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Pharmaceutical Standardisation of *Shadguna Makardhwaja* (*Ayurvedic* Herbo-mineral Formulation) Prepared by *Ashtasamskarita Parada*

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Abstract

Background: *Makaradhwaja* is a renowned herbo-mineral formulation composed of processed mercury, sulfur, and gold in specific proportions. Pharmaceutical standardisation of *Shadguna Makardhwaja* (SM), a recognised *Kupipakva Rasayana,* has been carried out using *Ashtasamskarita Parada* and following the process of *Balijarana*. **Aim:** Pharmaceutical Standardisation of *Shadaguna Makaradhwaja* prepared by *Ashtasamskarita Parada*. **Methods:** In the preparation of *Shadaguna Makaradhwaj,* the reference of *Bhaishajya Ratnavali* was followed. In the making of *Kumari Swarasa* (aloe juice) and *Rakta Karpasa Pushpa Swarasa* (flower juice) as levigation media, the references from Sharangadhara Samhita have been used. For *Ashtasamskaras of Parada* reference of text *Rasahruday Tantra* has been followed. For the *Shodhana of Gandhaka*, the reference to classic *Rasa Rasaratna Samuchaya* was followed. **Results:** In the present study, preparation of *Makaradhwaja* was executed using *Shuddha Swarna Varkha, Ashtasamskarita Parada*, and *Shuddha Gandhaka* in the ratio 1:8:48, respectively, through an Electrical Muffle Furnace (EMF) in 36 hours. Three batches of SM were prepared by taking 200 g of *Shadaguna Kajjali*. **Conclusion:** The average product obtained was 19.013 gm, and the average residue procured was 9.73gm. The average time taken for the flame is 1.1 hours. *Kupipaka* was carried for 36 hours. Inductively coupled plasma–atomic emission spectroscopy (ICP-AES) showed the presence of 421.86 particles per million gold in SM.

Major Findings: Shadaguna Makaradhwaja prepared in three batches with *Kramagni Paka* of 36 hours in Electronic Muffle Furnace yielded average 19.013 gm of final product with 421.86 ppm gold spectroscopically.

Keywords: *Ashtasamska, Balijarana, Kupipaka, Parada, Shadagun Makaradhwaja*

Abbreviations: SM – *Shadguna Makardhwaja*; ICP-AES - Inductively Coupled Plasma–atomic Emission Spectroscopy

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1. Introduction

Rasashastra is a branch of *Ayurvedic* pharmaceutical sciences that mainly deals with formulation, manufacturing, and development. One of the rampantly used herbo-mineral formulations from *Rasashastra* is *Makaradhwaja*. The phrases *Makara* and *Dhwaja*, which are both synonyms of *Kamadeva*, in the Hindu religion, who is a demigod governing desire and love, make up the name *Makaradhwaja*[1]. This medication is unique because of its preparation method, rapid action, *Rasayana* (rejuvenator and revitalizer), *Yogavahi* (endorsing), and effectiveness at lower dosages with a long shelf life. It is prepared as *Kupipakva Rasayana*[2] (a combination of medications heated gradually in a glass bottle). Thus, in this case, using six times as much sulfur as *Ashtasamskarita Parada* (processed mercury),[3] *Shadagun Makardhwaja* (1 Part Gold:8 Part Mercury:48 Parts Sulfur) was prepared; adopting reference of text *Bhaishajya Ratnavali*[4] through a

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particularly unique heating method, called as *Kramagni*[5] (progressive rising temperature), here the vertical Electrical Muffle Furnace is used (EMF)[6], which is a modification of the *Valuka Yantra*[7]. In the context of *Makaradhwaja,* different formulations are found, solely due to variances in the amount of *Gandhaka* (Sulfur) with *Parada* (Mercury). According to certain texts, the amount of *Gandhaka* is twice[8], thrice[9], or six times[10] that of *Parada*. Employing these *Makaradhwaja*, which were made using a particular ratio of *Gandhaka* known as *Balijarana*, is said to enhance the medicinal power of the *Makaradhwaja*[11,12]. The study aims at manufacturing *Shadaguna Makaradhwaja* using processed gold, *Asthasamskarita Parada*, and processed sulfur in the ratio of 1:8:48, following the reference of *Bhaishajya Ratnavali.*

2. Materials and Methods

2.1 Raw Material Procurement

The Gujarat Ayurved University in Jamnagar's pharmacy department provided the sources of *Ashuddha Parada* (raw mercury) and *Ashuddha Gandhaka* (raw sulfur). Sourced from Bijapur, Karnataka, fresh *Panchanga* (whole plant) and, of particular note, the blooms of *Rakta Karpasa* (*Gossypium arboretum* Linn.) were verified in the Pharmacognosy Laboratory, I.P.G.T. and R.A. Jamnagar. We collected *Kumari* (*Aloe barbadensis* Mill.) from the outskirts of Jamnagar. The making of *Kumari Swarasa* (aloe juice) and *Rakta Karpasa Pushpa Swarasa* (flower juice)[15], as well as *Ashtasamskaras* of *Parada*[13], *Shodhana* of *Gandhaka*[14], and others, was done following traditional sources. The *Shadaguna Makaradhwaja* is prepared in EMP in an average of 36 hours[16]. The items' minor chemical components have been studied using Inductive Coupled Plasma – Optical Emission Spectrometry (ICP-OES). The instrument was manufactured by CPA Limited, Bulgaria (Model: Optima 3300 RL).

2.2 Making of *Makaradhwaja*

There were seven stages to the entire process.

2.2.1 Gandhaka Shodhana (3 Batches)

An average of 2.93% loss of *Gandhaka* was observed after *Shodhana,* and 970.67 gm of *Shuddha Gandhaka* was procured from an average of 1kg of *Ashudha Gandhaka* (Table 1).

2.2.2 Parada Ashtasamskara

A total of 1676 gm of *Ashtasamskarita Parada* was procured from 2kg *Samanya Shodhita Parada*[17] (Figure 1). Initially, 2000 gm of *Samanya Shodhita Parada* was made to endure subsequent processes according to *text Rasahruday Tantra* 2nd *Avabodha*-chapter. After 67 days total, *Ashtasamskarit Parada* procured was 1676 gm, excluding 100 gm, where after each *Samskara,* 10 gm of the sample was kept; total mercurial loss was 12.19 %.

2.2.3 Making Swarna Pishti

First, a measured amount of processed mercury after eight specific procedures was placed in a specific mortar and pestle, viz., *Simaka Khalva Yantra,* followed by the addition of gold foils, i.e. *Swarna Varkha*[17], and the trituration procedure was sustained until amalgam (*Swarna Pishti*) preparation was reached. Preparation of *Swarna Pishti* using *Swarna Varkha*, a total of 90 g of *Swarna Pishti* was procured after 3 hours of trituration with 80 gm of *Ashtasamskarita Parada* and 10 gm of gold foils.

2.2.4 Making of Kajjali

Swarna Pishti that had already been produced was collected in a mortar and pestle, i.e. *Simaka Khalva Yantra*. *Shuddha Gandhaka* was then mixed with it in the recommended amount, which is 480 gm, and trituration was performed. Three batches of this process were completed, and the *Shadaguna Kajjali* received the corresponding *Bhavanas* (levigation) of fresh juice of blooms of *Gossypium arboretum* and *Aloe barbadensis*. Addition of six times of *Gandhaka,* i.e. 480 gm to 90 gm of *Swarna Pishti* with *Bhavana,* a total of 568 gm of *Shadaguna Kajjali* was procured with *Siddhi Lakshanas* viz. *Nischandratva* and *Rekhapurnatva* at the end of 72 *hours* of *Mardan* (Trituration). 6.85% weight was gained after the following *Bhavanas* (Levigation) of *Kumari Swarasa* (*Aloe barbadensis* Mill.) and *Rakta Karpasa Pushpa Swarasa* (*Gossypium arboretum* Linn.), in that order. (Table 2).

2.2.5 Kupi Filling

Using a funnel, the mud-smeared fabric of the subsequent seven layers (*Kapadamitti*), *Kacha Kupi* was added to the *Bhavita Kajjali* for each batch.

2.2.6 Kupipaka

Shadaguna Kajjali received *Kramagni* for thirty-six hours while *Kupi* was kept in EMF. Confirmatory tests such as the coin test, *Sheeta Shalaka* test, and red hot bottom test were performed once the flame was extinguished, and corking was completed. *Kupi* was allowed to cool on its own before being removed from EMF the following day to gather the sublimated drug at the neck, which was stored in airtight containers after trituration.

Table 1. Observations during *Gandhaka Shodhana*

Batch No.	*Ashuddha Gandhaka* (g)	Temperature range for complete melting of *Gandhaka* in ghee (°C)	*Shuddha Gandhaka* (g)	Total media required for *Shodhana* (*l*)	% loss of *Gandhaka* after *Shodhana* for 3 times
I	1000	116-119.8	968	6.02	03.2
II	1000	116.4-119.8	970	6.04	03.00
III	1000	116.8-119.4	974	6.00	02.06
Average	1000	116.4-119.6	970.67	6.02	02.93

Table 2. Preparation of *Shadaguna Makaradhwaja Kajjali* (SMK) and consequent *Bhavana*

Batch No.	Weight of gold amalgam (gm)	Weight of pro cessed sulfur (gm)	Total (gm)	Classical symptoms revealed-*Kajjali* (*hours*)	Trituration duration (*hours*)	Weight gain in *Kajjali* after Trituration (gm)	Redu ction in wt during Tri turation (gm)	Quantity of juice of *Gossy pium arbo retum*, ml/ tritu ration in *hours*.	Quantity of juice of *Aloe barba densis* (ml)/ tritu ration in hours.	Actual and % of weight gained after *Bhavana* (g)	
										Weight	
SMK	90	480	570	64	72	568.2	2	200/6 *hours*	110/6	41.8	6.85%

570 gm of *Shadaguna Makaradhwaja Kajjali* (SMK) prepared using 90 gms of processed mercury and gold amulgum with 480 gm of processed Sulphur with subsequent levigation (*Bhavana*) with *Rakta Karpasa Pushpa* (*Gossypium arboretum*) of 200 ml in 6 hours and *Ghruta Kumari (Aloe barbadensis)* of 110 ml in 6 hours to produce 568.2 gms of SMK.

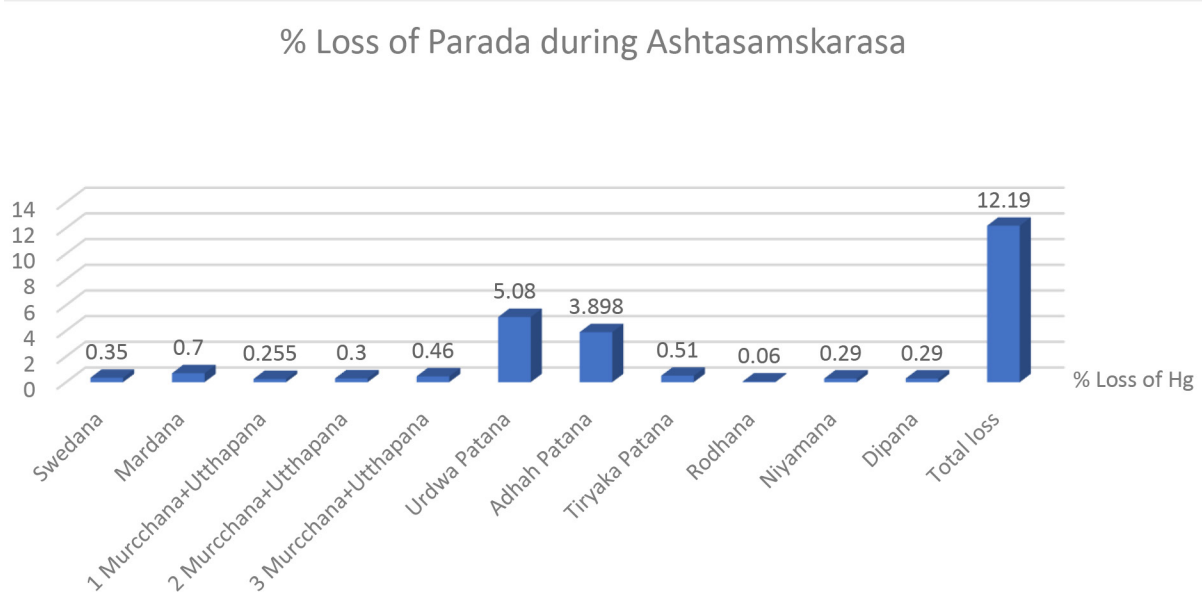


Figure 1. Graphical representation of *Parada* Procurement during *Ashtasamskaras*.

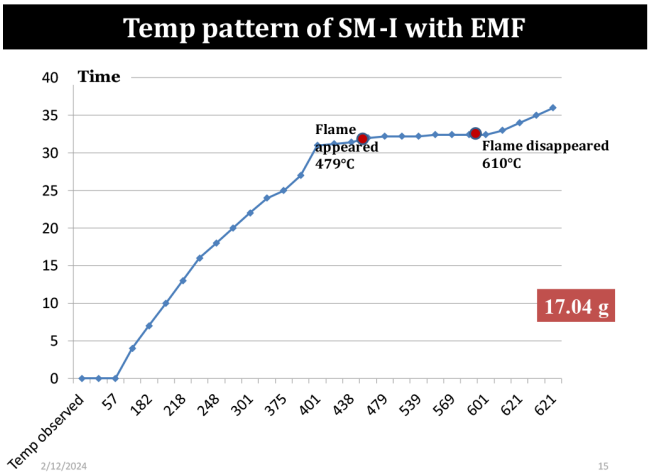


Figure 2. Temperature pattern of SM-1 with EMF (Batch-1).

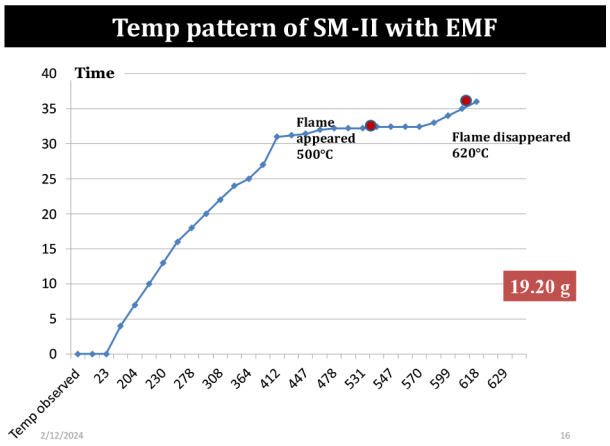


Figure 3. Temperature pattern of SM-2 with EMF (Batch-2).

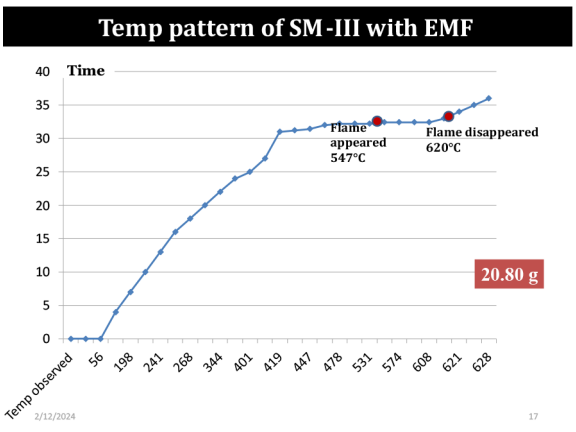


Figure 4. Temperature pattern of SM-3 with EMF (Batch-3).

Table 3. Results of ICP-AES analysis of *Shadaguna Makaradhwaja*

Sr. No.	Element	SM	
		IIT Mumbai	SICART Vallabha Vidya Nagar
1	Gold (Au)	-	421.86
2	Lead (Pb)	1.964	NA
3	Copper (Cu)	0.049	NA
4	Mercury (Hg)	812.7	NA

time taken for *Kupipaka* is an average of 36 hours (Figures 2, 3 and 4).

3. Results

In an inductively coupled plasma-atomic emission spectrometry (Model: Optima 3300 RL, Make: Perkin Elmer), 421.86 ppm of gold was detected, followed by 1.964 ppm of lead, 0.049 ppm of copper, and 812.7 ppm of mercury (Table 3).

4. Discussion

The seven qualities that the *Siddha Bheshaja Manimala* valued in *Makaradhwaja* (*Chandrodaya Rasa*[18]) were that it should be composed of gold, that it should be illuminated at night, that it should resemble the color of the rising sun, that it should be deposited well in the bottom of the mud smeared glass bottle, that it should be delightful and soft, and that it should have all the qualities that make it valuable. The quality of medications, conventional preparation techniques, and their entire style of use are all highly valued in *Ayurveda*[19–21].

Under *Gandhaka Shodhana* (sulfur processing), two main procedures are explained: *Ghruta* (charred ghee) absorbs harmful substances and aids in the elimination of fat-soluble contaminants. Milk will eliminate contaminants that are soluble in colloidal form and water. Weight reduction of an average of 2.93% was achieved in three batches by separating stones and other physical impurities through *Vastragalana* (filtration through cloth)[22]. Texts claim that *Ghruta* and milk are *Jeevaniya Dravyas* and possess *Madhura Rasa*. It is possible that the purification process used

in these medications eliminated the *Visha Dosha* found in sulfur, absorbing the unctuous characteristic and dissolving the fat-soluble impurities. Sweet taste, heavy, soft, fatty, rendering strength, sticky, slimy, and slow but satisfying are the attributes of milk according to *Ayurveda*[23]. *Virya Sheeta* possesses the following qualities: *Rasayana, Ojo Vriddhikara, Vrishya, Balya, Jeevaneeya, and Brumhaneeya.* mentioned in *Shosha, Udara, Shwasa, Kasa, Gulma, Pandu*, etc[24]. Generally, milk is regarded as emollient, demulcent, cooling, nourishing, strengthening, and vitalising. It's possible that these qualities were added to the sulfur after it was added to the milk, increasing its therapeutic potency. Milk contains a variety of salts and minerals, including potassium, magnesium phosphates, sodium chloride, calcium sulfates, and a trace amount of iron phosphate. Mineral salts, which are combinations of iron, chlorine, phosphorus, potassium, sodium, and calcium, may have reacted with the sulfur constituents to separate the impurities or toxic matter from the milk[25].

It is evident from the eight *Samskaras* of *Parada* that most of them support the inclusion of *Lavana* (rock salt) as an ingredient. Compared to the preceding six *Samskaras*, additional minerals, such as alum, *Khaga (Kasis),* borax, and *Saindhava Lavana* (rock salt), were employed as components of paste in the last two *Samskaras,* namely the *Niyamana* and *Dipana Samskaras*, and particularly in the eighth *Samskara*. Because of their "*Dipana*" and "*Pachana*" qualities, all of the *Dravyas* utilised in this *Samskara* are supposed to increase *Parada's* appetite (or "*Bubhukhsa*") for either *Lohavada* or *Dehavada* metal consumption. It could be the cause of the increase in *Parada's* power as accurately reported by manuscripts. Texts state that after the *Ashtasamskaras*, just 1/8th (*Ashtamansha Vashishyate*) of *Parada* should remain. However, thanks to improvements in equipment, sealing materials, and processes, we were able to prevent the majority of the *Parada* loss during *Ashtasamskaras* in the current study; as a result, the total *Parada* loss reported was 12.19 per cent, which was even less than 1/8th of the processed mercury used[26].

Shadagun kajjali preparation: There are several techniques to manufacture the compound of processed *Parada* and processed *Gandhaka*, but one always uses excess sulfur, more than is necessary for the stoichiometric preparation of mercuric sulphide, the making of *Kajjali* (about sulfur at one sixth of mercury's weight). Higher sulfur ratios may be used in the manufacture of *Kajjali* with the intention of both preventing oxidation and increasing the amount of sulfur available[27]. As a result, the likelihood of harm from *Kajjali* formulations is extremely low or nonexistent, given how long these medications have been utilised in conventional medical systems. Therefore, in the current investigation, *Shadagun Kajjali* is prepared using six times as much sulfur as mercury, compared to one part mercury. Furthermore, the particular technology used in the processing of mercury involves treating it with substances that lessen its toxicity. For instance, *Allium sativum* (*Rasona*) is utilised in *Ayurveda* for the processing (*Shodhana*) of mercury. Sour gruel, or *Kanji,* is employed in practically all mercurial processing operations, including distillation, sublimation, grinding, boiling in a liquid bath, and heating[28]. Sulfur is present in both sour gruel and *Allium sativum*, which lessens the toxicity of mercury[29].

Because of its rapid response on less dose, *Kupipakwa Rasayana* preparations hold a distinct significance in *Rasa Shastra* when compared to other formulations[30]. To maximise production and boost preparation effectiveness without causing any unintended or negative consequences, the heating pattern and method of preparing *Kajjali* are crucial. Classical literature identifies the *Kramagni* as the ideal heating pattern for *Kupipakwa* preparation[31]. Therefore, 36 hours of *Kupipaka* were used in the current investigation to obtain an average yield of 19.013 grams of *Shadagun Makaradhwaja.*

When it comes to herbo-mineral or metalo-mineral compound compositions, ICP-AES is a valuable tool for assessing higher concentrations of individual constituents. In addition to gold, significant levels of Pb, Cu, and iron were found in *Shadagun Makaradhwaja.* The current study of SM demonstrated that the sublimated product contained 421.86 parts per million of gold. Initially sample was sent for ICP-AES at IIT Mumbai for all Au, Pb, Cu and Hg, but as ICP-AES for gold was not available there, the sample for gold was sent to SICART Anand again, and the value was measured as 421.86, which is shown in Table 3. The study focuses primarily on *Makaradhwaja*, which has the second-highest recorded gold proportion. This lends additional credence to the findings of earlier researchers[32], since the preparation involved the use of

Swarna Varkha, or treated gold foils, rather than *Swarna*, or processed gold. The right interaction between gold and *Ashtasamskarita Parada* is ensured by properly triturating the combined mass[33]. According to *Parada Vijaniyam, Makaradhwaja* made during an extended period of *Paka* (mercury treatment with sulfur) is hypothesised to include a higher concentration of gold[34]. This hypothesis was corroborated by the particles per million standards of gold in the current study, SM, as the material was made in just 36 hours.

5. Conclusion

Average 19.013 gm of *Shadaguna Makaradhwaja* (SM) was procured with an average residue of 9.73gm from 200gm of *Shadaguna Kajjali* prepared from *Ashtasamskarita Parada*, *Shuddha Swarna Varkha,* and *Shuddha Gandhaka* after 36 *hours* of *Kupipaka* with 421.86 ppm gold in ICP-AES.

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7. Ethical Statement

Ethical clearance no. PGT/7/Ethics/2009-10/2157/ 24/09/2009.

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Author Contribution

Prof. Vd. Shraddha Dhundi and Prof. Vd. P K Prajapati distributed the Contributorship 60:40 as Prof. Prajapati guided the whole PhD work, and Prof. Shraddha executed the pharmaceutical study independently as Principal Investigator. All authors have read and agreed to the published version of the manuscript.