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PHARMACEUTICAL PREPARATION OF KAJJALI BY CLASSICAL METHOD

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ABSTRACT: Ayurveda explains the usage of various metals, minerals and herbo-mineral preparation in therapeutics. *Kajjali* (sulfide form of mercury) is one among such preparations, prepared by using mercury and sulfur. Present paper deals with the pharmaceutical preparation of *Kajjali* as per classical reference. Standard operative procedure mentioned in the classical texts was taken into consideration for the preparation of *Kajjali*. Purified mercury and sulfur were triturated in a stone mortar manually for 120 hours to get *Kajjali*. Aims and objectives: To prepare *Kajjali* classically and tested for organoleptic characters, *Bhasma Pariksha* (alchemy) and physiochemical characters. Materials and Methods: In Ayurveda different references are available for the preparation of *Kajjali*. For the present study *Samagunabalijarita Kajjali* (equal parts of mercury and sulfur) were triturated in a stony mortar. Also *Shodhana* (purification) of mercury and purification sulfur was also carried out. Result and conclusion: Total quantity taken was- 720g and obtained quantity of *Kajjali* can pass the *Bhasma Pariksha* (alchemical tests), organoleptic characters explained in classics. It is a longer and time consuming method but it can be carried out which helps to prepare a therapeutically beneficial product.

KEYWORDS: Kajjali, parada, gandhaka, samagunabalijarita kajjali, mercury, sulfur.

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Metals and minerals are used since ages in therapeutics in the branch of Rasashastra (branch of alchemy) in Ayurveda. Kajjali (sulfide form of mercury) is a medicinal formulation explained in various classical texts of Rasashastra like Rasa Ratna Samuchaya, Rasa Tarangini etc. Chemically it is Hg S (mercury sulfide). It is prepared by triturating or rubbing equal parts (1:1) of purified mercury and purified sulfur in a mortar with a pestle (stony). Various texts explain the ratio of mercury as one part but that of sulfur varies 2, 3, 4 & 6 parts i.e.; 1:2, 1:3, 1:4 and 1:6 respectively. Before starting the trituration the purifying procedures of mercury and sulfur, as per references were carried out. Obtained Kajjali is jet black in color very fine powder in consistency, smooth and soft to touch. It takes few days for the preparation, depending on the hours of trituration, as per the classical method of preparation. In Ayurvedic therapeutics various Rasayoga (herbo-mineral formulations) contain *Kajjali* as a prime ingredient and is also used as a medicine separately [1]. The sulfur molecules are packed in between the mercury molecules because of the constant trituration process for hours together and as it is continued further the compact placement of sulfur becomes more fixed [2]. Therapeutic potential of Kajjali based on the ratio of sulfur present, it has a wide range of therapeutics for various disorders along with different adjuvant [3]. Present study aims at the pharmaceutical preparation of Kajjali as mentioned in the classical text Rasa Ratna Samuchaya, followed by testing for its organoleptic characters, alchemy (classical Bhasma Pariksha) and physico chemical parameters.

2. MATERIALS AND METHODS

2.1. Ingredients;

1) Parada (mercury)

2) *Gandhaka* (sulfur)

Both of these ingredients were obtained from the Department of Rasashastra and Bhaishajya Kalpana, S D M Ayurveda College and Hospital, Hassan. Other ingredients like lime stone, garlic, salt, milk & ghee used for purification procedures were obtained from local market of Hassan. Authentications of these were carried out in the laboratory of Dravya Guna Department of SDM College of Ayurveda & Hospital, Hassan. The complete study was conducted in the teaching pharmacy of S D M College of Ayurveda & Hospital, Hassan.

2.2. Methodology

Purification of the ingredients;

2.2.1. *Parada Shodhana* (Purification of mercury) [4]

The purpose for Parada Shodhana was to prepare Kajjali, as per the reference of Rasa Tarangini. Type of procedure adopted was Mardana (trituration). Equipments used were stone mortar and pestle, vessel, cloth & spatula.

Method for purification of mercury;

Mercury was triturated in a stone mortar with lime stone powder till it gets completely mixed into the powder. Then it is regained back and again triturated further with garlic paste and salt and all standard operative procedures were carried out as per mentioned in the classics.

2.2.2. Gandhaka Shodhana (Purification of Sulfur) [5]

It was carried out as per the reference of Ayurveda Prakash. Type of procedure adopted is Dalana (pouring or quenching) in milk, Prakshalana (washing) with warm water. Equipments used were steel cylindrical vessel, spoon, gas stove, cloth, iron vessel & warm water.

Method for purification of sulfur;

Sulfur weighed, pounded into powder in a stone mortar. Sulfur was melted and poured (Dalana) in milk then collected and washed with warm water. This procedure was repeated for total three times. Precautions; should be careful while heating sulfur as it catches fire easily. The cloth tied onto the mouth of the cylindrical container should be smeared ghee for the easy passage of sulfur into milk.

2.2.3. Preparation of Kajjali [6]

Reference followed was Rasa Ratna Samuchchaya, type of procedure was *Mardana* (trituration) Equipments- Mortar and pestle, cotton swab, spatula, mask and hand gloves.

Ingredients-

Started on	Materials	Quantity	Completed on	
date	Purified mercury	360 g	date	
21/12/16	Purified sulphur	360 g	20/01/17	

Table 1: Ingredients for Kajjali Preparation [6]

Method of *Kajjali* preparation;

Equal parts of purified mercury and purified sulfur are taken in a stone mortar and pestle. They are triturated thoroughly in the mortar, changes were observed in color, appearance, consistency etc.; were noted in below table of results and observations.

Stone mortar size – Black stony mortar, length (internal) - 47cm, breadth (internal) - 28cm, depth (internal) - 13cm, thickness- 3 cm and height- 20 cm was used. Pestle size- Length- 25.5 cm, circumference at top (breadth) - 11 cm, middle- 22 cm, bottom- 26 cm was used for trituration.

Precautions; Wear a mask to avoid inhaling of Kajjali. Mortar and Pestle was cleaned and dried before starting the process. Purified sulfur was finely powdered, before adding to purified mercury. Trituration was done carefully and in uniform speed to avoid spillage.

Hours	Color	Odor	Consistency	Other Observations	
After 5 min.	Yellow	Sulfur	Powder	Purified mercury + Purified sulfur	
				starts mixing.	
After 10 min	Yellow	Sulfur	Powder	Mixing of mercury with sulfur	
After 30 min	Yellow	Sulfur	Powder	Light greyish yellow color with shiny	
				globules.	
After 1 hr.	Light	Sulfur	Powder	Yellow streaks seen, mercury gets	
	grey			turned into small globules.	
After 3 hr.	Light	Sulfur	Powder	Mercury turns into very small	
	grey			globules and gets mixed.	
After 5 hrs.	Light	Sulfur	Powder	Bottom surface of the stone mortar	
	grey			turns shinny.	
After 8 hrs.	Light	Sulfur	Powder	Mercury turned into very tiny circular	
	grey			globules.	
After 12 hrs.	Light	Sulfur	Powder	Mercury was not seen separately in	
	grey			the <i>churna</i> .	
After 18 hrs.	Grey	Sulfur	Powder	Tiny shinny particles of mercury were	
				seen.	
After 24 hrs.	Grey	Sulfur	Powder	Lot of shiny particles present, as	
				mercury got scattered in the churna.	
After 30 hrs.	Grey	Sulfur	Powder	Shiny particles present.	
After 40 hrs.	Grey	Sulfur	Fine	It turned to fine powder started	
			powder	spilling out of the mortar.	
After 55 hrs.	Dark	Sulfur	Fine	Attained Rekhapurnatva. Spilling	
	grey		powder	was seen more.	
After 65 hrs.	Dark	Sulfur	Fine	Varitara and Unama tests were	
	grey		powder	positive.	
After 80 hrs.	Black	Sulfur	Fine	Shiny particles present.	
			powder	Copper plate test positive.	
After 90 hrs.	Black	Sulfur	Fine	Few shiny particles were present.	
			powder	Copper plate test positive.	

 Table 2: Observations/Different phases of Kajjali during Preparation

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After 115	5 hrs.	Jet	Sulfur	Fine	Jet black, smooth soft powder, shiny
		black		powder	particles were reduced.
After 120) hrs.	Jet	Sulfur	Fine	Jet black smooth, soft and very fine
		black		powder	powder, Nishchandratva (shiny
					particles were absent).

Table 3: Showing Results for Pharmaceutical Preparation of Kajjali

1)Total	2)Obtained	3)Weight loss	4)Weight loss	5)Total no. of	6)Total no.
quantity taken	quantity of	(in g)	in %	hours for	of days
	Kajjali			trituration	
720g	700g	20g	2.85%	120 hrs.	30 days

Table 4: Organoleptic Characters of Kajjali

Date	Sr. no.	Parameters	Kajjali
	1.	Color	Jet black
	2.	Odor	Characteristic
21/1/17	3.	Taste	Tasteless
	4.	Consistency	Very fine
	5.	Touch	Smooth and fine

Table 5: Result of Classical parameters of Kajjali [6]

Date	Sr. no.	Parameters	Result for <i>Kajjali</i>
	1.	Varitara	Positive
	2.	Rekhapurnatva	Positive
22/1/17	3.	Unnama	Positive
22/1/1/	4.	Copper plate test	Positive
	5.	Nishchandratva	Positive
	6.	Mridtva & Slakshanatva	Positive
	7.	Gatarasatva	Positive
	8.	Anjanabhasa	Positive
	9.	Vishistavarnautpati	Positive

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Date	Sr. no.	Parameters	Results
	1.	Ash value	0.18%
25/1/17	2.	Acid Insoluble ash	0.15 %
	3.	Water Soluble ash	0.08 %
	4.	рН	5.7

Table 6: Results of Physico-chemical Analysis of Kajjali

DISCUSSION

Pharmaceutical preparation of Kajjali was carried out as per the reference of Rasa Ratna Samuchaya. Purification of mercury and sulfur are vital procedures to be done before starting the Kajjali preparation. For the preparation of Kajjali, trituration of purified mercury and purified sulfur was done for total 120 hours for 30 days (4hrs/ day). Until all the organoleptic characters, Bhasma Pariksha (classical tests) and physico chemical parameters were attained. The organoleptic characters of the final product of Kajjali were jet black in color, characteristic odor, very fine powder in consistency, smooth and soft to touch. The color changes from light yellow to grey and then jet black may be due to the chemical and physical reactions occurring in between the ingredients while rubbing. The continuous manual pressure applied during trituration for hours make it very soft, smooth and fine in consistency. It passes the Bhasma Pariksha⁶ (classical tests) like Varitara, Unnama suggesting the light weight, fine nature and less particle size of the final product. Rekhapurnatva, Mridutva, Slakshanatva and Anjanabhasa prove the fineness, softness and smoothness of Kajjali. Nishchandratva and Copper plate test proved the absence of free mercury in the final product making if safe for the internal administration without causing any irritation. Kajjalabhasa, Gatarasatva and Visistavarnotpothi suggest the organoleptic characters of Kajjali [6]. Physico chemical parameters like total ash-0.18%, acid insoluble ash-0.15%, water soluble ash-0.08% and pH- 5.7 were attained. 360g purified mercury and equal quantity of sulfur 360g was taken for Kajjali preparation. Total quantity of Kajjali obtained was 700/720g. Loss in weight was 20g (2.85% loss) was observed may be due to spillage during triturating it and also dusting of the product as it turned finer and finer after continuous rubbing. Preparation of Kajjali following the classical method requires high labor effort when done manually but yields maximum product with minimal loss. Few articles [7] opine new grinding method (using mixer or a grinder) is very easy, time saving and the product obtained is similar to the obtained classical product hence can be adopted. Analytically there was no much difference seen in the products obtained using different source of mercury [8]. As no difference is noted in the organoleptic, physicochemical, XRD (composition of the product) and SEM (particle size) tests of these products hence any method can be followed to prepare Kajjali.

Preparation of *Kajjali* following classical

Preparation of *Kajjali* following classical method as per reference of Rasa Ratna Samucchaya text yielded maximum product with a minimal loss of 2.85% loss. Obtained product was very fine, soft, smooth, jet black color sulfide form of mercury. Attains the organoleptic characters and passes the classical tests (*Bhasma Pariksha*), following the physico chemical analysis, which has been said to have beneficial therapeutic properties as per the classics.

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6. CONFLICT OF INTEREST

No conflict of interest.

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PHOTOGRAPHS: PREPARATION OF KAJJALI



Fig 1. Purified Mercury



Fig 2. Purified



Sulfur

Fig 3. Mercury+ Fig 4. Kajjali trituration on 3rd day



Fig 5. Trituration on 6th day



Fig on 15th day



6.Trituration Fig 7.Trituration on 28th day



Fig 8. Kajjali

CLASSICAL TESTS OF KAJJALI

Plate test





Fig 10.Varitara test Fig 11.Copper





Fig 12. Nishchandra test

Fig9.Rekhapurna test



Fig 13.Unnama test