



Pharmaceutical Standardization

Standard manufacturing process of *Makaradhwaja* prepared by *Swarna Patra* – *Varkha* and *Bhasma*

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Abstract

Makaradhwaja is an important *Kupipakwa Rasayana*. It is prepared by using *Swarna* (gold), *Parada* (mercury) and *Gandhaka* (sulfur) in different ratios, i.e. 1:8:16, 1:8:24 and 1:2:4, respectively. The amount of *Gandhaka* in the *Jarana* process is directly proportional to the increase in therapeutic efficacy and reduces the toxicity of the product. Specific temperature pattern for the preparation of *Makaradhwaja* has been followed. In the present study *Swarna*, *Parada* and *Gandhaka* were taken in the ratio 1:8:24, respectively, and 12 h of heating for a specified amount of *Kajjali* (i.e., 400 g) in a *Kacha Kupi* 1/3rd of its capacity. There are some controversies regarding the form of *Swarna* (i.e., *Swarna Patra Swarna Varkha* or *Swarna Bhasma*) used in the preparation of *Makaradhwaja*. Therefore, in the present study, the samples of *Makaradhwaja* were prepared by *Swarna Patra*, *Varkha* and *Bhasma* in different batches. It was found that the use of *Varkha* produced a good-quality product along with the maximum amount of gold, i.e. 268 ppm, in comparison with *Patra*, i.e. 131 ppm, and *Bhasma*, i.e. 19 ppm, respectively.

Key words: *Bhavana*, *Hingulottha Parada*, *Kupipaka*, Standard manufacturing process, *Shodhana*

Introduction

Makaradhwaja is a popular *Kupipakwa Rasayana*, prepared with the *Swarna* (gold), *Parada* (mercury) and *Gandhaka* (sulfur) in a specified ratio. It was first described by Rasendra Chintamani^[1] by the name of *Chandrodaya Rasa*, although the word *Makaradhwaja* was first coined by Rasaratnakara. The term *Makaradhwaja* is composed of two words, i.e. *Makara* and *Dhwaja*. The term *Makaradhwaja* is also a synonymous of *Kamadeva*,^[2] the God of beauty. When it is used for therapeutic purposes, it produces *Rasayana* and *Vrishya* (in literary meaning, *Makara* indicates the aphrodisiac because *Makara Retasa* has been described as best *Shukrala*^[3] while *Dhwaja* [straight rod or flagpole] indicates its sexual potency. It is directly correlates the *Dhwajabhanga*, i.e. non-erection of penis.) property. A total of 30 formulations^[4] are found described by the name of *Makaradhwaja* and *Chandrodaya*, and two types of instruments are used for its preparation, i.e. *Valuka Yantra*

and *Khalwa Yantra*. Nowadays, *Makaradhwaja* is generally prepared as per the reference of Rasendra Chintamani due to easy and convenient preparation method; here, *Swarna*, *Parada* and *Gandhaka* are used in 1:8:16 ratio, but in different *Rasa* classics it is found described that the amount of *Gandhaka* is directly proportional to the therapeutic activity.^[5] Therefore, in this study, the ratio was followed as per the *Bhaishajya Ratnawali*, i.e. 1:8:24.

Aims and objective

The aim of the study was to develop the Standard Manufacturing Process (SMP) for *Makaradhwaja* prepared by *Swarna-Patra-Varkha* and *Bhasma* by Electrical Muffle Furnace (EMF).

Materials and Methods

Swarna was collected from a local authentic hallmark-certified Jeweler from Jamnagar. *Hingula*, *Tila Taila*, *Gandhaka* and *Kulattha* were collected from the Pharmacy, Gujarat Ayurved University, Jamnagar. *Takra*, *Kanji*, *Kulattha Kwatha*, *Japakusuma Swarasa*, *Kumari Swaras*, *Nimbu Swarasa* etc. were taken as per the classical reference and processed through prescribed methods. The whole process has been divided into the following:

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Shodhana of raw materials

Kantakavedhi Swarna Patra was prepared from 24 carat gold biscuits on the machine that had 2.5 cm breadth, 150 cm length and 0.5 mm diameter. For *Samanya shodhana*, these *Kantakavedhi Swarna Patra* were heated up to red hot through a Gas blower and dipped into prescribed liquid media three times. ^[6] *Gandhaka*^[7] was melted along with *Goghrita* and poured into the *Godugdha*. Then, *Swedana* (heating under liquid bath) was done for 3 hrs. After that, it was washed with hot water, dried and powdered [Table 1].

Hingulottha Parada Nirmana

Shodhana of *Hingula* was done by giving *Bhavana* of lemon juice three times.^[8] After that, it was washed, dried and stored. The required amount of *Parada* was extracted from *Hingula* by *Nada Yantra* method. Fine powder of *Shuddha Hingula* was wrapped in cotton cloth (equal weight of *Hingula*) and burnt under the pot. Thus, due to heat, the sulfur part of *Hingula* burns and leaves the *Parada*, which gets evaporated as vapor and is collected on the inner side of the pot. *Parada* was collected by rubbing with cloth and then washing with hot water and filtering through four folders of cloth. This *Parada* was used to prepare *Makaradhwa* [Table 2].

Preparation of Swarna Varkha

Shodhita Swarna Patra was cut into small pieces (2 cm × 4 cm length). Then, these *Patra* were continuously hammered with the help of an iron hammer in the leather bags up to the *Varkha* formation. This procedure was performed in Ahmedabad under supervision. The thickness of the *Varkha* was not measured because it was too thin. This *Varkha* was then used in the preparation of *Swarna Pishti*.

Preparation of Swarna Bhasma

Shuddha Swarna Patra was cut into fine pieces and triturated with the *Hingulottha Parada* up to *Pishti* (amalgam) formation and then this amalgam was kept between *Shuddha Gandhaka* in *Sharava*, i.e. *Swarna Pishti* was covered completely by *Shuddha Gandhaka*. *Sharava Samputa* was prepared and after complete drying, it was subjected to heat. After each *Putra*, *Parada* was reduced by 1/16th from the quantity of the initial *Parada* and the *Gandhaka* was in equal quantity of *Swarna* up to the last *Putra*. But, here, a total of 30 *Putra* were required for the preparation of *Swarna Bhasma* up to *Kumkum* colored without shining of particles.^[9]

Preparation of Swarna Pishti

Shudha Swarna patra were cut into small pieces. *Hingulottha Parada* was taken in *Simaka Khalvayantra* and, after that, *Shuddha Swarna Patra* pieces were added one by one to it with proper trituration. The mixture was triturated up to a homogeneous form. The *Nimbu Swarasa* was added for proper preparation of amalgamation. Thus, semisolid, soft *Swarna Pishti* (amalgam of gold) was formed.^[10]

The second batch of *Swarna Pishti* was prepared from *Swarna Varkha* and *Hingulottha Parada*; *Nimbu Swarasa* was not needed because it was prepared within few minutes by simple trituration.

The third batch of *Swarna Pishti* was prepared from *Swarna Bhasma* and *Hingulottha Parada*, with the addition of *Nimbu Swarasa*. But, for this, a large quantity of *Nimbu Swarasa* and a longer period of trituration was required even it was not properly prepared so that an equal amount of *Saindhava Lavana*^[11] was added to it and again triturated till the formation of *Pishti* [Table 3].

Preparation of Kajjali of Makaradhwa

The *Swarna Pishti* (amalgam of gold) was taken in a *Simaka Khalvayantra* and *Shuddha Gandhaka* was added to it in the prescribed quantity. *Mardana* was done for 24 hrs till fine, soft, *Nishchandra Kajjali* was formed [Table 4]. This was subjected to *Bhavana Dravya* of *Japakusuma Swarasa*, which was added to it in an adequate amount to wet the *Kajjali (Rasapankavat)* semisolid and *Mardana* was carried out for 3 hrs, till the homogeneous, soft mass was formed and then it was dried in sunlight^[8] [Table 5]. The same procedure was repeated by adding the *Bhavana Dravya*, i.e. *Kumari Patra Swarasa*, and it was taken 1/4th of the total amount of *Kajjali* as it was found to be sufficient to wet the total material.^[10] The observations of *Kupibharana* of *Makaradhwa* are shown in Table 6.

Preparation of Makaradhwa Apparatus

Mortar and pestles, *Kanchakupi*, *Multani mitti*, cloth, *Loha shalakas-2*, kerosene oil, matchbox, thread, enamel tray, glass container, cork, copper coin, torch, knife; Electric muffle furnace: Outer length: 40 cm, breadth: 40 cm, height: 50 cm, inner hearth length: 15 cm, breadth: 15 cm, depth: 30 cm, *Kanchakupi*: Amber-colored beer bottle, capacity: 625 ml, total height: 28 cm, cylindrical part: Height: 14 cm; circumference: 24.5 cm; diameter of the bottom: 6.5 cm, conical part: Height: 14 cm; diameter of the mouth: 2cm, weight: Before *Kapadamitti*: 450 g; after *Kapadamitti*: 590 g.

Table 1: Observation of Shodhana of the raw materials

Drug	Media	Method	Initial weight (ml)	Final weight (ml)	Loss/gain (ml)	Duration (days)
<i>Swarna</i>	<i>Tila taila</i>	<i>Nirvapa</i>	155	155	00↓	1
<i>Samanya Shodhana</i>	<i>Takra, gomutra, Kanji, Kulattha Kwatha</i>	3 times in each				
<i>Gandhaka</i>	<i>Godugdha</i>	<i>Dhalana</i>	5000	4810	190↓	1

Table 2: Observation of extraction of Parada from Hingula

Quantity of Hingula (g)	Quantity of cotton cloth (g)	Method	Time taken (hrs)	Procured amt. of Parada (g)	Procured amount of Parada (%)
3000	3000	<i>Urdhvapatan</i> by <i>Nada yantra</i>	8	2196	73.20

Table 3: Observations of Swarna Pishti from Swarna Patra, Varkha and Bhasma

Batch	Weight of Swarna Bhasma (g)	Weight of H.Parada (g)	Nimbu Swaras (ml)	Weight of Saindhava Lavana (g)	Duration (h)
MP	125	1000	90	-	12
MV	30	240	-	-	1
MB	40	320	150	40	32

MP- Makaradhwaja prepared by Swarna Patra, MV- Makaradhwaja prepared by Swarna Varkha, MB- Makaradhwaja prepared by Swarna Bhasma

Table 4: Observations during preparation of Kajjali of Makaradhwaja

Batch	Weight of Swarna Pishti (g)	Weight of S.Gandhaka (g)	Total	Nischandratva, Rekhapurnatva of Kajjali (h)	Total Mardana period (h)	Weight of Kajjali after Mardana (g)	Weight loss during Mardana (g)
MP	1098	3000	3098	16	24	3028	70
MV	270	720	990	12	24	973	17
MB	360	960	1320	16	24	1292	28

Table 5: Observations during Bhavana processing of Kajjali of Makaradhwaja

Batch	Weight of Kajjali after Mardana (g)	Japakusuma Swaras (ml)	Total Mardana period (hrs)	Kumari Swaras (ml)	Total Mardana period (hrs)	Weight of Kajjali after Bhavna (g)	Weight increased due to Bhavna Weight (g)	%
MP	3028	750	3	750	3	3183	155	4.86
MV	973	250	3	250	3	993	20	2.10
MB	1292	325	3	325	3	1341	49	3.79

Table 6: Kupikabharana of Makaradhwaja

Batch	No. of Kupi	Sub batch	Weight of Kajjali (g)	Duration of heat (hrs)
MP	9	MP1	424	12
		MP2	424	12
		MP3	424	12
		MP4	424	12
		MP5	424	12
		MP6	424	12
		MP7	424	12
		MP8	424	12
		MP9	424	12
MV	3	MV1	330	12
		MV2	330	12
		MV3	330	12
MB	4	MB1	330	12
		MB2	330	12
		MB3	330	12
		MB4	330	12

Procedure

The Bhavita Kajjali of Makaradhwaja was taken, triturated well in Khalvayantra and filled in Kanchakupi [Table 6]. The Kupi was placed exactly at the center of the electric muffle furnace and fixed in proper position with the help of firebrick blocks. The heating process was carried out in a Kramagni pattern, i.e. increasing order but intermediate heating. Heat was gradually increased over a period as per the schedule, i.e. 3 hrs Mandagni (120-250°C), 6 hrs Madhyamagni (250-450°C), 3

hrs Tivragni (450-600°C). The temperature of the furnace was recorded after intervals of 30 min. During the course of heating, the hot Shalaka was repeatedly inserted into the mouth of the Kupi to burn the accumulated sulfur at the neck of the bottle to prevent blocking. After achieving the confirmative test, the mouth of the Kupi was corked and the temperature was increased up to 600°C and it was maintained for the next 2 hrs. [Table 7]. Then, the Muffle furnace was switched off and left for self-cooling. After Swangsheeta, Kanchakupi was taken out from the muffle furnace and the outer covering was removed; a thread (which was soaked in kerosene) was tied below 1 inch from the final product and ignited. Then, a few drops of water were sprinkled, which leads to break the Kupi, and finally, Makaradhwaja was collected from the neck of the Kupi. Swarna powder was collected from the bottom of the Kupi. The Makaradhwaja was triturated well in Khalva yantra up to a fine red color powder [Table 8]. Makaradhwaja samples were analyzed by employing various possible organoleptic, physical and chemical parameters [Tables 9 and 10]. The same procedures were followed for all three samples of the Makaradhwaja, i.e. for Swarna Patra, Swarna Varkha and Swarna Bhasma. A total of 17 batches were prepared to determine the SMP [Tables 8 and 11].^[10]

Discussion

For the preparation of Kupipakwa rasayan, preparation of Kajjali and heating pattern are the most important factors to obtain maximum quantity of yield and to increase efficacy of the product without any untoward effect. As per classical texts, the Kramagi^[12] heating pattern should be provided during processing of any Kupipakwa rasayana. It means temperature pattern should

Table 7: Observations during Kupipaka of Makaradhwaja (MP, MV and MB avg)

Time (hrs)	Temp. setting (°C)	Temp. recorded (°C)	Observations
00:00	100	37	Switch on the furnace
00:30	150	105	Slight sulfur aroma was smelt at the <i>Kupi</i> mouth White fumes started
01:00	200	156	Fumes turn slightly yellowish
01:30	250	204	Fumes turn slightly yellowish
02:00	250	251	Melting of <i>Kajjali</i> started and yellowish fumes continued
02:30	300	254	Melting of <i>Kajjali</i> with yellowish fumes continued
03:00	300	305	Yellowish color deposition at the neck
03:30	350	302	<i>Kajjali</i> -semi liquid form, yellowish fumes increased
04:00	350	347	<i>Kajjali</i> -molten and yellowish fumes increased
04:30	400	352	Complete molten <i>Kajjali</i> and yellowish fumes increased
05:00	400	399	Persisting yellow fumes
05:30	400	398	Persisting yellow fumes
06:00	450	403	Yellowish fumes increased, stickiness was found inside the <i>Kupi</i>
06:30	450	452	Profuse dark yellowish fumes started
07:00	475	454	Profuse yellowish fumes
07:30	475	478	Fumes disappeared and reddish blue-colored flame started
08:00	500	476	Flame increases to about 4-5 inches height
08:30	500	501	Flame gradually decreased and slight sulfur deposit found at <i>Kupikantha</i> (neck of the <i>Kupi</i>). Red tinge at <i>Kupitala</i> (bottom of the <i>Kupi</i>) was observed
09:00	550	499	Slight bluish flames persisting at the neck of the <i>Kupi</i> and red tinge at the bottom gradually increased
09:30	550	554	Flame disappeared, bottom of the <i>Kupi</i> was found bright red, <i>Sheeta Shalaka</i> test and copper coin test were found to be positive. Corking was done immediately at 9.25 hrs
10:00	600	553	Temperature maintained till the completion of heating
10:30	600	599	Temperature maintained till the completion of heating
11:00	600	598	Temperature maintained till the completion of heating
11:30	600	604	Temperature maintained till the completion of heating
12:00	stop	599	Furnace was switched off and left for self-cooling

MP- Makaradhwaja prepared by Swarna patra, MV- Makaradhwaja prepared by Swarna Varkha, MB-Makaradhwaja prepared by Swarna Bhasma

Table 8: Results of preparation of Makaradhwaja of the different batches

Batch	No. of <i>Kupi</i>	Sub batch	Weight of <i>Kajjali</i> (g)	<i>Makaradhwaja</i> (g)	% of <i>Makara</i> obtained	Residue (g)	% res
MP	9	MP1	424	92	86.85	20	4.7
		MP2	424	89	83.96	20	4.7
		MP3	424	96	90.56	15	3.5
		MP4	424	101	95.28	15	3.5
		MP5	424	102	96.22	19	3.5
		MP6	424	95	89.62	21	4.4
		MP7	424	109	102.83	21	4.9
		MP8	424	101	95.28	30	7.0
		MP9	424	114	107.54	18	4.2
Avg.				99.88	94.22	19.88	4.6
MV	3	MV1	330	55.6	59.78	31	9.3
		MV2	330	77	82.79	12	3.6
		MV3	330	81	87.09	12	3.6
Avg.				71.2	76.2	18.3	6.1
MB	4	MB1	330	79	84.94	11	3.6
		MB2	330	82	87.86	12	3.9
		MB3	330	86	92.14	12	3.9
		MB4	330	81	86.78	13	4.2
Avg.				82	87.8	12	3.9

be an increasing order but intermediate heating process. In can be divided into three stages, i.e. *Mridu*, *Madhya* and *Tivra agni*. Here, *Mriduagni* indicates the melting stage of *Kajjali*, *Madhyam agni* indicates the boiling stage of *Kajjali* and *Tivra agni* means immense heating, which takes place a confirmative test of the final product. One such effort had been done by Prajapati *et al.*,^[13-15] who has given the temperature range for the particulars of *Agni*, such as-*Mridu Agni* 120-250°C (6 hrs), *Madhyama Agni* 250-450°C (6 hrs), *Tivra Agni* 450-630°C (6 hrs). This standardization was done in an electric muffle furnace for the preparation of *Makaradhwaja* in the ratio of 1:8:16, and the same was also followed by Chinta Durga *et al.*^[16] and Patgiri *et al.*^[17,18]

But, for the present study, to prepare the *Triguna Balijarita Makaradhwaja* in minimum heat duration, the heating pattern was changed. As the proportion of *Gandhaka* increases with *Parada*, i.e. *balijarana*, it was observed that there is an increase in the heating duration for the *Jarana*. Here, an attempt was made to prepare the same in minimum time with least consumption of energy while maintaining its therapeutic

efficacy. Therefore, the duration of *Mriduagni* and *tivraagni* period was decreased without disturbing the *madhyamagni* duration (i.e., *Mriduagni* for 3 hrs, *Madhyamagni* for 6 hrs and *Tivragni* for 3 hrs). Because of a higher amount of *Kajjali* in *Makaradhwaja* prepared by the *Swarna Patra* sample, each batch was prepared with 424 g of *Kajjali* whereas in the *Varkha* and *Bhasma* samples, because of the lesser amount, it was prepared with 330 g of *Kajjali* in the same heat duration for the standardization purpose.

The *Hingulottha Parada* was used because as per classical text, its properties are equal to those of *Astasamskarita Parada*.^[19] For the preparation of *Swarna Pishti* of *Varkha*, only 1 hr was required as compared with 12 hrs required for *Swarna Patra*, which may be because the particle size of *Swarna Varkha* is too fine as against that of *Swarna Patra*. In the preparation of *Pishti* of *Swarna Bhasma* 32 hrs were required, which was too much in comparison with that required for *Swarna Varkha* and *Swarna Patra*; the reason behind this may be that the *Swarna Bhasma* is not in elemental form, which leads to the extra time taken for the amalgamation with *Parada* [Table 3]. The *Nischandratva* and *Rekhapurnatva* tests of *Kajjali* were passed in 16 hrs, but 24 hrs trituration was done for the fineness. The weight of *Kajjali* was found to be increased (3.5% on an average) after *Bhavana*, which may be due to the added solid contents of *Japakusuma Swarasa* and *Kumari Swarasa* [Table 5].

It was observed during a trial and error study that the amount of *Gandhaka* is directly proportional to the burning period. Therefore, as per the classical notes, a specific temperature pattern was mentioned for the *Samguna Kajjali Sindura*, i.e. *Mridu Agni*, *Madhyama Agni* and *Tivraagni* in an equal ratio. In this, *Gandhaka* was just in the melting stage in the *Mriduagni* while in the *Madhyama Agni* stage, *Gandhaka* boils and burns and in the *Tivra Agni* period, *Parada* with *Gandhaka* sublimes. Thus, the temperature required for the melting of *Gandhaka* and sublimation of the product is not dependent on the amount of *Gandhaka*. Taking note of this, the period of *Mridu* and *Tivra Agni* was not changed but the period of *Madhyama Agni* was increased twice of the normal ratio due to which an excess amount of *Gandhaka* gets more period for the burning, which is the main aim. Also, in the previous study, it was found that *Samaguna* and *Dwiguna Sindura* were prepared in 16-20 hrs. Here, an attempt was made to prepare the *Triguna*

Table 9: Classical analytical tests of the Makaradhwaja samples

Pariksha	MP	MV	MB
Varna	Red	Red	Red
Sparsh	Slakshana	Slakshana	Slakshana
Gandha	Not specific	Not specific	Not specific
Rasa	Tasteless	Tasteless	Tasteless
Shabda	+ve	+ve	+ve
Rekhapurnata	+ve	+ve	+ve

+ve - Compiles as per classics, MP- Makaradhwaja prepared by *Swarna patra*, MV- Makaradhwaja prepared by *Swarna Varkha*, MB- Makaradhwaja prepared by *Swarna Bhasma*

Table 10: ICP analysis of the Makaradhwaja sample

Element	Sample results of MP mg/kg (ppm)	Sample results of MV mg/kg (ppm)	Sample results of MB mg/kg (ppm)
Au mg/kg (ppm)	131	268	19
Hg (%)	82.9	80.1	81.6

MP- Makaradhwaja prepared by *Swarna patra*, MV- Makaradhwaja prepared by *Swarna Varkha*, MB- Makaradhwaja prepared by *Swarna Bhasma*

Table 11: Standard manufacturing procedure for the preparation of Makaradhwaja

No. of process	Quantity of ingredient	Method	Yantra	Temp.	Duration (hrs)
Swarna Pishti	Swarna Patra Shuddha Swarna Patra + Hingulottha Parada	Mardan	Khalva yantra	-	12:00
	Swarna Varkha Shuddha Swarna Varkha + Hingulottha Parada	Mardan	Khalva yantra	-	01:00
	Swarna Bhasma Swarna Bhasma + Hingulottha Parada	Mardan	Khalva yantra	-	32:00
Kajjali	Swarnapishti + 24-times Shuddha Gandhaka	Mardan	Khalva yantra	-	24:00
Bhavana	1. Japakusuma Swarasa 2. Kumari Swarasa	Mardana	Khalva yantra	-	03:00 hrs each
Kupipaka	Makaradhwaja kajjali	Kupipaka	EMF	Kramagni up to 600°C	12:00

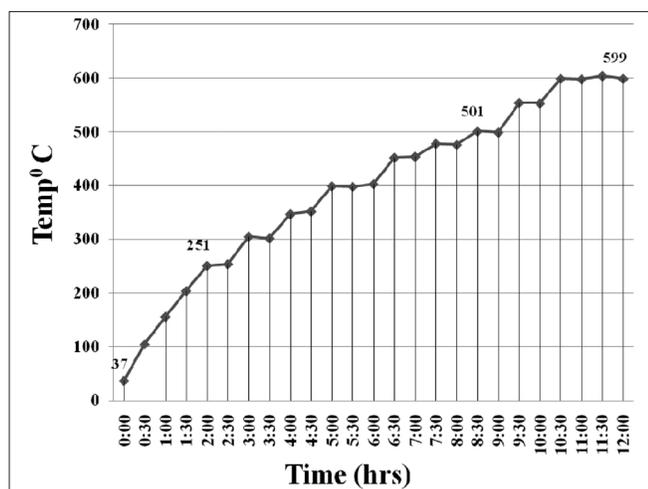


Figure 1:The average temperature for preparation of Makaradhwaja through the electrical muffle furnace

Baliyarita Makaradhwaja in a minimum heating period, which was 12 hrs [Tables 6 and 7]. For this, many trial and error studies were carried out to finalize the temperature pattern. During the *Kupipaka*, flame of sulfur occurred at the neck of the *Kupi* after 7.30 hrs on an average, which was continued for 1.45 hrs [Table 7].

An average of 94.22% of the *Makaradhwaja* was prepared by the *Swarna Patra* with residue (gold powder) of 4.6%, also 76.2% of *Makaradhwaja* and 6.1% of gold powder was prepared by *Swarna Varkha* with 87.8% of *Makaradhwaja* and 3.9% gold powder was prepared by *Swarna Bhasma* [Table 8].

The first sample of *Makaradhwaja* prepared by *Swarna Varkha* was not properly sublimed due to irregular electrical power so that the average percentage of the final product of *Makaradhwaja* was decreased and residue (gold powder) was increased compared with the other two samples.

Analytically, there were no changes found in loss on drying, ash value, acid-insoluble ash and carbon disulfide extract.

But, in the ICP analysis for gold content, it was found to be 268 ppm in *Makaradhwaja* prepared by *Swarna Varkha* whereas in a previous study (Patgiri et al.),^[20] *Makaradhwaja* prepared by *Swarna Patra* found only 7.5 ppm and also by author prepared *Makaradhwaja* prepared by *Swarna Patra* and *Bhasma* was found to be 131 ppm and 19 ppm. This variation found in the gold content may be due to the particle size of the raw material (gold), because the particle size of *Swarna Varkha* is least compared with the *Swarna Patra* and, in the *Bhasma* form, gold is not as elemental as the form of gold. Thus, here, it is observed that least particle size of elemental gold increases the gold content in the sublimed *Makaradhwaja*. This increased concentration of gold content in sublimed *Makaradhwaja* enhances the therapeutic efficacy of *Makaradhwaja*, which has been also observed in comparative clinical trials of *Makaradhwaja* prepared by *Swarna Patra-Varkha* and *Bhasma* on *Madhumeha* (diabetes mellitus),^[21] and pharmacological studies also supports this.

Conclusion

Makaradhwaja has been standardized in terms of time and temperature for 330-424 g. *Kajjali* (average), i.e. *Mridu Agni*: 100-250°C (2.5 hrs), *Madhyamagni*: 250-450°C (5 hrs), *Tivragini*: 450-600°C (4.5 hrs). *Makaradhwaja* prepared by least particle size of elemental gold increases the concentration of gold content in the sublimed *Makaradhwaja* [Figure 1].

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