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KEY WORDS: *Tamra bhasma,* analytical study, pharmaceutical study.

COMPARATIVE PHARMACEUTICO-ANALYTICAL STUDY OF *TAMRA* BHASMA PREPARED BY CLASSICAL AND MODERN TECHNIQUES.

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ABSTRACT

In present study *nepaliya tamra bhasma* was prepared using two different ways: by classical *gajaputa* and EMF. The current pharmaceutical study of both the *bhasmas* was carried to evaluate the quality of both *bhasmas*. *Kantakavedhi tamra patra* (copper foil 0.05mm thick) was processed for *samanya shodhana* and *vishesh shodhana*. *Vishesh shodhita tamra* was divided into two samples and subjected to *marana*(incineration) using *gajaputa* according to the classical reference and EMF according to recent advanced method. Both the samples of *tamra bhasma* qualified all *bhasma pariksha* with *dadhi pariksha* after the 8th *puta*. SEM analysis at resolution 100 nm and magnification 75000× showed *tamra bhasma* particle size of sample 1 (by *gajaputa*) reached 31.3nm and sample 2 (by EMF) reached 41.4 nm. Considering all the above parameters it can be concluded that tamra bhasma prepared using classically *gajaputa* reached more reduced size and stands better in quality than that of *bhasma* prepared by EMF.

INTRODUCTION.

According to available literature *nepaliya* and *rakta varna tamra* is considered best compared to *mlechha* and *krishna*. According to *lakshanas,* best variety copper is very smooth, soft, reddish in color, heavy and does not change its properties by application of heat.[1]

Though numbers of methods are described in literature, *tamra bhasma* preparation has always been a practical problem. Moreover, improperly prepared(*apakwa*) *tamra bhasma* has been quoted as poison because of its hazardous effects on the body.[2] *Ayurveda prakasha* have quoted *ashtamahadoshas* (eight major ill effects) to indicate its toxic potential.[3] Therefore, it is extremely important to prepare *tamra bhasma* of good quality. Safety and efficacy depends 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 microfine 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 *tamra 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.

Kantakavedhi nepaliya tamra patra(copper foil: size 1×1" and thickness 0.05mm) was procured from the market. It was qualitatively analyzed for its copper content by XRF analysis. *Kaddalikanda*(Musa paradisiaca corm), *gomutra*(cow urine), *tankanakhara*(borax), *parada*(mercury), *gandhaka*(sulphur), *nimbu* (Citrus limon(Linn).Burm. f.) were procured from the market.

B. Preparation of *tamra bhasma*:

1. *Tamra patra* 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 - rasachandanshu* chapter 473.
2. *Vishesh shodhita tamra* was divided into two batches and subjected to *marana*(calcinations/incineration) procedure using classical *gajaputa* and EMF respectively according to the reference of *rasatarangini* chapter 17/25.

a. Process of *tamra samanya shodhana*:

Samanya shodhana of *tamra* was carried out by *nirvapa*(heating till red hot and quenching) in *kaddalikanda swarasa*, prepared as per the references of *sharangadhara samhita*. *Tamra patra* 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 *tamra* was taken.

b. Process of *tamra vishesha shodhana*:

Vishesha shodhana of *samanya shodhita tamra* patra was done by *swedana*(stewing/boiling) with *gomutra, limbu rasa* and *tankanakhara* for 1 *prahara*(3 hours) in SS vessel. It was then washed with warm water and dried. Temperature of mixture was noted, using a pyrometer.

c. Process of preparation of *kajjali*:

Parada and g*andhaka shodhana* was done as per the classical reference of *rasatarangini* chapter 5/27-30 and chapter 8/7-12 respectively. Preparation of *samaguna kajjali* was done as per the classical reference of *rasatarangini* chapter 6/107. *Shuddha parada* and *shuddha gandhaka* were taken in a *khalvayantra* (mortar and pestle) in equal quantity and triturated. It was continued until the powder became black, smooth, and lusterless.

d. Process of *marana*:

Vishesh shodhita tamra was divided into two batches and *tamra bhasma* was prepared by *marana*(calcinations/incineration) of *shuddha tamra* as per the reference of *rasatarangini* chapter 17/25.

Batch 1: *Samaguna kajjali* equal to the amount of *shuddha tamra* was taken in *khalvayantra*, *nimbu swarasa bhavana*(wet trituration) was given. When paste like consistency appeared, *shuddha tamra* was added in it and triturated. After pelletization and drying in shade, it was kept in *sharava*(earthen saucer) and covered by another *sharava* and *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: *Samaguna kajjali* equal to the amount of *shuddha tamra* was taken in SS body stone grinder and *nimbu swarasa bhavana* was given. When paste like consistency appeared, *shuddha tamra*

was added in it and triturated. After pelletization and drying in shade, it was kept in *sharava* and covered by another *sharava* and sandhibandhana was done and subjected to *puta* in a horizontal electric muffle furnace(EMF). Following temperature pattern of EMF referenced from previous research work done was maintained: 1st *Puta* at 700°C for 20 min, 2nd *Puta* at 600°C for 25 min, 3rdand subsequent *Puta* at 500°C for 30 min.[4]

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. In subsequent *puta* equal amount of *samaguna kajjali* was added to that of one *puti bhasma* and triturated well by giving *bhavana* of sufficient quantity of *nimbu rasa*. After pelletization and drying it was subjected to their respective *puta*. Repeated the procedure till *bhasma* attained *siddhi lakshanas*.[5]

C. Analysis of final product:

1. Organoleptic parameters: *varna*(colour), *rasa*(taste), *sparsha*(touch), *gandha*(odour).
2. Classical tests: *rekhapurnatva, varitara, unama, nishchandrata, apunarbhavatwa*[6]*; avami*, *niswaduta*[7] and *dadhi pariksha*(curd test).[8]
3. Modern physicochemical parameters: LOD, total ash value, acid insoluble ash.
4. Sophisticated analytical instrumental techniques like scanning electron microscopy(FEG-SEM-EDX)

OBSERVATION.

Table 1. XRF Analysis of Tamra Patra.

Element.		Mass(%)
Phosphorus	P	0.00
Copper	Cu	99.99

During the *bhasma* preparation, cracks were observed on *sharava* in both samples after *Puta*. Whitish layer of mercury was observed near the door of EMF. After first *puta*, *tamra patra* pieces 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 the weight loss in gajaputa for Sample 1.

No. of puta.	Weight of shuddha tamra (gm).	Weight of Kajjali(gm).	Total weight (gm).	Weight after puta(gm).
1st	178	356	534	208
2nd	200	52	252	201.6
3rd	196	49	245	175.91
4th	172	43	215	149.2
5th	144	36	180	140
6th	136	34	170	132
7th	128	32	160	124.96
8th	120	30	150	112.2

Table 3: Showing the weight loss in puta for Sample 2 (EMF).

No. of puta.	Weight of shuddha tamra. (gm)	Weight of Kajjali(gm).	Total weight (gm).	Weight after puta(gm).
1st	160	320	480	183.05
2nd	180	45	225	186.07
3rd	184	46	230	167.94
4th	164	41	205	136.01
5th	132	33	165	133.54
6th	128	32	160	108.37
7th	104	26	130	99.38
8th	96	24	100	82.4

Table 4: Showing the weight loss in both samples after gajaputa.

	Sample 1(*Gajaputa*).	Sample 2(EMF).
Initial weight (gm).	178	160
Weight after marana (gm).	112.2	82.4
Loss (gm).	65.8	77.6

Table 5: Showing organoleptic characters.

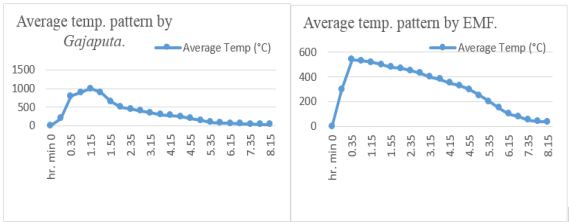
No. of Puta.	Sample 1 (*Gajaputa*).				Sample 2 (EMF).			
	Colour.	Taste.	Touch.	Odour.	Colour.	Taste.	Touch.	Odour.
1.	Grey	Metallic	Rough	Odourless	Grey	Metallic	Rough	Odourless
2.	Blackish green	Metallic	Rough	Odourless	Blackish green	Metallic	Rough	Odourless
3.	Blackish, green and brown tinge.	Metallic	Smooth	Odourless	Blackish green	Metallic	Smooth	Odourless
4.	Brownish black	Tasteless	Smooth	Odourless	Blackish, green and brown tinge.	Tasteless	Smooth	Odourless
5.	Brownish black	Tasteless	Smooth	Odourless	Brownish black	Tasteless	Smooth	Odourless
6.	Brownish black	Tasteless	Smooth	Odourless	Brownish black	Tasteless	Smooth	Odourless
7.	Brownish black	Tasteless	Smooth	Odourless	Brownish black	Tasteless	Smooth	Odourless
8.	Blackish brown.	Tasteless	Smooth	Odourless	Blackish brown.	Tasteless	Smooth	Odourless

Table 6: Showing bhasma pariksha.

Parameters.	Sample 1 (*Gajaputa*)							Sample 1 (EMF)						
	Puta.							Puta.						
	1.	2.	3.	4.	5.	6.	7.	8.	1.	2.	3.	4.	5.	6.	7.	8.
Rekhapurnatva.			+	+	+	+	+	+			+	+	+	+	+	+
Varitara.					+	+	+	+					+	+	+	+
Unama.					+	+	+	+					+	+	+	+
Nishchandrata.						+	+	+						+	+	+
Apunarbhavawa.							+	+							+	+
Dadhipariksha.								+								+

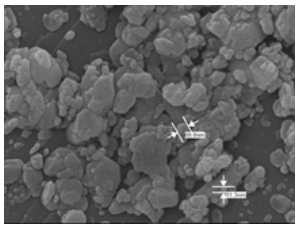
Table 7: Showing Physio-Chemical Analysis.

Sr.no.	Parameter	Sample 1 (*Gajaputa*).	Sample 2 (EMF).
1.	L.O.D.	0.42	0.45
2.	Total ash %.	97.36	97.42
3.	Acid insoluble ash %.	91.25	91.33



Temperature pattern of *puta*.

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



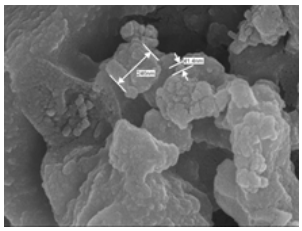


Fig.1: Sample 1(*Gajaputa*). **Fig.2: Sample 2(EMF).**

DISCUSSION AND CONCLUSION.

Aim of the present study was to compare *tamra bhasma* prepared using classical and modern techniques. For the *marana*, *lepa* application of *kajjali* is mentioned but both sample were converted to fine pieces so it was difficult to apply as a *lepa* hence, uniform mixing was done followed by *nimbu rasa bhavana* and its *chakrika* were kept in *sharava* and subjected to respective *puta* after *sandhibandhan*. Same procedure was followed for next *putas*. According to reference 3 *gajaputas* are mentioned but after 3 *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, nimbu swarasa* was required gravimetrically 1/4th of the total amount of *shuddha tamra* and *samaguna kajjali*. This amount of *nimbu swarasa* increased from second *puta* onwards. This is because of reduced particle size and increased surface area of the material. Compared to *tamra bhasma* prepared by gajaputa, *tamra bhasma* prepared by EMF showed more gravimetric loss. At the end of 8th *puta* both the samples qualified all the *bhasma pariksha* like *rekhapurnatva, varitara, unama, nishchandrata, apunarbhavatwa* along with no discoloration in *dadhi pariksha* even after 48 hours. After 8th puta SEM analysis at resolution 100 nm and magnification 75000× showed particle size of sample 1(by *gajaputa*) reached 31.3nm and sample 2(by EMF) of *tamra bhasma* reached 41.4 nm.

Considering all the above parameters it can be concluded that tamra bhasma prepared using classically *gajaputa* reached more reduced size and stands better in quality than that of *bhasma* prepared by EMF.

REFERENCES

1. Sharma Sri Sadananda, Rasatarangini, New Delhi: 11thedition, Motilal Banarasidas; 2000, Tarang 17/7.
2. Upadhyaya Madhava. Ayurved Prakasha, 3/115. reprint. Varanasi: Chaukhamba Bharatiya Academy; 1999. p. 368.
3. Ayurved Prakasha, 3/116; 368
4. Chandrashekhar Y. Jagtap, Pradeep Kumar Prajapati, Biswajyoti Patgiri, and Vinay J. Shukla. Standard manufacturing procedure of Tamra Bhasma. Ayu. 2012 Oct-Dec; 33(4): 561–568. PMCID: PMC3665197 doi: 10.4103/09748520.110528
5. Rasa Ratna Samucchya 8/27-28.
6. Vagbhattacharya . In: Rasaratna Samuchchaya, 8/2630. reprint. Kulkarni DA, editor. New Delhi: Meharchand Laxmandas Publication; 2007. p. 148.
7. Mishra SN. 15th edition. Varanasi: Chaukhamba Orientalia; 2006. Ayurvediya Rasashastra; p. 94.
8. Shastri DN, Sharma SN. In: Rasa Tarangini, 17/3233. reprint. Shastri KN, editor. Delhi: Motilal Banarasi Das; 2004. p. 416.
9. The Ayurvedic Pharmacopoeia of India, ebook, Part I. V(Appendix2.2)