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Pharmaceutical Standardization of *Samaguna Bali Jarita Antardhuma Rasasindura* Prepared by Modified Method

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ABSTRACT

Rasasindura is a famous Ayurvedic *Kupipakwa Rasayana* formulation containing Mercury and Sulphur as major ingredients. Now a day's *Bahirdhuma Rasasindura* is in common practice but final product is expensive and yield is less. Moreover, the Sulphur fumes which come out during the preparation pollute the environment. This study was focused on preparation of *Rasasindura* in *Antardhuma* process and to establish standardization of the method.

Medicine was prepared in EMF (Electrical Muffle Furnace) method and observations were recorded. Obtained product was subjected to organoleptic and physico-chemical analysis.Final product was Red in colour as mentioned in classical text. Average yield of the product is 90.4%. *Antardhuma Rasasindura* preparation is simple, economical, better yielding, eco-friendly and superior to *Bahirdhuma* method.

KEYWORDS

Rasasindura, Antardhuma, Kupipakwa Rasayana

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INTRODUCTION

Rasasindura is a popular Ayurvedic*Rasayana* formulation used to achieve fast results in small doses. It is prepared by *Kupipakwa* in *Valukayantra* (sand bath) which is one of the best methods used for metallic medicinal preparations, particularly for *Gandhaka* (Sulphur) *Jaarana* (digestion).

Rasasindura is indeed the "*Sa Gandha*, *Sa Agni*, of Mercury. It is of two types- *Antardhuma* and *Bahirdhuma*. In this process *Jaarana* of Sulphur takes place which makes Mercury highly potentiated [1]. The traditional furnace used to manufacture RS is known as *bhatti* and fuel used is either

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Rasasindura is indeed the "*Sa Gandha*, *Sa Agni*, of Mercury. It is of two types- *Antardhuma* and *Bahirdhuma*. In this process *Jaarana* of Sulphur takes place which makes Mercury highly potentiated [1]. The traditional furnace used to manufacture RS is known as *bhatti* and fuel used is either hard or soft coal. Difficulty in controlling the temperature, large amount of fuel consumption, exposure of the personnel to heat, and air pollution are the drawbacks in the traditional method. With advancement in pharmaceutics, replacement of the fuel and instrument by more efficient instruments such as the electric muffle furnace (EMF) may be considered, which has benefits like easy handling, temperature control, control of air pollution, and reduction in human effort.

Purpose of present study:

While *AntardhumaRasasindura* is not uncommon in classical literature, today the *BahirdhumaRasasindura* is widely practiced. *BahirdhumaRasasindura* product is expensive and yield is also less. Moreover, the Sulphur fumes which come out during the preparation pollute the environment.

AIMS AND OBJECTIVES

1) Pharmaceutical standardization of *Samaguna Gandhaka Jaarita Rasasindura* (equal amount of Sulphur digested *Rasasindura*) by *Antardhuma* process

2) To demonstrate the importance of *Sulphur* in the *Jaarana* procedure.

3) To re-establish the superiority of *Antardhuma Jaarana* in comparison to *Bahirdhuma Gandhaka Jarana* with special reference to Classics

MATERIALS AND METHODS

Materials used:

- Purified Mercury: 25 grams
- Purified Sulphur : 25 grams
- *Kupi* (glass bottle coated with 7 layers of mud-smeared cloth, capacity: 750 mL)[2],
- EMF- inner hearth (length: 15 cm, breadth: 15 cm, depth: 30 cm, max. temp. capacity: 1000°C) were collected as per the requirement.

Method:

The preparation of RS is divided into three stages, namely, preoperative (*Purvakarma*), operative (*Prdhanakarma*), and postoperative (*Paschatkarma*) stages. RS was subjected to various organoleptic and physicochemical analyses like texture, color, taste, odor, pH, ash value, acid-insoluble ash, water-soluble ash, loss on drying, and percentages of mercury, free mercury, sulfur, and free sulfur.

Purvakarma

Extracted mercury and purified sulfur were taken in an appropriate ratio and triturated in an iron mortar till the whole mixture was converted into a fine black, lusterless powder (*Kajjali*). Fifty grams of *Kajjali* was filled which was placed on a traditional furnace in such a way that the neck of the kupi remained just outside the sand, and in EMF, the *Kupi* was placed in the center in such a way that the *kupi* could receive equal distribution of heat. Corking of *kupi* was done before we switch on the EMF.

Table 1 Temperaturegradation and time duration

Agni (flame/heat)	Standard temperatures of *Krama Agni*	EMF(hr)
Mrudu(mild)	Till 250^0C	18
Madhyama(moderate)	250^0C to 450^0C	18
Tivra(severe)	450^0C to 640^0C	18
Total		54

EMF : Electrical muffle furnace ; hr: Hour

Pradhankarma

In the preparation of RS by EMF the temperature pattern standardized by the traditional method mentioned in Table no.1 was followed and the pattern of gradual rise in temperature was also used. Observations were recorded, and in the same way, two more batches were prepared to ensure a standard manufacturing process.

Paschatkarma

On the next day, after self-cooling, the bottle was carefully scraped, broken, and the product deposited at the neck was collected and weighed as mentioned in Fig 1.

OBSERVATIONS

- *Kupipakwa Antardhuma Rasasindura* was *kanthastha* (formed at

neck of flask), as the temperature ranged up to *Tivra Agni* (640°C at 54th hour).

- Colour of final product was dark red and after powdering colour was pale red.
- There was no residue at the bottom assuring temperature was given for sufficient time period.
- Slight pungent gas was smelled after breaking the flask, probably of SO_2 (Sulphur dioxide). Sulphur may have reacted with the Oxygen molecules, as space were occupied by air.

RS, collected from the neck of and calculated for the percentage of absolute the *Kupi* from all the batches were weighed and relative yield which are mentioned below in Table no.2.

Table 2 Weight and yield (%) of EMF method

Wt. of *Kajjali*(gm.)	Wt. of Product (gm.)	Yield %
50	44.8	89.6
50	45.6	91.2
50	45.2	90.4
Avg	45.2	90.4

Table 3 Results of organoleptic tests

Parameters	**Observation**
Texture	Compact
Colour (after trituration)	Vermillion
Taste	Tasteless
Smell	Indistinct

Table 4 Consolidated data of Physico-chemical parameters of samples

S.No.	Name of Sample	LOD in %	pH(10%w/v suspension)	Total Ash in %w/w	Acid Insoluble Ash in w/w %	Water Soluble Ash in w/w %
1	Kajjali RS	0.35%	6.60	0.60%	0.23%	0.27%
2	RS -1	0.6%	6.98	0.50%	0.27%	0.20%
3	RS -2	0.5%	7.02	0.46%	0.33%	0.25%
4	RS -3	0.5%	6.88	0.43%	0.31%	0.22%

Critical Explanation:

GandhakaJaarana refers to the contact duration of melted *Gandhaka* with *Parada* followed by bond formation and subsequent burning or evaporation of free Sulphur depending on *Antardhuma* or *Bahirdhuma* process. In *BahirdhumaRasasindura* during *Jaarana* process *Gandhaka* burns out due to its reaction with oxygen and final product is HgS (artificial Cinnabar). In *AntardhumaRasasindura* during *Jaarana* process *Gandhaka* evaporates to form a sublimate and is evenly mixed physically (not chemically) with the HgS compound. Hence *AntardhumaRasasindura* is a well-blended mixture of Cinnabar and Sulphur. The superior therapeutic qualities of *AntardhumaJaarana* are clearly mentioned in classical texts. We can assume that *AntardhumaRasasindura* attains superior therapeutic values due to the presence of sublimate of Sulphur. The sublimated Sulphur concept can be explained by a reference from *Anandakanda* text.

Anandakanda[3] mentioned the sublimation process of *Gandhaka* and named it as *Gandhakasatwa* (using the word *Satwapatana* for *Gandhaka* is not acceptable as *Gandhaka* itself is *satwarupa).Anandakanda* inner meaning was to obtain purest form of Sulphur by sublimation. Present day pharmaceutical industries prepare 99.99% pure Sulphur mainly through sublimation process. This pure sublimated Sulphur is no doubt therapeutically effective. This is explained below with an example: *Gandhakasodhana* is mainly done by Ghee and milk. The explanation we give is, Ghee removes the toxic substances from *Gandhaka* and floats over milk while *Gandhaka* sinks to the bottom. Practically even after repeated hot water washing of purified Gandhaka some amount of Ghee and milk particles will be attached to *Gandhaka.Ghee* smell is also felt. As per the concept toxins are taken by Ghee which is still in contact with *Gandhaka* and traces of milk particles compromise the sterility as there can be a chance of bacterial growth. The purest form of Sulphur can be obtained by the sublimation process mentioned by *Anandakanda* as *Gandhakasatwa* which is therapeutically more effective.

- *BahirdhumaRasasindura* is HgS
- And *AntardhumaRasasindura* is a well-blended HgS + S
- This may be the first practical attempt of *KupipakwaAntardhumaRasasindura*.

DISCUSSION

Processing Mercury and Sulphur to form red coloured product similar to *Rasasindura* probably started from 8th century AD. They were prepared in *Lohasamputa* (Iron vessels), *Musha* (earthen crucibles), *Angara paka*, *putapaka* methods, etc. *Valukayantra* (sand bath) was first mentioned in *Rasahridayatantra* (10th AD). *KachaKupi* (glass flask or bottle) was first mentioned in *Rasendrachudamani* (12th AD)[4]. *KachaKupi* in *Valukayantra* for *Kupipakwa* was used from the period of *Rasa prakashasudhakara* (13th AD). According to *RasendracintamaniKupi* (flask or bottle) can be made from glass, clay, gold, iron, silver[5]. *Rasasindura* word first appeared in *Rasendracintamani* (15th AD)[6]. The very first instance of *GandhakaJaarana* was *Antardhuma*method processed in *yantra* similar to *Mushayantra*, described in *Rasendramangalam* (8th AD)[7]. According to *RasahridayaTantra* the method of *ParadaJaarana* where there is no loss in Mercury should be followed[8], which is only possible in *Antardhuma*. The therapeutic

attributes of *AntardhumaJaarana*[9] are ranking high to *BahirdhumaJaarana*[10] due to the inadequate *GandhakaJaarana* in *Bahirdhumamethod*[11]. It reveals the superiority of *Antardhuma.*

Readable reference of *BahirdhumaGandhakaJaarana* is seen in *RasendraCintamani* (15th AD)[12] and *Rasa Tarangini* (20th AD)[13]. Clear emphasis on *BahirdhumaRasasindura* started from 17th century AD onwards where the use of *Salaka* (rod) in cleaning the blocked mouth of *Kupi* (bottle) is cited[14]. This reveals that *Antardhuma* was the most common process frequently used in *Rasashastra* than *Bahirdhuma* for preparing *Rasasindura* or product similar in preparation with different names like *Rasa bhasma*, *Kamadeva rasa*, *Udayabhaskara rasa*, *Mrutasuta*, etc.

Average yield in *Bahirdhum* method is mainly around 50 -55 % whereas in *Antardhuma*method it is found about 90 % which clearly indicates the better yield in *Antardhuma* method.

Analytical study revealed the presence of Cinnabar and Sulphur in the sample. Modern science listed Mercury under highly toxic metals. But the toxic levels of oral administered Mercury in the form of Cinnabar (HgS) are considerably low. Absorption of Cinnabar from the gastrointestinal tract is < 0.2%[15], very less compared to other non-Sulphur Mercurial compounds. Solubility of Cinnabar is 0.001g/L at 20°C, which is quite low compared with other Mercurial compounds like Mercuric chloride (30-70g/L at 20°C). Detoxification of Mercury is done with chelating agents like Dimercaptosuccinic acid (DMSA) ($C_4H_6O_4S_2$),Dimercapto-propane sulfonate (DMPS) ($C_3H_8O_3S_3$). All these compounds contain Sulphur and also food supplements containing Sulphur are recommended. Mercury has higher affinity towards Sulphur especially to thiols which leads to detoxification. Our body's natural detoxification system also works under this relation with the help of thiol complexes like glutathione ($C_{10}H_{17}N_3O_6S$). In *Rasasastra*, advantages of Mercurial medicines containing Sulphur and side effects of non-Sulphur Mercurial medicines are mentioned[16]. Sulphur may considerably decrease the accumulation of Mercury in the body in addition increases the efficacy of Mercurial therapeutic attributes. Mercury is considered to be *Yogavahi* (fast acting), particularly as a stimulant which penetrates quickly to minute parts of the body and increases the properties of herbal drugs used along even in minute quantities with its catalytic activity. So, Mercury need not be available for a longer period in the body to show its action. Non-Sulphur products of Mercury are toxic in higher doses compared to *Rasasindura* and cannot

be used for a longer periods even in therapeutic doses due to the risk of accumulation.

SamagunaGandhakaJaarana, Dviguna (double), *Shadguna* (six times), *Astaguna* (eight times), *dwadasaguna* (twelve times) [17], *Sataguna* (hundred times) and *Sahasraguna* (thousand times) are therapeutically superior in increasing order of *Jaarana*. So, according to Ayurveda more the Sulphur content safer and effective is the Mercurial medicine. In *AntardhumaRasasinduraSulphur* percentage is higher compared to *Bahirdhuma*, which ensures the safety of *AntardhumaRasasindura.*

CONCLUSION

As per the critical study *Antardhuma* method was most commonly followed by the *Rasasastra* Siddhas (practitioners) for*Parada Jaarana* and *Sa-Agni Murchana* with *Gandhaka*. References on the importance and therapeutically superior attributes of *AntardhumaGandhakaJaarana* are cited in the texts. The preparation *AntardhumaRasasindura* is simple, economical, eco-friendly and better yielding compared to *Bahirdhuma* method. Toxicology and Clinical studies should be conducted to standardize the therapeutic dose and usage of *AntardhumaRasasindura.*

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