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PHARMACEUTICO-ANALYTICAL STUDY OF KANTA LAUHA BHASMA: BIO-SYNTHESIZED TRADITIONAL NANOPARTICLES USING CLASSICAL AND MODERN METHODS.

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ABSTRACT

In present study *raktavarna-romakant-kantalauha-bhasma* was prepared using two different methods: classical *gajaputa* and EMF. The pharmaceutical study of both the *bhasmas* was carried to evaluate the quality of both *bhasmas*. *Raw kantalauha* was processed for *samanya shodhana*, *vishesh shodhana and pachana process of marana*. *Goghrita pachita shuddha kantalauha* was divided into two samples and subjected to *puta*(incineration) using *gajaputa* according to the classical reference and EMF according to recent advanced method. Both the samples of *kantalauha bhasma* qualified all *bhasma pariksha* including *amalki pariksha* after the 10th *puta*. SEM analysis at resolution 100nm and magnification 75000× showed *kantalauha bhasma* particle size of sample 1(*gajaputa*) reached 22.1nm and sample 2 (EMF) reached 27.5 nm. Considering all the above parameters it can be concluded that kantalauha bhasma prepared using classically *gajaputa* reached more reduced size and stands better in quality than that of *bhasma* prepared by EMF. The manufacturing method of *kantalauha bhasma* is in tune to nanotechnology of contemporary era which may cover scientific validation of today.

KEYWORD: *Lauha bhasma*, iron nanoparticles, pharmaceutical study, analytical study, EMF.

INTRODUCTION

According to available literature *raktavarna/romakant*[1] *kantalauha*[2] (magnetite iron ore)[3] *bhasma* is considered best compared to other types of *lauha* for preparation of *bhasma*. Though numbers of methods are described in literature, *lauha bhasma* preparation has always been a complex-practical problem, involving several steps aimed at converting metal into a de-toxified, biocompatible form that can be easily absorbed and assimilated. Moreover, improperly prepared(*apakwa*) *lauha bhasma* has been quoted to have hazardous effects on the body in *ayurveda prakasha*.[4] Total 293 formulations containing *lauha bhasma* are elucidated and 85 formulations containing iron compounds effective in 55 diseases.[5] Therefore, it is extremely important to prepare safe and efficacious *kantalauha bhasma* of good quality, depending upon the methodology adopted for the preparation.

The process of *bhasmikarana*(incineration) of metals can be classified into *shodhana*, *mardana*, *marana*, *putapaka*. The bhasma has more surface area due to micro-fine size(compared to their elemental form) to increase bio-absorption in the GIT. So as to manufacture such important ayurvedic formulations different fundamental aspects such as qualitative, quantitative, processing techniques with scientific approach should be considered to standardize the process.

So, in present study *kantalauha bhas*ma prepared using two different methods i.e. by classical *gajaputa* and EMF is compared to evaluate the quality of *bhasmas*. Final products were analyzed by classical tests, physicochemical parameters and by applying some advanced analytical techniques.

MATERIAL AND METHOD

A. Collection of raw material

Kantalauha was procured from the market. It was qualitatively analyzed for its iron content by XRF analysis. *Kaddalikanda* (Musa paradisiaca corm), *gomutra*(cow urine), *goghrita*(cow ghee), *triphala bharada*(coarse powder) were procured from the market.

B. Preparation of *kantalauha bhasma*

1. *Kantalauha* was subjected to *samanya shodhana*(general purification/detoxification) and *vishesha shodhana*(special purification/detoxification) procedure according to the following references:

- *Samanya shodhana - rasatarangini* chapter 15/7.
- *Vishesh shodhana - rasatarangini* chapter 20/18.

2. *Vishesh shodhita kantalauha* was subjected to *marana*(calcinations/incineration) procedure using classical *gajaputa* and EMF respectively according to the reference of *rasaratnasamucchaya* chapter5/103-104.

a. Process of *kantalauha samanya shodhana*

Samanya shodhana of *kantalauha* was carried out by *nirvapa*(heating till red hot and quenching) in *kaddalikanda swarasa*, prepared as per the references of *sharangadhara samhita*. *Kantalauha* was heated to red-hot-stage with a princess torch and quenched in liquid media for 7 times. Temperature at the time of red hot stage was taken by a pyrometer. Each time fresh liquid media gravimetrically equal to the *kantalauha* was taken.

b. Process of *kantalauha vishesha shodhana*

Vishesha shodhana of *samanya shodhita kantalauha churna* was done by subjecting it to *tivraagni*(severe heat). A mixture of *triphala kwatha* and *gomutra*, prepared in 1:1 proportion was added in the *kadhai* and subjected to exhaustion. This process was repeated 7 times totally and *vishesha shodhita kantalauha churna* was obtained. Temperature and time for exhaustion of mixture was noted, using a pyrometer.

c. Process of *marana*

Stage of *pachana*

Vishesh shodhita kantalauha churna with equal quantity of *goghrita*(cow ghee) was placed in *lauha kadhai* and subjected to *bharjana*(roasting) with *tivraagni*(severe heat) and *mardana*(levigation) with *lauha darvi*. After complete exhaustion of *goghrita*, again same quantity of *goghrita* was added to it and this process was repeated for 5 times till complete exhaustion of *goghrita*. *Goghrita pachita kantalauha churna was obtained.*

Stage of *bhavana* (levigation), *chakrika*(pelletization), *sharava samputikarana* (sealing) *and gajaputa*(incineration)

Goghrita pachita kantalauha churna was divided into two batches and *kantalauha bhasma* was prepared by *marana* (calcinations/incineration) as per the reference of *rasaratnasamucchaya* chapter 5/103-104.

Batch 1

Goghrita pachita kantalauha churna was taken in *khalvayantra* and *triphala kwatha bhavana*(levigation/wet trituration) was given for 4-8 hours. After pelletization and drying in shade, it was kept in *sharava*(earthen saucer); covered by another *sharava; sandhibandhana*(junction sealed by double fold of *multany mitty* smeared clothes) was done and subjected to *gajaputa*(incineration pit) of size 57×57×57cm by using total 200-250 cow dung cakes for each puta. Pyrometric analysis of *gajaputa* for batch 1 was observed.

Batch 2

Goghrita pachita kantalauha churna was taken in SS body stone grinder and and *triphala kwatha bhavana*(levigation/wet trituration) was given for 2-4 hours. After pelletization and drying in shade, it was kept in *sharava;* covered by another *sharava;* sandhibandhana was done and subjected to *puta* at 600^{o}C in a horizontal electric muffle furnace(EMF). Maintained temperature pattern of EMF was referenced from previous research work done.[6]

On the next day, after *swangasheetikarana*(equilibrium with atmospheric temperature) *sharava samputa* of both the batches were taken out with precaution and special care against chances of rupturing and spoiling its content. The joint of *sharavas* was exposed by carefully breaking the seal and content was observed and noted for changes.

Material was collected and triturated individually avoiding contamination. For subsequent *puta*, one *puti bhasma* was triturated well with sufficient of quantity *triphala kwatha(bhavana)*. After pelletization and drying it was subjected to their respective *puta*. Repeated the procedure till *bhasma* attained *siddhi lakshanas.*[7]

C. Analysis of final product

1. Organoleptic parameters: *varna*(colour), *rasa*(taste), *sparsha*(touch), *gandha*(odour).
2. Classical tests: *rekhapurnatva, varitara, unama, nishchandrata, apunarbhavatwa*[8] *avami, niswaduta*[9] and *amalki pariksha*.[10]
3. Modern physico-chemical parameters: LOD, total ash value, acid insoluble ash.[11]
4. Sophisticated analytical instrumental techniques like scanning electron microscopy(FEG-SEM-EDX)[12,13]

OBSERVATION

Table 1: XRF analysis of *kantalauha*

Element.		Mass (%)	Intensity (cps/µA)	Formula	Mass (%)
Silicon	Si	0.46	0.092	SiO_2	0.762
Phosphorus	P	0.10	0.040	P_2O_5	0.174
Sulphur	S	0.05	0.042	SO_3	0.093
Manganese	Mn	0.00	0.000	Mn_2O_3	.000
Iron	Fe	99.03	419.695	Fe_2O_3	98.668
Nickel	Ni	0.01	0.024	NiO	0.009
Copper	Cu	0.35	0.932	CuO	0.295
Oxygen	O_2	30.276	0.412		

During the *samanya shodhana*, coarse *kantalauha* was taken in a *lauha kadhai*, heated to red-hot-stage at 750^{o}C and subjected to *nirvapa*(quenching) in *kaddalikanda swarasa* using a *pithaharayantra*. *Kantalauha* averagely took 10-15 min. to reach red-hot-stage and produced typical “hissing” sound on quenching followed by rise in temperature of the *swarasa*. After every quenching some residue in the form of black powder was observed. After complete *shodhana*, *kantalauha* turned into a mixture of black coarse powder.

During the *vishesha shodhana*, *kantalauha* achieved a temperature of 750^{o}C when subjected to *tivraagni* for 15-20 min. Mixture of *triphala kwatha* and *gomutra*, prepared in 1:1 proportion when added to *kadhai* took another 15-20 min for exhaustion. Froth was observed initially on the mixture after 2 min of boiling. Temperature of mixture was recorded between 100°C and 105°C throughout the procedure.

During *pachana* of *vishesh shodhita kantalauha churna* with equal quantity of *goghrita*(cow ghee) placed in *lauha kadhai* and subjected to *bharjana*(roasting) with *tivraagni*(severe heat); *mardana*(levigation) with *lauha darvi* was not possible due to the inflammation tendency of the mixture and severe heat.

During the *bhasma* preparation, cracks were observed on *sharava* in both samples after *Puta*. After first *puta*, *kantalauha chakrika* became so brittle that it was getting powdered on rubbing between two fingers. Black, smooth, and very fine *bhasma* was obtained after 2nd *puta*. Particulars of *marana* procedure, duration of temperature given to *puta*, specific and other observations regarding change in weight are depicted in tables below.

Table 2: Showing changes in weight of kantalauha during processes.

Process.	Initial weight (gm).	Final weight (gm).	Change in weight (gm).
Samanya shodhana.	1000	990	-10
Vishesha shodhana.	990	1200	+210
Goghrita pachana.	1200	1300	+100

Table 3: Showing changes in weight of both samples after gajaputa.

No.of Puta	Sample 1(*Gajaputa*).			Sample 2(EMF).		
	Initial weight (gm).	Weight after marana (gm).	Loss (gm).	Initial weight (gm).	Weight after marana (gm).	Loss (gm).
1st	650	645	5	650	648	2
2nd	645	642	3	648	645	3
3rd	642	640	2	645	640	5
4th	640	638	2	640	640	0
5th	638	638	0	640	635	5
6th	630	620	8	635	630	5
7th	620	620	10	630	620	10
8th	620	600	10	620	610	10
9th	600	590	10	610	600	10
10th	590	570	20	600	580	20

Table 4: Showing organoleptic characters.

No.of Puta.	Sample 1 (*Gajaputa*).				Sample 2 (EMF).			
	Colour.	Taste.	Touch.	Odour.	Colour.	Taste.	Touch.	Odour.
1.	Black	Metallic & sour	Rough	Pungent	Black	Metallic & sour	Rough	Pungent
2.	Black		Rough	Pungent	Black		Rough	Pungent
3.	Black-purple	Metallic	Rough	Odourless	Black-purple	Metallic	Smooth	Odourless
4.	Black-purple	Tasteless	Smooth	Odourless	Black-purple	Tasteless	Smooth	Odourless
5.	Black-purple	Tasteless	Smooth	Odourless	Black-purple	Tasteless	Smooth	Odourless
6.	Dark purple	Tasteless	Smooth	Odourless	Dark purple	Tasteless	Smooth	Odourless
7.	Dark purple	Tasteless	Smooth	Odourless	Dark purple	Tasteless	Smooth	Odourless
8.	Dark purple	Tasteless	Smooth	Odourless	Dark purple	Tasteless	Smooth	Odourless
9.	Purple	Tasteless	Smooth	Odourless	Purple	Tasteless	Smooth	Odourless
10.	Pakwa jambu phala varna	Tasteless	Smooth	Odourless	Pakwa jambu phala varna	Tasteless	Smooth	Odourless

Table 5: Showing *bhasma pariksha* of sample 1 (*Gajaputa*).

Parameters.	Puta.									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Rekhapurnatva.			+	+	+	+	+	+	+	+
Varitara.				+	+	+	+	+	+	+
Unama.					+	+	+	+	+	+
Nishchandrata.						+	+	+	+	+
Apunarbhavatwa.								+	+	+
Amalki pariksha.										+

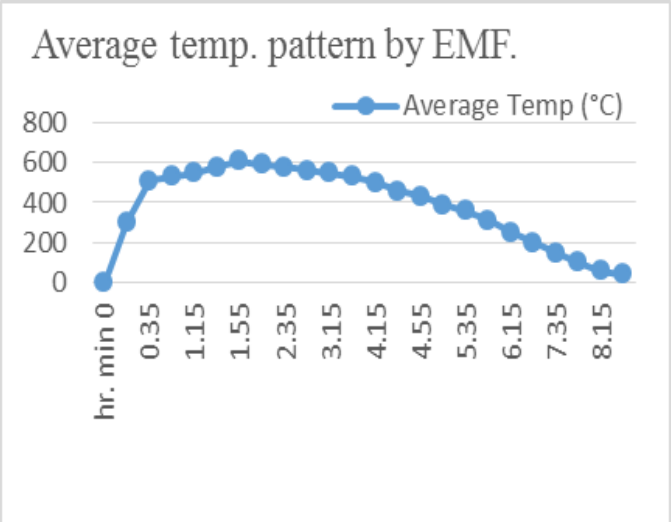
Table 6: Showing *bhasma pariksha* of sample 2 (EMF).

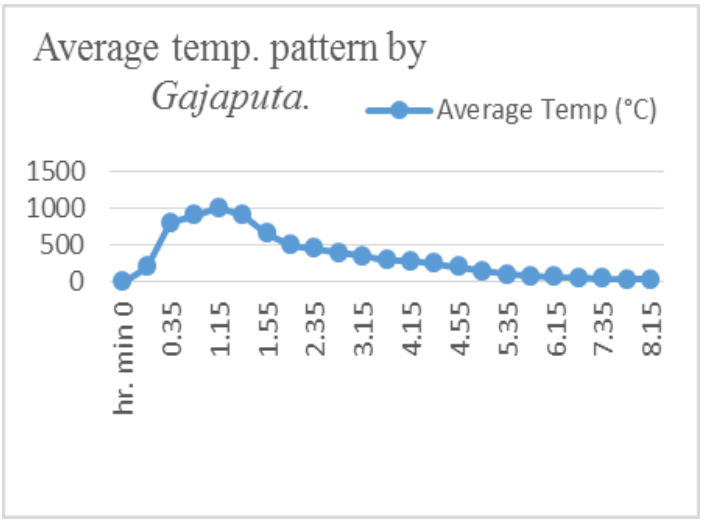
Parameters.	Puta.									
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Rekhapurnatva.			+	+	+	+	+	+	+	+
Varitara.				+	+	+	+	+	+	+
Unama.					+	+	+	+	+	+
Nishchandrata.						+	+	+	+	+
Apunarbhavatwa.								+	+	+
Amalki pariksha.										+

Table 7: Showing Physio-Chemical Analysis.

Sr.no.	Parameter	Sample 1 (*Gajaputa*).	Sample 2 (EMF).
1.	L.O.D.	0.31	0.37
2.	Total ash %.	99.65	99.86
3.	Acid insoluble ash %.	58.65	62.57

Graph: Showing temperature pattern of *puta*.



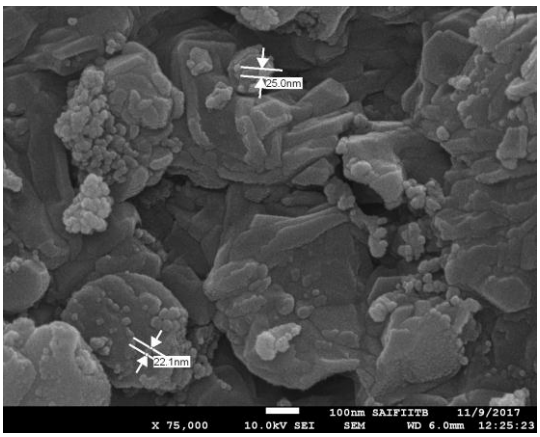

Average temp. pattern by
Gajaputa.
Average Temp (°C)
1500
1000
500
0
hr. min 0
0.35
1.15
1.55
2.35
3.15
4.15
4.55
5.35
6.15
7.35
8.15


399.


118.6



SEM ANALYSIS: At resolution 100 nm and magnification 75000×.



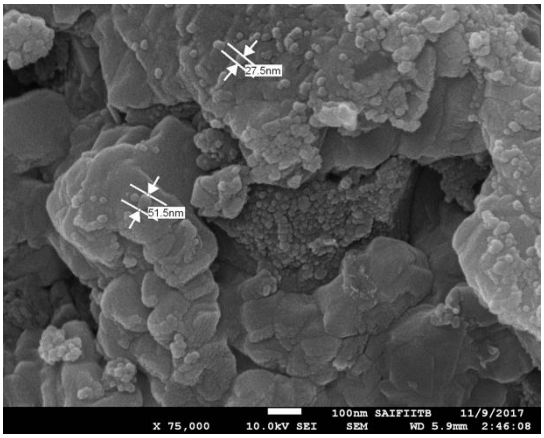


Fig. 1: Sample 1(*Gajaputa*). Fig.2: Sample 2(EMF).

DISCUSSION AND CONCLUSION

Aim of the present study was to develop a SMP of *kantalauha bhasma* prepared using classical and modern techniques. Curie temperature(T_C) is a temperature at which certain material lose their permanent magnetic property. For iron, Fe_2O_3 and Fe_3O_4 is 1043, 948 and 858^oC resp. hence, to avoid physical, chemical and structural(lattice) changes prior to preparation of lauha bhasma; its conversion to *kantakavedhipatra*(foil) was avoided.

According to reference 4 *gajaputas* are mentioned but after 4 *puta* both the sample didn't qualify the *bhasma pariksha* so subjected for further *puta*.

During this *marana* procedure after 1st *puta* both samples were easily breakable and easily made into powder. For the first *puta, triphala kwatha* was required gravimetrically 1/2th of the total amount of *shuddha kantalauha*. This amount of *triphala kwatha* increased from second *puta* onwards. This is because of reduced particle size and increased surface area of the material. Compared to *kantalauha bhasma* prepared by EMF, *kantalauha bhasma* prepared by gajaputa showed more gravimetric loss. At the end of 10th *puta* both the samples qualified all the *bhasma pariksha* like *rekhapurnatva, varitara, unama, nishchandrata, apunarbhavatwa* along with no discoloration in *amalki pariksha* even after 48 hours. After 10th puta SEM analysis at resolution 100 nm and magnification 75000× showed particle size of sample 1(*gajaputa*) reached 22.1nm and sample 2(EMF) of *kantalauha bhasma* reached 27.5 nm. Visually both the samples consist of more smaller particles.

Considering all the above parameters it can be concluded that *kantalauha* bhasma prepared classically using *gajaputa* reached more reduced size and stands better in quality than that of *bhasma* prepared by EMF. The manufacturing method of *kantalauha bhasma* is in tune to

nanotechnology of contemporary era which may cover scientific validation of today.

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