



## Pharmaceutical Standardisation

# Pharmaceutical study of *Triguna* and *Shadguna Balijarita Makaradhwa*

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### Abstract

*Makaradhwa* is a herbo-mineral drug prepared by *Kupipakwa* method. In the present study *Makaradhwa* was prepared by *Triguna* and *Shadguna Balijarana* using *Ashtasamskarita Parada*. Total five batches of *Triguna Makaradhwa* (TM) were prepared by taking 330 g of *Kajjali* in each batch, average product obtained was 29.12 g. In the preparation of *Shadguna Makaradhwa* (SM) too, five batches were prepared, taking 250 g of *Kajjali*, average product obtained was 16.8 g. The average time taken for flame in TM was 3.01 h and that in SM was 4.58 h. *Kupipaka* was carried out for 18 and 36 h in TM and SM, respectively. Inductive Coupled Plasma – Optical Emission Spectrometry (ICPOES) revealed the presence of 7.2976 ppm gold in TM, whereas 663.14 ppm in SM.

**Key words:** *Ashtasamskarita Parada*, *Parada*, *Balijarana*, *Makaradhwa*, *Murcchana*

## Introduction

*Makaradhwa*<sup>[1]</sup> is a type of *Galastha*<sup>[2]</sup> (product sublimed at the neck of glass bottle), *Sagandha* (having sulfur as a component), *Rasa Murcchana*<sup>[3]</sup> (a compound formulation having processed mercury as a ingredient) prepared by *Kupipakwa* method<sup>[4]</sup> (gradual heating of mixture of drugs in glass bottle), adopting two references [for *Triguna Makaradhwa* (TM) and *Shadguna Makaradhwa* (SM)] of *Bhaishajya Ratnavali*<sup>[5,6]</sup> by a very specialized heating system, that is, *Kramagni*<sup>[7]</sup> (subsequent increasing temperature) manner by vertical Electrical Muffle Furnace (EMF),<sup>[8]</sup> which is a modification of *Valuka Yantra*.<sup>[9]</sup> *Triguna* and *Shadguna Balijarana* were carried out using *Ashtasamskarita Parada* (processed mercury) [Figure 1]. *Jarana* is a process in which *Parada* consumes *Swarna*, etc., by various processes with heat through *Vida*, *Valuka*, and *Kacchapa Yantra*. It means after distillation and straining, the consumed substance like *Abhraka* (mica), *Swarna* (gold), etc., does not remain distinct and *Parada* remain in its preceding state and its weight also does not change.<sup>[10]</sup> A specific process after which *Parada* is used for therapeutic purposes is known

as *Parada Murcchana*.<sup>[11]</sup> It is a process in which *Parada* with or without *Gandhaka* is converted into suitable compound, which is classified in to *Sagandha Murcchana* (processed with *Gandhaka*) and *Nirgandha Murcchana* (processed without *Gandhaka*).<sup>[12]</sup> The *Sagandha Murcchita Yogas* are widely used in therapeutics due to their least toxicity and high potency. *Kajjali*, *Rasaparpati*, *Rasagarbha Pottali*, *Hemagarbha Pottali*, *Rasasindura*, *Makaradhwa*, etc., are the examples of this process. *Rasa* classics claims that, *Parada* (mercury) treated with *Gandhaka* (sulphur) becomes highly potentiated, that is, acquire many pharmacological and therapeutic properties. It is further believed in these contexts that the potentiation of *Parada* depends on the proportion of *Gandhaka* burnt in *Jarana* process. The textual references also support the above statement and according to this *Shadguna Balijarita Parada* is claimed to be much more powerful and effective than *Samaguna* or *Dwiguna Balijarita Parada*.<sup>[13]</sup> In addition, many texts claim that without *Shadguna Gandhaka Jarana*, *Parada* does not acquire the power of curing diseases.<sup>[14]</sup>

Preparations which are primed in *Kachakupi* with a specific heating pattern in *Valuka Yantra* are termed as *Kupipakwa*. Initially these were carried out in *Sharava* and *Musha*<sup>[15]</sup> in context of *Parada Bhasma*. But in later period of *Rasaprakash Sudhakara*, that is, from 14<sup>th</sup> century onwards, it was modified with the use of *Kachakupi* (glass bottle). *Kupipakwa Rasayana Kalpana* is unique, due to its preparation method, properties like quick action, *Rasayana* (rejuvenator and revitalizer), *Yogavahi* (promoting) and effective in smaller dosage along with long shelf life. Hence, here with the help of three and six times

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of sulfur in proportion to *Ashtasamkarita Parada*,<sup>[16]</sup> TM, and SM were prepared to judge the importance of *Jarana*.

## Materials and Methods

### Collection of raw material

*Ashuddha Gandhaka* (raw sulfur), *Ashuddha Parada* (raw mercury) were initially procured from Pharmacy, Gujarat Ayurved University, Jamnagar and authenticated. *Kumari* (*Aloe barbadensis* Mill.) was collected from periphery of Jamnagar and fresh *Panchanga* (whole plant) and especially flowers of *Rakta Karpasa* (*Gossypium arboreum* Linn.) were collected from Bijapur, Karnataka and authenticated in the Pharmacognosy Laboratory, I.P.G.T. and R.A. Jamnagar.

*Ashtasamkaras* of *Parada*, *Shodhana* of *Gandhaka*,<sup>[17]</sup> preparation of *Rakta Karpasa Pushpa Swarasa* (flower juice) and *Kumari Swarasa* (aloe juice) were carried out as per classical references. The products were analyzed for Inductive Coupled Plasma – Optical Emission Spectrometer (ICPOES) for their minor chemical constituents. The maker of instrument was CPA Ltd. Bulgaria (Model-Optima 3300 RL).

### Preparation of *Makaradhwa*

The whole process was carried out in four stages:

#### Preparation of *Swarna Pishti*

The measured quantity of *Ashtasamkarita Parada* was taken in *Simaka Khalva Yantra* (mortar-pestle) then *Swarna Varkha* (gold foils) [Figure 2] was added to it and trituration process was carried out till the formation of *Swarna Pishti* (amalgam) [Figure 3].

#### Preparation of *Kajjali*

Previously prepared *Swarna Pishti* was taken in *Simaka Khalva Yantra* then *Shuddha Gandhaka* [Figure 4] was added to it in prescribed quantity followed by trituration process till the

formation of *Kajjali*. This process was carried out in eight batches for *Triguna Kajjali* (TK) and three batches in *Shadguna Kajjali* (SK) [Figure 5].

#### *Bhavana*

Respective *Bhavanas* (levigation) of *Rakta Karpasa Pushpa Swarasa* and *Kumari Swarasa* were given to both the *Kajjali* [Figure 6].

#### *Kupipaka*

The *Bhavita Kajjali* was filled in seven layers mud smeared cloth (*Kapadamitti*) *Kacha Kupi* for respective batches through funnel. *Kupi* were kept in EMF and *Kramagni* was given for 18 h to TK and 36 h to SK. After disappearance of the flame confirmative tests like red hot bottom, *Sheeta Shalaka* test, coin test were carried out and corking was done. *Kupi* were left for self cooling and on the next day the *Kupi* were taken out of EMF for collection of products, which were kept in air tight container [Figure 7].

## Observations and Results

In preparation of TM by *Shuddha Swarna Varkha* (gold foils of processed gold), *Ashtasamkarita Parada* (*Parada* after eight specific processes – in which initial five are purificatory and last three are potentiating in nature).

Out of four batches, total 669.5 g of *Swarna Pishti* was procured. The total 669.5 g of *Pishti* and 1800g of *Shudha Gandhaka* was added and trituration was carried out to procure 2425.8 g of TK 39 g loss in weight of *Kajjali* was observed. The TK was further processed for sequential *Bhavanas* of *Rakta Karpasa Pushpa Swarasa* (fresh juice of flowers of *Gossypium arboreum* Linn.) and *Kumari Swarasa* [Table 1]. Overall 62 g of weight gain of *Kajjali*, that is, 2.70% was observed after *Bhavana* process.

For the preparation of *Kajjali* of *Shadguna* [Table 2], 833.1 g



Figure 1: *Ashtasamkarita Parada*

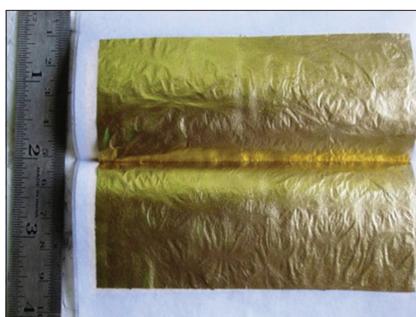


Figure 2: *Swarna Varkha*



Figure 3: *Swarna Pishti*



Figure 4: *Shuddha Gandhaka*



Figure 5: Preparation of *Kajjali*

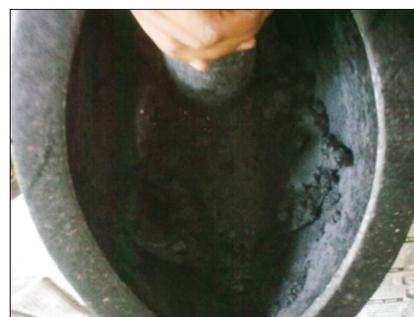


Figure 6: Levigation of *Makaradhwa Kajjali*

**Table 1: Brief observational profile of consequent *Bhavana* of *Triguna Makaradhwa* *Kajjali***

Wt of <i>Kajjali</i> after <i>Mardana</i> (g)	<i>Rakta Karpasa Pushpa Swarasa</i> ml	Total <i>Mardana</i> period (h)	<i>Kumari Swarasa</i> (ml)	Total <i>Mardana</i> period (h)	Wt of <i>Kajjali</i> after <i>Bhavana</i>	Wt increased due to <i>Bhavana</i>	
						Wt	%
2425.8	668	48	920	48	2487.8	62	2.70

**Table 2: Observations during preparation of *Shadguna Kajjali* with *Bhavanas***

Wt of <i>Triguna Kajjali</i>	Wt of <i>Shu. Gandhaka</i> (g)	<i>Rakta Karpasa Pushpa Swarasa</i> (ml)	Total <i>Mardana</i> period (h)	<i>Kumari Swarasa</i> (ml)	Total <i>Mardana</i> period (h)	Total (g) %	<i>Nischandratva Rekhapurnatva</i> of <i>Kajjali</i> (h)	Total <i>Mardana</i> period (h)	Wt of <i>Kajjali</i> after <i>Mardana</i> (g)	Wt loss during <i>Mardana</i> (g) %
833.1	600	148	18	320	18	1433.1	176	194	1420.1	13 0.93

**Table 3: Mean observations during *Kupipaka* of *Triguna Makaradhwa* (Batch I-V)**

Time (h)	Temp set (°C)	Temp observed (°C)	Observations
0.00	150	39	<i>Kupi</i> Kept, EMF Started, Typical Smell of <i>Makaradhwa</i> <i>Kajjali</i> can be smelt, Slight fumes started within 15 min
0.45	150	158	White fumes can be recognized
6.30	350	335	Dense yellow fumes, neck wet
10.15	425	422	Semi molten <i>Kajjali</i> at the bottom
12.15	450	452	Flame appeared 1 inch out of neck
13.15	455	457	Flame persists with fumes—4 inches
13.45	465	458	Very dense fumes with flame burning with blue color—5 inches
14.30	480	484	Flame in neck
15.00	490	494	<i>Sheeta Shalaka</i> test +ve, coin test +ve, Bottom can be seen red hot
15.15	500	501	Flame went off
15.30	525	519	Loose corking done,
15.45	525	521	Sublimation started
16.00	550	548	Corking
18.00	Stopped	603	Stopped, left for self cooling

EMF: Electrical muffle furnace

of TK and 600 g *Gandhaka* (i.e., three times *Gandhaka* to the weight of *Parada*) was added and trituration was done. After SK *Nirmana*, the prescribed *Bhavana* of *Rakta Karpasa Pushpa Swarasa* and *Kumari Swarasa* were given. Finally 1420.1 g of SK with 13 g of weight loss, that is, 0.93% was procured.

TM is prepared in five subsequent batches of 330 g of TK with 18 h of *Kramagni Paka* (increasing heating system). Similarly SM is prepared in five subsequent batches of 250 g of SK with 36 h of *Kramagni Paka*.

**Table 4: Mean observations during *Kupipaka* of *Shadguna Makaradhwa* (Batch I-V)**

Time (h)	Temp set (°C)	Temp observed (°C)	Observations
0.00	150	34	<i>Kupi</i> started, typical smell of <i>Makaradhwa</i> <i>Kajjali</i>
1.00	150	148	White fumes can be visualized
4.30	200	200	Slight yellow fumes
14.30	275	271	Semi molten <i>Kajjali</i> at bottom
20.30	350	346	Dense yellow fumes
26.30	450	452	Dense yellow fumes with total wet neck
27.30	475	465	Flame appeared, 2 inch in length
28.30	500	498	5 inches in length, then reduced slowly
29.30	525	521	Vigorous <i>Shalaka Sanchalana</i> , flame in neck, gradually decreased, <i>Sheeta Shalaka</i> positive, coin test positive
30.30	550	548	Flame went off, loose corking done
31.30	550	552	Corking done, sublimation started
36.00	Stopped	603	Furnace stopped, kept for self cooling

The pharmaceutical preparation of TM [Table 3] and that of SM [Table 4], the flame lasted averagely in TM for 3.01 h and in SM for 4.58 h [Chart 1, Figure 8]. Average TM obtained was 29.12 g, percentage of TM was 8.83 g, [Figures 9, 10] whereas average SM obtained was 16.8 g, [Figures 10-12] percentage of SM was 6.59% [Charts 2, 3].

Organoleptic analysis showed that both products were tasteless, the color of TM as reddish brown and of SM as reddish chocolate brown after vigorous trituration, both were odorless, and in touch outer surface was smooth and inner side was rough crystalline.

The physicochemical analysis of two of the *Kajjalis* and both



Figure 7: Placement of filled *Kupa* in EMF



Figure 8: Flaming stage of *Kupa*



Figure 9: Finished product of *Triguna Makaradhwa*

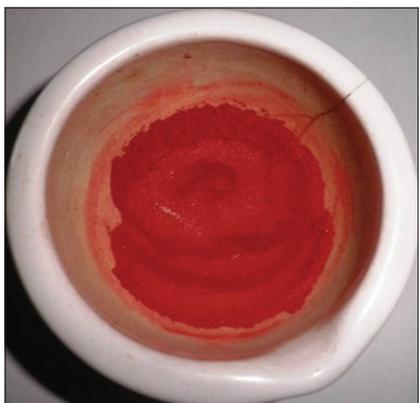


Figure 10: *Triguna Makaradhwa* after trituration



Figure 11: Finished product of *Shadguna Makaradhwa*

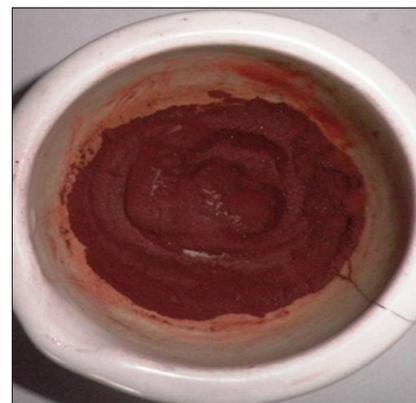


Figure 12: *Shadguna Makaradhwa* after trituration

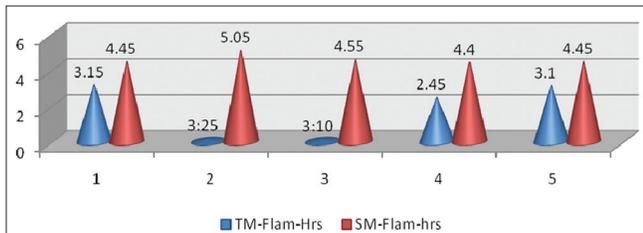


Chart No. 1: Average flame duration of TM and SM

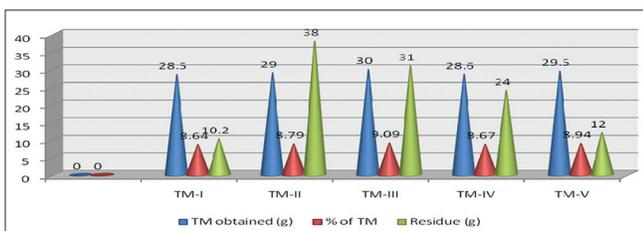


Chart No. 2: Results of *Triguna Makaradhwa* (I-V)

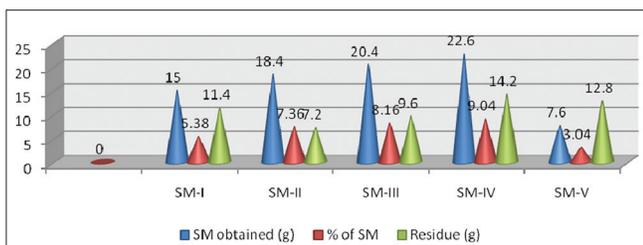


Chart No. 3: Results of *Shadguna Makaradhwa* (I-V)

finished products revealed that, moisture content<sup>[18]</sup> of TK and SK were 0.35 and 0.008, whereas that of TM and SM was same as 0.0009 for both. Ash values<sup>[19]</sup> of previous four entities were 26.38, 26.43, 0.4, and 0.35, respectively [Table 5].

The ICPOES study sample of TM confirmed the presence of 7.2976 ppm (particle per million) of gold, whereas the amount of gold achieved in SM was 663.14 ppm, which was remarkably many folds higher than TM [Table 6].

## Discussion

The *Siddhabheshajamanimala* appreciated seven qualities of *Makaradhwa* (*Chandrodaya Rasa*<sup>[20]</sup>) as it should have gold as a constituent, it should be enlightened or shining in night, it should show color of rising sun, which is settled in the bottom of *Kupa*, which is very pleasant, soft and should possess all the qualities for which it is appreciated.

The change in color of *Triguna* to SM can be justified by the reason that the amount of *Gandhaka* used and time taken for preparation of SM than TM was exactly double and it might also be due to the formation of polysulfide compound, which is relevant with procurement of darker product.

In comparing the ash value of both *Kajjali* of TM and SM with the finished product. The value decreased from 26.38 to 0.4 in TM and from 26.43 to 0.35 [Table 5] in SM, which shows existence of comparatively loose bonds in *Kajjali* and compact bonds in TM and SM.

ICPOES is an instrument useful for measuring higher

**Table 5: Physicochemical parameters of 4 samples**

Parameter	Samples			
	TK	SK	TM	SM
Moisture content (LOD)	0.35	0.008	0.0009	0.0009
pH value	5.08	4.22	6.16	6.05
Ash value (%w/w)	26.38	26.43	0.4	0.35
Acid insoluble ash (%w/w)	0.44	0.08	2.4	0.16

TK: *Triguna Kajjali*, SK: *Shadguna Kajjali*, TM: *Triguna Makaradhwa*, SM: *Shadguna Makaradhwa*

**Table 6: Results of inductive coupled plasma – optical emission spectrometry analysis of *Triguna* and *Shadguna Makaradhwa***

Element	Wavelength	Instrument detection limit (ppm) mg/L	TM	SM
Gold (Au)	267.595	0.0310	7.2976	663.14
Lead (Pb)	220.353	0.0420	0.8951	51.576
Copper (Cu)	327.393	0.0097	4.2019	13.154
Iron (Fe)	238.204	0.0046	39.153	550.92

TM: *Triguna Makaradhwa*, SM: *Shadguna Makaradhwa*, ppm: particle per million

concentrations of individual ingredients as far as herbo-mineral or metallo-mineral compound formulations are concerned.

Apart from presence of gold, lead, copper, and iron were also detected in ppm levels in both the samples, namely, TM and SM. Quantity of gold present in TM (7.2976 ppm) was far below the levels reported<sup>[21]</sup> (268 ppm), although it is nearly equal to the levels reported initially (7.65 ppm). It is to be noted that in first case<sup>[21]</sup> TM had been prepared from *Hingulottha Parada*, whereas in other works<sup>[8]</sup> done it was prepared from by *Ashtasamskarita Parada* and *Dwiguna Balijarana* from *Patra of Swarna*. In the present work, *Makaradhwa* was prepared by *Ashtasamskarita Parada* and subsequently *Triguna* and *Shadguna Balijarana* were carried out with *Swarna Varkha*.

Majority of the works had done initially signify the presence of gold in the sublimated product. Recent work carried out in 2009 had concluded that if *Makaradhwa* is prepared by least particle size of elemental gold, gold content increases in the finished product.<sup>[21]</sup>

Copper was present in both the samples, 4.2019 ppm in TM and 13.154 ppm in SM. This is due to incorporation of *Tamra* during *Urdhwapatana Samskara* of *Parada*. In addition, presence of iron was also seen [Table 5]. It may be due to the utilization of *Ushma Shalaka* during the later stages of *Kupi Paka*. Moreover, for *Tiryaka Patana Samskara*, iron instruments were used. Trituration of *Kajjali* in iron mortar and pestle may also be the possible reasons. Previously the presence of trace elements in *Rasasindoora* to the roots of *Ficus benghalensis*<sup>[22]</sup> had been accredited, in *Swarasa* of whose it was triturated. This may also be possible in this case too. *Karpasa Pushpa Swarasa* (media for levigation) may have iron contents in it. Lead was also present in traces in both the samples (TM – 0.8951 ppm and SM – 51.576 ppm). Cross contamination from adjacent formulations or possibly leaded water used for *Prakshalana* (washing) during processing may also be a source of contamination.

Further, in the present work, SM showed presence of 663.14 ppm of gold in the sublimated product. By far the research works concerned on *Makaradhwa*; this is the highest percentage of gold reported till date. This further supports the conclusion of prior researcher<sup>[21]</sup> as *Swarna Varkha* was used in the preparation. Duration of trituration of *Swarna Pishti*, duration of *Paka* (*Madhyamagni* and *Tivragni*, at the time of sublimation) and to a certain extent, errors in sample preparation may be the reasons for low quantity of gold reported in TM. Proper trituration of the amalgamated mass ensures proper interaction of gold with *Parada*.<sup>[23]</sup> As per *Parada Vijaniyam*, *Makaradhwa* prepared over longer duration of *Paka* are postulated to have more gold content,<sup>[24]</sup> which was supported by ppm values of gold in present study SM as it was prepared in 36 h in comparison to TM, which was prepared in 18 h. Improper sublimation of the final product may also be one of the reasons.

## Conclusion

The duration of heat and amount of sulfur are directly proportional to therapeutic efficacy. At the same time the amount of gold to be sublimated with the product in ppm level is unswervingly proportional to the *Balijarana*, which may help to increase the remedial value.

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## हिन्दी सारांश

### त्रिगुण एवं षड्गुण मकरध्वज का निर्माण

श्रद्धा एन. धुंदा, बिस्वाज्योति पटगिरि, प्रदीप कुमार प्रजापति, विनय जे. शुक्ला, बी. रविशंकर

कुपिपक पद्धति द्वारा निर्मित मकरध्वज एक रसायन द्रव्य है। अष्टसंस्कार एवं बलिजारणा से निर्मित मकरध्वज श्रेष्ठ होता है। अतः प्रस्तुत अध्ययन में मकरध्वज का निर्माण त्रिगुण एवं षड्गुण बलिजारणा के द्वारा किया गया। त्रिगुण एवं षड्गुण मकरध्वज का निर्माण पांच वर्गों में किया गया। ३३० ग्रा. त्रिगुण कज्जली से २९.९२ ग्रा. त्रिगुण मकरध्वज एवं २५० ग्रा. षड्गुण कज्जली से ९६.८ ग्रा. षड्गुण मकरध्वज की प्राप्ति हुई। कन्ठगत ज्वाला के लिये त्रिगुण मकरध्वज में ३.०१ घंटे एवं षड्गुण मकरध्वज में ४.५८ घंटे लगे। अति प्रबुद्ध तकनीकी विश्लेषणों से निर्मित मकरध्वज में स्वर्ण का मूल्यांकन करने पर त्रिगुण में ७.२९७६ पी.पी.एम. और षड्गुण में ६६३.९४ पी.पी.एम. स्वर्ण प्राप्त हुआ।