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ORIGINAL RESEARCH ARTICLE

Quality Control Evaluation of *Maska Mruganka RASA*: An Ayurvedic Metallic Formulation

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ABSTRACT

Introduction: Rasashastra, the ancient science of Ayurvedic pharmaceutics,mainly deals with preparation of formulations with metals and minerals as main constituents. The chemical nature of most of these metallic preparations is less known and development of physico-chemical profile of them is the need of hour. *Maska Mruganka Rasa* is one of such metallic preparation indicated in diabetes; comprisingMercury, Tin, Sulphur and Ammonium Chloride as ingredients.

Aims and objectives: To develop quality control profile of *Maska Mruganka Rasa.*

Methodology: Three batches offormulationwere prepared by following standard classical guidelines and subjected to Physico-chemical analysis, X-ray Diffraction (XRD), Scanning Electron Microscope (SEM), Inductive Couple Plasma Optical Emission Spectrometry (ICPOES) and Carbon, Hydrogen, Nitrogen and Sulphur elemental analysis (CHNS).

Results and conclusion: The average yield of *Maska Mruganka Rasa* was found to be 37.15%. The color of final product wasGolden Yellow. Chemically, it was identified as $HgSn_6$ withhexagonal structure. Its solubility was found better in ethyl alcohol than honey, HCl and water.SEM analysis showed particle size ranging from 11.24 micrometer to 90.83 micrometer. Particles were relatively compacting microcrystalline in structure.

Key words:*Kupipakva Rasayana, Maska Mruganka Rasa*,Mercury, *Parada.*

INTRODUCTION

Ayurveda, ancient system of medicineutilizes natural resources including metals and minerals in therapeutics.Due to more attentiveness in present situation about existence of heavy metals and minerals in Ayurvedic Formulations; it is highly desirable to provide evidences regarding the usefulness of metallic preparations through modern parameters.

Details of processing metals and minerals are emphasized in the classics of Rasashastra which are mandatorily to be followed while preparing metallic preparations.*Maska Mruganka Rasa* is one of such preparation indicated to be used with honey in the management of *Madhumeha*(Diabetes Mellitus).[1]Previous study on this formulation reports the chemical nature of *Maska Mruganka Rasa* as Stannic Sulphide (SnS_2)[2].To develop further physico-chemical profile of the formulation, an attempt has been made to analyze the formulation through SEM, X-RD, CHNS and ICPOES.

MATERIALS AND METHODS

Materialswerecollected and authenticated inRasashastra and BhaishajyaKalpana Department, Dr. NRS Govt. Ayurvedic College, Vijayawada. Formulation composition of *MaskaMruganka*Rasais shown in the (**Table1**).Pharmaceutical study of *Maska Mruganka Rasa* was divided into three parts viz. *Shodhana*(Purification)of raw drugs, Preparation

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of *Kajjali* and Preparation of *Maska Mruganka Rasa.*

***Shodhana* (purification) ofrawmaterials:**

Parada(Mercury) was triturated with *Kshara traya*(three alkalies) viz. *Sajjikshar* (sodium carbonate), *Yavakshar* (alkali derived from Maize)and *Tankana*(Borax)along with juices of *Ardraka*(*Zingiber officinale* Roxb.) and *Nagavallipatra*[3](*Piper betle* Linn.) followed by washing with hot water.

Samanyashodhana of *Vanga*(tin)was done by *dhalana*(melting and quenching) process as per Ayurvedic texts. *Vishesha shodhana* was done by pouring molten *Vanga*in *Churnodaka*(lime water) for seven times.[4]

Gandhaka(Sulphur) was purified by *Galana* (melting and straining)process in cow milk.[5]

Purification of *Navasadara*(Ammonium chloride) was carried outby dissolving it in three times of water, which was filtered through 3 layered muslin cloth.[6]The water part was evaporated by heating to get purified *Navasadara*.

Preparation *Kajjali*:

Shuddha Vanga(purified tin)was taken in aniron ladle and heated to melt.Molten *Tin* was added with equal quantity of Mercury in *KhalvaYantra*(mortar and pestle)and instantly*mardana*(trituration) was done to formulate amalgam, followed by levigation with blend of *Nimbuswarasa*(lemon juice) and *Saindhava lavana*(rock salt)and washed with lukewarm water.*ShuddhaGandhaka*(purified Sulphur) was added to this blend and triturated thoroughly. At the end, *shodhitaNavasadara*(Ammonium chloride)was added and triturated to form the *Kajjali*[7](black sulphide of mercury).

Preparation of *Maska Mruganka Rasa*:

Prepared *Kajjali* was filled in mud smeared*Kachakupi*[8](glass bottle)and placed in *Valukayantra*[9](heating apparatus). It was exposed to heat in*Mrudu* and *Madhyama agni*(*Mruduagni*: 100^0C-250^0C and *Madhyama agni*:250^0C-450^0C).Corking wasnot done to the bottle[10]during the procedure.In the course of procedure fumes of *Gandhaka* and *Navasadara*took place. The depositedconstituent parts of *Gandhaka* and *Navasadara* at neck of the bottle were cleared by repeated insertion of red-hot iron rod to keep the neck of the bottle open.Complete cessation of fumes (of *Gandhaka* and *Navasadara*) from the neck was considered as the end point of the procedure.[11]After complete cessation of fumes, cold iron rod was introducedinto the bottle to make certain the development of final product.Golden yellow colored shiny particles over the *shalaka*(Iron Rod)indicated the completion of the process. On observing these signs, heating process was stopped. The apparatus was permitted to cool on its own. Bottle was removed from heating apparatusafter self-cooling and the external layers of cloth were removed and the bottle was broken carefully in the middle. Golden yellow colored *Maska Mruganka Rasa*deposited at the bottom of the bottle was collected.By following similar method two more batches were also prepared. The average yield 3 samples of *Maska Mruganka Rasa* was 37.15%. (**Table2**)

Analytical study:

Prepared three batches of *Maska Mruganka Rasa* were subjected to physico-chemical analysis and other modern parameters like X-RD(X-Ray Diffraction), ICPOES (Inductively Coupled Plasma Optic Emission Spectrometry), CHNS (Carbon, Hydrogen, Nitrogen, Sulphur elemental analysis) and SEM(Scanning Electron Microscopy). (**Table 3 to 7**)

In X-RD Graphs of all 3 samples of *Maska Mruganka Rasa* "d-spacing [Å]" value are approximately equal for major peaks. These d-spacing valuesof major peaks were compared with standard JCPDS (Joint Committee on Powder Diffraction Standards) card table to findthe compound present on comparing these samples of *Maska Mruganka Rasa*.

The samples of *Maska Mruganka Rasa* were subjected to X-RD, ICPOES and SEM at DMRL, Hyderabad. CHNS was conducted at IICT, Hyderabad. Quantitative analysis and Solubility tests were carried at Quality Control Lab, ALN Rao Memorial Ayurvedic College, Koppa.

RESULTS ANDDISCUSSION:

The current attempt is the first towards developing physico-chemical profile of *Maska Mruganka Rasa*.It was observed in pharmaceutical study that, duration of minimum 10-12 hours is required in preparing the formulation maintaining temperature in two different phases(*Mrudu* and *Madhyama agni*).Primarily white fumes were observed escaping from the neck of the bottle; followed by yellow fumes. Constant probing by hot rod was done remove the deposits and is mandate in case of this practical. Completion of process wasevident by *Sheeta Shalaka*(iron rod)

test by inserting into the bottle. The *sheetashalaka* should yield golden coloured crystals on it after removing from the bottle. However, repeated probing of iron rodshould be avoided, that interfere the chemical reactions. After self-cooling, product was carefully collected from bottom of the bottle as it was *Talastha* (obtained at bottom of bottle), *Bahirdhooma* (without corking the bottle) *Kupipakva Rasayana* (medicine prepared in glass bottle). The product was spongy, golden yellow in colour.The finished product was found to be more soluble in Ethyl alcohol, less in Honey, Glycerin and HCl, sparingly soluble in CCl_4, Methanol, and Chloroform.

XRD study revealed the structure of the compound as hexagonal with $HgSn_6$ as amajor phase.ICPOES revealed the percentages of Mercury in *Maska Mruganka Rasa* as 25.3, 28.4 and 23.1. Tin was 13.5, 14.6 and 12.2 in sampleI, II and III respectively. It revealed that the major constitutes of *Maska Mruganka Rasa*as Mercury and Tin.Previous studiesreported the finished product as Stannic Sulphide $(SnS_2)^2$, but in current study, it is observed to be $HgSn_6$. In CHNS elemental analysis, percentage of Sulphur in *Maska Mruganka Rasa* is 25.16%. Carbon, Hydrogen and Nitrogen were not detected.

In SEM analysis, sample showed particle size ranging from 11.24 micrometer to 90.83 micrometer. Minimum particle size in sample I, II & III was 26.70, 11.24 and 19.74 micrometer respectively. The surface morphology of sample I was smooth, while sample II showed rough surface appearance. Sample III was observed mixture of micro particles. Hence it showed mixture of particles with rough and smooth surface. All three samples were relatively compacting microcrystalline in structure and aggregates with loss of grain boundaries.

Table 1: Composition of *Maska Mruganka Rasa*

S No	Ingredient	Classical composition	Quantity (gms)
1	*Shodhita Parada*	Equal parts	80
2	*Shodhita Vanga*		80
3	*Shodhita Gandhaka*		80
4	*Shodhita Navasadara*		80

Table 2: Yield of *Maska Mruganka Rasa*

Parameter	Batches			Average
	I	II	III	
Kajjali (gms)	320	320	320	320
Final Product (gms)	120	125	110	118.3
Loss (gms)	200	195	210	201.6
Yield (%)	37.50	39.60	34.37	37.15

Table 3: Physicochemical profile of *Maska Mruganka Rasa*

S No	Test	Batches			Average
		I	II	III	
1	Loss on drying (% w/w)	1.0	0.5	0.21	0.57
2	Total Ash (% w/w)	76	52	56	61.33
3	Acid Insoluble Ash (% w/w)	43	32	38.01	37.67
4	Water Soluble Ash (% w/w)	23	18	17.01	19.33
5	pH	4.02	4.05	4.92	4.32
6	Assay for Mercury as Hg %	24.51	22.71	25.63	24.28
7	Assay for Tin as Sn %	7.50	11.73	13.33	10.85

Table 4: Solubility of *Maska Mruganka Rasa*

SNo	Solvent	Solubility (%)			
		Batches			Average
		I	II	III	
1	Distilled water	4.12	2.01	1.03 %	2.38
2	Methanol	1.02	0.92	0.97 %	0.97
3	HCl	6.12	4.04	4.06%	4.74
4	Chloroform	0.1	0.00	0.00%	0.03
5	Ethyl alcohol	23.02	14.33	16.01%	17.78
6	Honey	7.13	8.12	7.90	7.71
7	Glycerin	4.01	5.20	7.17	5.46
8	Carbon Tetrachloride	1.91	0.45	0.54	0.80

Table 5: Observation in X-Ray diffraction study of *Maska Mruganka Rasa*

Sample	Phase	Structure	Space group	Lattice parameter
Maska Mruganka Rasa	HgSn6	Hexagonal	P6(191)	a-3.205 c-0.9310 z-0.14

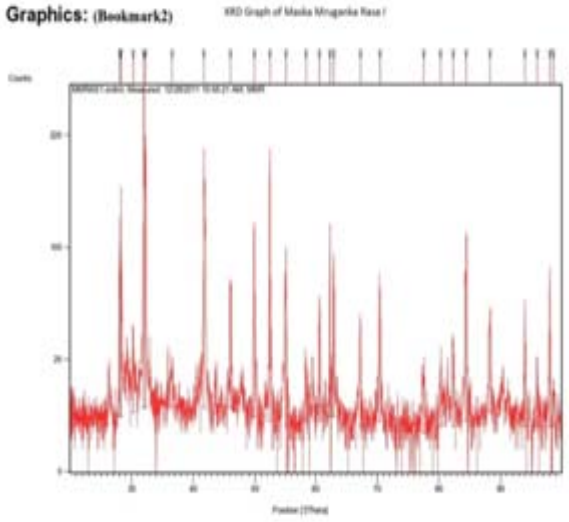
Table 6: Elemental Analysis (ICPOES) of *Maska Mruganka Rasa*

S No		Batches			Average
	Elements (%)	I	II	III	
1	As	0.02	0.04	0.04	0.03
2	Hg	25.3	28.4	23.1	25.6
3	Fe	0.05	0.03	0.03	0.04
4	Sn	13.5	14.6	12.2	13.4

Table7: C.H.N.S. elemental analysis

Sample name	% C	% H	% N	% S
Maska Mruganka Rasa	N.D	N.D	N.D	25.16 %

Figure 1: Final product obtained- Maska Mruganka Rasa



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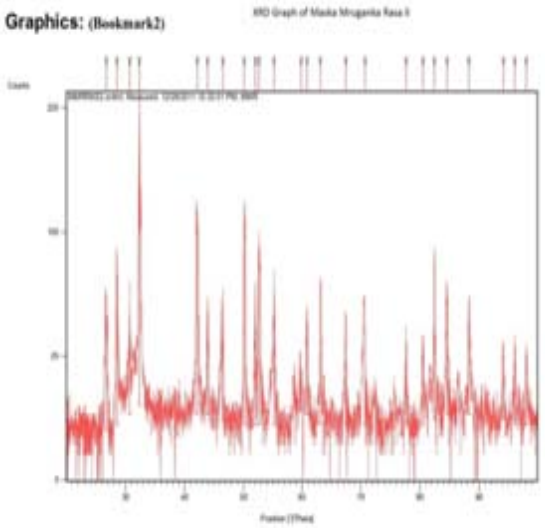

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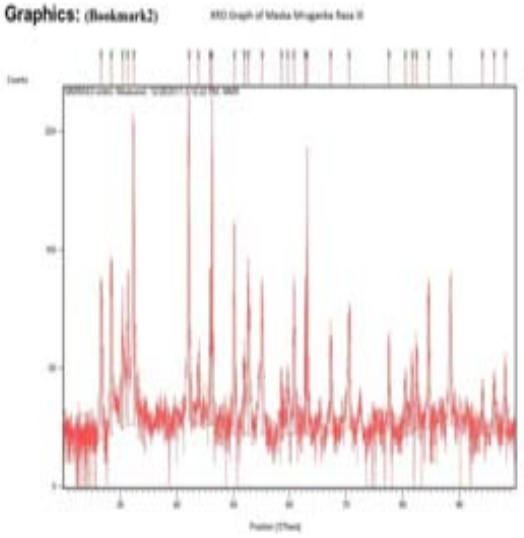
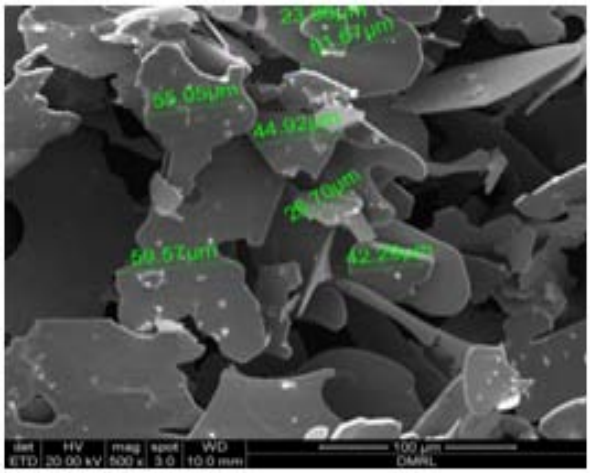
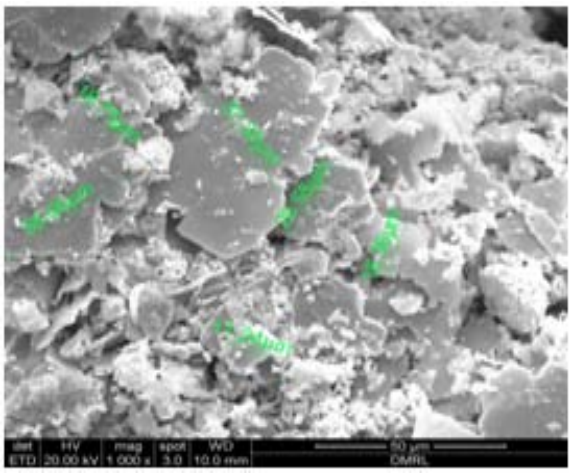


Batch 3

Figure 2: XRD of all batches of Maska Mruganka Rasa



Batch 1



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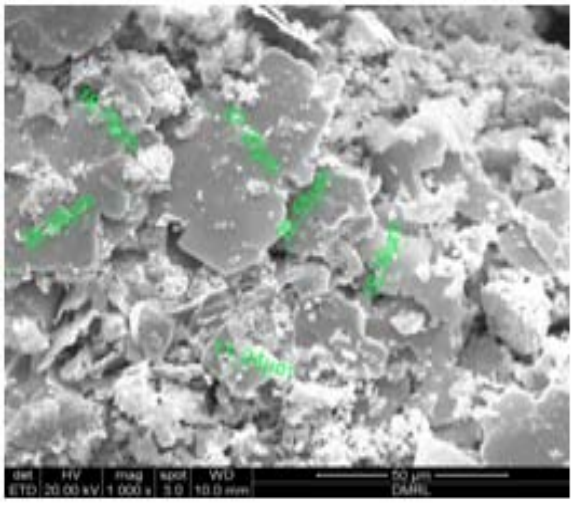

Batch 3

Figure 3: SEM analysis of all batches of Maska Mruganka Rasa

CONCLUSION

Maska Mruganka Rasa is a *Talastha*, *BahirdhoomaKupipakvaRasayana*and the preparation needs 10-12 hours of gradual heating pattern withaverage yield of 37.15%.The color of *Maska Mruganka Rasa* is Golden Yellow. Chemically, itis $HgSn_6$ withHexagonal structure.SEM analysis showed particle size ranging from 11.24 micrometer to 90.83

micrometer. Particles were relatively compacting microcrystalline in structure. The current study is reporting for the first time, and can be referred as standard in future studies.

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