.30am		100	Slight white fumes seen
10.00am	150	126	White fumes coming out of kupi
10.30am		158	Irritating odour begun
11.00am	200	186	Thin layer of yellow colour deposited at the neck of the kupi
11.30am	220	209	Yellow fumes seen, odour of sulphur
11.45am		221	Yellow fumes increased
12.45pm		249	Dense yellow fumes, bottom of kupi not visible
1.20pm		280	Sheeta shalaka inserted, kajjali was sticking to shalaka,melting started
1.45pm	350	304	Yellow powder deposit at the neck, thick, dense fumes, cleared with tapta shalaka
2.00pm		320	Complete melting of kajjali ascertained by using sheeta shalaka
2.30pm		352	Yellow fumes
3.00pm	400	370	Dense yellow fumes, cleared with tapta shalaka
4.45		448	Fumes decreased gradually
5.00pm	500	498	Boiling of kajjali seen through using torch
5.30pm		512	Blue flame at the neck of the kupi
5.50pm	550	560	Blue flame increased by 4-5 inches
6.20pm	575	568	Flame at the mouth of the bottle, tapta shalaka used to clear the block
1.00am		613	Flame gradually reduced
2.30am	625	624	Flame reduced , yellow & brown fumes seen
3.30am		638	Flame completely reduced but seen on and off at the neck
5.00		658	Flame present on and off, Mercury globules collected at the neck of the kupi, mild Suryodaya lakshana seen
6.00		630	Flame completely ceased, brownish fumes seen, Suryodaya lakshana appreciated, Copper coin test positive
6.20	550	612	Corking done using Multani mitti
6.45	700	603	Maintained for 1 hour and then furnace switched off



Graph 1: Temperature vs Time of preparation of Talakarasayana1 (TR1) in Lavana Yantra



Graph 2: Temperature vs Time of preparation of TR1 in Vertical Muffle furnace



Graph 3: Temperature vs Time of preparation of Talakarasayana2 (TR2) in VMF
Series 1: temperature set in VMF**, Series 2:** temperature inside the VMF

Table 3: Results Obtained After Completion Of Procedure

	Total Wt. of Kajjali	Wt. of T.R 1 and 2	Wt. of product adhered to wall	Total Wt.	Loss	Yield
TR 1	150 g	38 g	4g	41 g	109 g	27.33%
TR 2	125 g	48 g	6g	54 g	71 g	43.2%

ANALYTICAL STUDY

Talakarasayana(TR)was subjected to different **Physico-chemical** and instrumental analysis. The results are as follows

Table 4: Results of Physico-Chemical Analysis

Physical test	Talakarasayana kajjali (TRK)	Talakarasayana(TR1)	Talak rasayana(TR2)
Colour	greyish black	Maroon red	Maroon red
Odour	Sulphur like	Odourless	Odourless
Taste	Tasteless	Tasteless	Tasteless
Touch	Amorphous	Amorphous	Amorphous

Table 5: Results Of Estimation Of Total Mercury And Sulphur

Sample	Total mercury	Total sulphur
TR 1	48.18 %	24.12
TR 2	47.05%	24.58%

AAS Analysis

Estimation of Hg in Hingula
Hg in Hingula – 87.71%

Estimation of As in Haratala
As in Asuddha Haratala – 69.86%

Estimation of As in TRK, TR1, TR2

Table 6 : Results of Arsenic in TRK, TR1,TR2

Sample	As content
TRK	20.3%
TR1	20.5%
TR2	18.6%

Table 7: Results Of XRD Analysis

TRK	Major phase- HgS Minor phase – As
TR 1 & 2	HgS Hexagonal crystal structure

Table 8: Results of SEM-EDAX

Particle size analysis

Sample	Particle 1 (in nm)	Particle 2 (in nm)	Particle 3 (in nm)	Mean particle size (in nm)
TRK	14.69	19.86	21.31	18.62
TR 1	23.47	23.49	24.71	23.89
TR 2	21.31	24.41	25.74	23.82

Elemental analysis

Samples	TRK		TR-1		TR-2	
Element	Weight%	Atomic%	Weight%	Atomic%	Weight%	Atomic%
Hg	31.05	7.95%	48.18%	15.87%	48.05%	15.15%
S	47.02	75.60%	24.30%	50.21%	24.16%	47.77%
As	20.29%	13.93%	20.80%	18.35%	18.93%	15.94%
Mg	0.23%	0.48%	1.02%	2.77%	2.12%	5.51%
C	0.03%	0.12%	0.75%	4.13%	1.08%	5.69%
Ca	1.03%	1.32%	4.04%	6.66%	4.01%	6.32%
P	0.37%	0.56%	0.93%	1.98%	1.74%	3.58%

Table 9: Results of FTIR analysis

TR 1 & 2	Alkynes, Alkenes, Phenols And Alcohol, Carboxylic Acids, Esters, Ethers

Figure 1: Shuddha Parada (Purified Mercury)

Figure 2: Shuddha Gandhaka (Purified Sulphur)

Figure 3: Shuddha Haratala (Purified Orpiment)

Figure 4: Dwiguna Balijarita Kajjali

Figure 5: Talaka Rasayana Kajjali

Figure 6: Kupi placed In Lavana yantra

Figure 7: Kupi placed In VMF

Figure 8: Appearance Of Flame During Teevragnipaaka

Figure 9: Scraping of Kupi

Figure 10: Product Collected At The Neck Of Kupi

Figure 11: Final Product

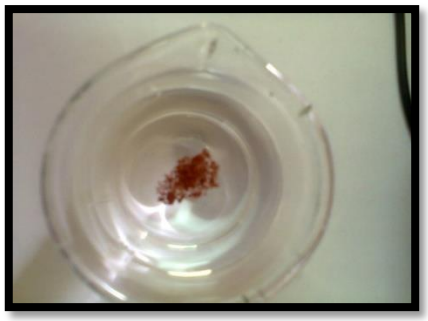


Figure 12: Varitara lakshana

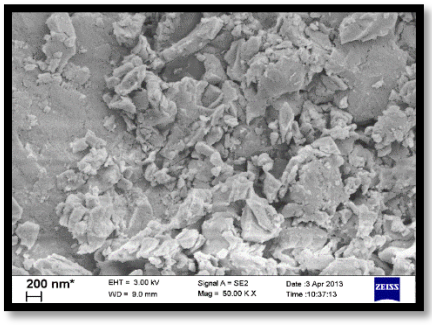


Figure 13: Particles In The Range Of Nano Size by SEM

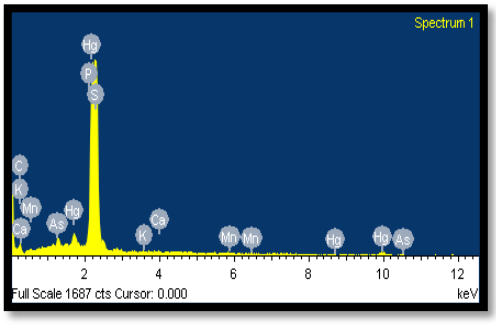


Figure 14: Elemental Analysis by EDAX

DISCUSSION

In the present study an effort was made to prepare Talaka Rasayana by Kupi pakwa method using a yantra with using common salt in a gas furnace and by Vertical Muffle Furnace. All the raw drugs- Hingula, Gandhaka and Haratala which satisfied all the classical Graahya lakshanas were taken for the study. They were also subjected to instrumental analysis. Hingula and Haratala were analysed by AAS which revealed that Hingula contains 87.71% of Hg and Haratala had 69.86% of As in it. 99% pure Sulphur powder was purchased for the study.

After shodhana of Hingula with lime juice there was a weight gain by 10grams which may be due to infiltration of organic constituents from the juice. Shodhita Hingula was further subjected to Urdhwa Patana procedure. Decomposition temperature of Cinnabar is 580^0C. Hence, sufficient heat up to 650^0C was given for decomposition of Cinnabar and sublimation of Mercury. During Gandhaka Shodhana 3% loss was seen in the yield. This may be due to thin layer of sulphur sticking to the cloth used, also some amount would be lost in the form of SO2.Haratala shodhana carried out by levigating with lime water yielded a slight increase in the content. The Calcium present in the media may act as a natural chelating agent of Arsenic making it safer to the system[9].

It took 190 hours for preparation of Dwiguna Bali Jarita Kajjali.The formation of Dwiguna bali jarita Kajjali could be taken for "HgS black formed due to displacement of Hg via S by applying mechanical energy"[10]. Further Shuddha Haratala was added and triturated for 8 hours and then levigated with the juice of Aloe vera and the kajjali for Talaka Rasayana was prepared. The Kajjali was filled in to kupi, placed in the Lavana yantra with common salt using gas furnace in the first method and using Vertical Muffle furnace in the second method and subjected to heat.

During the preparation of TR 1, it was observed that the rise as well as maintenance of temperature in Lavana yantra using gas burner was very difficult. After 32 hours of continuous heating the maximum temperature raised was 496^0C which lasted for a very short duration. The salt in lavana yantra was turning harder restricting the rise of temperature. Even when the flame temperature was 850^0C the temperature in Lavana was fluctuating between 480- 496^0C. The temperature in lavana yantra was not enough for sublimation of the final product due to which it was shifted to VMF.

The reason for poor raise in temperature could be that[11] "Sodium chloride (NaCl) or table salt is a poor conductor of heat and electricity in the solid phase, however, it is a very good conductor in the molten phase. This characteristic is shared by all ionic bonded molecular substances. Electricity could be defined as the flow of charge while heat,to some extent, as the flow of energy. When a solid, sodium chloride, which consists of positive sodium ions and negative chloride ions, are stationary, fixed in a rigid crystal lattice structure. The charges cannot move, therefore electricity and heat will not be conducted well".

Based on the observations definite heating pattern was followed and variations done accordingly in the VMF for both TR-1(after shifting from lavana yantra) & TR-2. The observations recorded have been tabulated in the Table 1,2. Due to continuous and definite increase in heat given, the Kajjali melts boils and finally sublimates as the sindoora. Corking was one after the sindoora siddha lakshanas such as Suryodaya, copper coin test were positive. Even after corking, heat was continued for some more time for complete sublimation of the product. The entire apparatus was allowed for self cooling as it allows further recrystallization of the final product.

The product Talaka Rasayana-1 was conical shaped, maroon red shiny block while the TR-2 obtained in pieces of maroon red colour.The colour of finely powdered Sindoora was brick red (Gairika) colour. The change in black colour of Kajjali to red coloured Sindoora after the heat contact may be due to change in their allotropic form (Stoichiometry) and rearrangement of crystalline structure. At different temperature Arsenic and Mercuric Sulphide will change the form. Nischandratva (absence of lustre) indicates absence of mercury in elemental form. Varitaratva[12] confirmed the fineness of the product.

XRD analysis of **TRK** revealed the compound was HgS in major phase and had As in minor phase whereas the sindoora was HgS Cinnabar with hexagonal crystal structure. The observed change in chemical nature from kajjali to sindoorais due to the effect of heat and specific procedure adopted in Kupipaka, resulting in the chemical reaction and recrystallization of the compound in the form of HgS

SEM analysis showed the compounds **TRK** and **TR1, 2** had mean particle size of 18.62,23.89 and 23.82 nm respectively, indicating the lightness and fineness of it. Owing to the particle size in nano meter which aids in the better absorption of the product. The slight increase in particle size of sindoora from kajjali may be due to agglomeration of particles.

EDAX revealed that kajjali and sindoora had Hg, S, As as major elements, Mg, C, Ca, P as minor elements and gold in traces. The percentage fall of Sulphur from kajjali to sindoora was observed which is due to loss of S during heating process (kramaagni paka). The presence of Mg, C, Ca, K in all the samples confirm the transfer of trace elements from the herbal drugs used in Shodhana and Bhavana of kajjali. Raw milk contains Ca as major element; apart from this it also contains K, Mg, etc. Also the Churnodaka/lime water used for Haratala shodhana contains good amount of Ca which is seen in all the samples.

FTIR report of **TR1,2** showed the presence of functional groups – alkanes, alkenes, alkynes, phenols& alcohols, carboxylic acids, ethers, esters. Phenols are primarily the functional group present in Curcumin (active constituent of Haridra).[13] Citric acid has carboxylic acid as its functional group. Nimbu swarasa contains citric acid as its major constituent which might be the reason for its presence. Similarly other organic compounds may be imbibed from the different herbal drugs used during shodhana, bhavana like milk, lime water, juice of aloe vera etc.

CONCLUSION

The present study aimed at preparation of Talaka rasayana by classical Lavana yantra and VMF. With reference to previous works carried out, common salt was used in Lavana yantra. Gas furnace method was adopted. The study revealed completion of Krammagni paka is impossible in Lavana yantra using common salt in gas furnace due to failure in rise of temperature in lavana. As a result the kupi was shifted to VMF and the procedure was completed. The total time taken for the completion of procedure was 42hours and 27.33% of yield was obtained. In the second method the procedure was once again repeated in VMF which was completed in 22 hours and 38.4% of yield was obtained Analytical tests revealed the sindoora prepared was HgS , Cinnabar of hexagonal crystal structure with nano sized

particles. It also showed the presence of different trace elements and organic functional groups.

The study showed that temperature rise in Lavana yantra is difficult in comparison to widely used Valuka yantra. Henceforth, further studies are required to standardize the lavana yantra with respect to the type, quality and quantity of salt to be used and its temperature pattern.

REFERENCES

1. CB Jha, Ayurvediya Rasa Shastra, Varanasi, Chaukhambha , Surabharathi Prakashana , 2002 , 5th Chapter, p. 152
2. Sri HariSharananada Sharma, KupiPakwa rasa NirmanaVijnana, 1st edition, Amritsar, Ayurveda Vijnane GauthaKaryalaya, 1941, p. 43
3. Vaidya Pandit Hariprapanna Sharma. Rasayoga Sagara. Choukhambha Krsihnadas Academy ,2004, Yoga no 67, p. 546
4. Vaidya Pandit Hariprapanna Sharma. Rasayoga Sagara. Choukhambha Krsihnadas Academy ,2004, Yoga no 67, p. 585
5. Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11thEdition, New Delhi, Motilala Banarasidas publication, 1979, 9nd Chapter, Shloka 16-17, p .202
6. Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11thEdition, New Delhi, Motilala Banarasidas publication, 1979, 8th Chapter, Shloka 13-17, p. 187
7. Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11thEdition, New Delhi, Motilala Banarasidas publication, 1979, 11th Chapter, Shloka 25, p. 248
8. Sri Sadananda Sharma, Rasa Tarangini, Edited by Kashinath Shastri, 11thEdition, New Delhi, Motilala Banarasidas publication, 1979, 5th Chapter, Shloka 38-42, p. 82-83
9. Protective effects of selenium, calcium, and magnesium against arsenic-induced oxidative stress in male rats-Srivastava D et.al. https://www.ncbi.nlm.nih.gov/pubmed/20587388
10. Disposal of elemental mercury via sulphur reaction by milling, F.A. López, F.J. Alguacil, C.P. Roman, H. Tayibi And A. Lópezdelgado, Dept. of Primary Metallurgy and Materials Recycling. National Centre for Metallurgical Research, CENIM (CSIC). Avda. Gregorio del Amo, 8. 28040 Madrid (Spain)
11. http://www.answers.com/Q/Is_sodium_chloride_a_poor_conductor_of_heat_and_electricity
12. Pranacharya Sadananda Sharma, Rasa Tarangini, Hindi translation, edited by Pandit Kashinath Shastri, 11th edition reprint, Varanasi, Motilal Banarasidasa Publication, 2004, 2nd Taranga, shlokas 53, p. 22
13. Chemical composition and product quality control of turmeric (Curcuma longa L.): http://scholarworks.sfasu.edu/agriculture_facultypubs/1

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