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Research Article

Pharmaceutical Standardization of *Muktashukti Bhasma* and *Muktashukti Pishti*

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Abstract: *Shukti* is an important component of *Sudhavarga*, the most recent class in the subject of *Rasa Shastra*. According to the availability, two forms of *Shukti* have been stated in *Rasa Shastra* texts: *Jalashukti* and *Muktashukti*. *Muktashukti* is considered for the study. This study has tried to develop the standard operating process for manufacturing *Muktashukti bhasma* and *Muktashukti pishti*. Three batches of *MSB* & *MSP* were prepared from the purified *Muktashukti*. While manufacturing three batches same raw material and manufacturing instruments were used. Before processing for *Bhasma* or *Pishti,* the purification process is advocated for *Muktashukti. Kanji (Rice gruel)* was used for purification as per textual reference. Purified *Muktashukti* was levigated *with* Rose water to obtain *Pishti*. However, for Bhasma preparation, the *Muktashukti* was triturated with Aloe vera juice, and then heating was done in an Electric muffle furnace. 7 liters of Kanji was taken for 500g of *Muktashukti Shodhana* by *Swedana* for 3hrs in *Dolayantra*, with an average weight rise of 96.24% and a weight loss of 3.76% during the *Shodhana* method. During *MSB* preparation, a 10% loss was observed & 90% of *Bhasma* was obtained. However, in *MSP* preparation, a 12.14% loss was observed & 87.86% was obtained. This study will give the direction related to the duration of levigation and temperature regulation while Muktashukti *Bhasma* preparation. For *Pishti* preparation, the wet grinder was used, which will provide exact rotation and duration to obtain the proper *pishti* from *Muktashukti.*

Keywords: *Shodhana*, *Marana*, *Muktashukti*, *Bhasma, Pishti*

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1. INTRODUCTION

Rasashastra is concerned with pharmaceutical compositions made of metals or minerals [1]. One such mineral is the group of *sudhavarga,* which is rich in calcium. Due to the prevalence of calcium (*Sudha), Shukti* was considered among the *Sudha Varga*[2]. The author of *Ayurved Prakasha* mentions two forms of *Shukti* for the first time *Jalashukti* and *Muktashukti* [3]. To convert toxic ingredients into non-toxic and more powerful disease-eradication medicines, several pharmaceutical processing procedures, such as *Shodhana, Bhavana,* and *Marana*, were developed[4]. First, the raw material undergoes a specific purifying *(shodhan)* process, followed by incineration *(maran)*. Here the purification processes in which the unwanted material is either removed or by different processes of heating and trituration, the drug is converted into a brittle and soft form. The specific heating is followed for the incineration (Marana); the heating unit is known as *Puta.* Here the *Puta* was given in an Electric muffle furnace to prepare *Bhasma*. These are the steps to convert the drug into an organic form. For *sudhavargiya dravya (calcium-rich minerals)*, the use of *Bhasma* and *Pishti* was mentioned. *Bhasma* is a form of incinerated ash produced under a specific heating pattern. The result, *bhasma*, is a non-toxic, quickly absorbed, and assimilated substance[4]. *Pishti* is a fine powder medicine that the body readily absorbs. The drug is triturated with essential liquids under sunshine or moonlight to prepare pishti[4]. *Pishti* is cold in potency than *Bhasmas*[5]. The *Bhavana* concept is utilized to lower the particle size of the drug, and it incorporates the properties of the *Bhavana dravya*[6]. The *Bhavana* is a levigation process done with specific organic liquid media[7]. The same pure material can be used to make both *pishti* and *bhasma,* but the manufacturing techniques are different and may differ in characterization. This study has made an effort to develop the standard operating process of bhasma and pishti preparation. *Bhavana* (Levigation) is a therapeutic technique that, by altering the physical and chemical changes, is ideally useful to eliminate the side effects of pharmaceuticals and to increase drug action. In this procedure, herbal powders are triturated alongside herbal juice, decoction, or any other organic liquid media until the liquid has been completely absorbed [8]. In this article, the process of levigation is used to prepare *Muktashukti Pishti. For* the process of levigation the wet grinder is used. To specify the rotation and duration, the instrumentation gives the proper direction. For *Muktashukti bhasma* preparation, the incineration and levigation processes are involved. For *bhasma* preparation*, Puta (unit of heat)* is advocated in Ayurveda. For *Puta,* the cow dung cakes in specific quantities are mentioned in ayurvedic texts[9]. But, a Muffle furnace is used for heating treatment of metals and minerals in Ayurveda [10] as it is more convenient to monitor and regulate the temperature. This article develops the standard operating process to prepare *Muktashukti pishti* preparation and *Muktashukti bhasma* preparation to direct the Ayurveda pharmaceutics. The duration and levigation involved in *Muktashukti pishti* preparation using modern instrumentation techniques like a wet grinder can be assessed. For *Muktashukti bhasma*, the muffle furnace and wet grinders were used using the temperature required to get the proper incarnated *bhasma* can be assessed.

2. MATERIALS AND METHOD

2.1 Raw materials

Muktashukti is the raw material used in this study. These were procured from professional suppliers and collected according to the features mentioned in Rasa classics. Samples of *Muktashukti* were procured from Indore, Madhya Pradesh. *Muktashukti* was procured from the vendor and was authenticated by the Department of *Rasashashtra* (MGACH & RC), as mentioned in Figure 1

2.2 *Pharmaceutical processing*

A) *Shodhana* of *Muktashukti*

- **Equipment**

Gas burner, Steel vessels, Spatula, Measuring Jar, Weighing machine, Thermometer (360^0C)

- **Ingredients**

Muktashukti- 500g (for each batch), *Kanji*- 7l (for each batch)

- **Procedure**

Muktashukti was made into smaller pieces and tied in a cotton cloth-like bundle. It was then hung in a '*Dolayantra'* (Swinging apparatus) containing '*kanji*' (Sour gruel) as liquid media and subjected to heating by fomentation for 3hrs, as shown in Figure 2. During this heating process, precaution was taken that the bundle with the *Muktashukti* should be embedded in liquid media. Later, the drug in the cloth was washed with warm water, dried, and stored as '*Shuddha Muktashukti'* (purified); 3 batches were prepared.

B) *Maran of Muktashukti*

- **Ingredients***: Shuddha Muktashukti:* - 550gm

- **Equipments**

Horizontal Electric muffle furnace (EMF), Weighing machine, spoon, earthen saucer, Fuller's clay, Cotton cloth.

- **1st heating in EMF**

Procedure

Shuddha Muktashukti was kept in the earthen saucer and then covered with another earthen saucer of equal size. The junction of the two earthen saucers was sealed with a cotton cloth smeared with Fuller's clay, and then it was allowed for sun-dried. After that, it was subjected to EMF at 678 ˚C temperature, as shown in Figure 3. After reaching 678°C, the temperature was maintained for 8 hr. After self-cooling the fixed earthen saucers, it was opened, and *Muktashukti* powder was collected and weighed.

- **2nd to 5th heating in EMF**

Procedure: Previously processed *Muktashukti* was taken in the mortar and pestle of black stone & trituration process was carried out till it was converted into a fine powder, shown in Figure 4; the other electric mixer was used for fine powder. *Muktashukti* powder was levigated with Alovera juice in an Edge runner mill (electric wet grinder) until it attains a thick paste consistency, the time required for this was 3.15 hrs, the Pellets were prepared from that and allowed for sun drying. The same process was repeated until the *Bhasma parikshas* (parameters to be passed for internal administration) were attained.

- **Average measurements of Pellets**

Diameter: -2cm to 2.3 cm,
Thickness: - 0.4cm to 0.6cm
Weight: -6gm to 8gm

C) *Muktashukti Pishti* Preparation

- **Ingredients**

1) *Shuddha Muktashukti:* - 700g 2) Rose water*:* -4lit

- **Equipment**

Edge-runner mill, Weighing machine, Spoon, Tray.

- **Procedure**

Purified *muktashukti* was pounded in an Edge runner mill, and levigation by Rose water was given as shown in Figure 5. After giving levigation on each day, the *pishti* was dried in a shed. The same procedure was repeated for 21 days. After each levigation by Rose water the fineness of *pishti* was increased with the essence of the rose, as shown in Figure 6.

3 OBSERVATION & RESULTS

Before purification, *Muktashukti* was creamy and lustrous in color, and after purification white color, a brittle *Muktashukti* was obtained. The bundle color was observed to be yellowish. The temperature of *Kanji* was between 100 to 104° C. Each batch required an average of 7 lit*ers of Kanji* for the purification process. Obtained quantity of *Muktashukti* after purification is 481.2g(average of three batches), and the Loss found was 18.8g(average of three batches). The Percentage of Loss on average is 3.76%. The Loss could be due to material dissolving and leaking via the pores of the bundle during the purification process. Some particles may be lost during the washing process after purification. The observations are depicted in Table no. 1

Table no.1: Results obtained during the process of *Muktashukti* Purification *(Shodhana)*

Batch No.	Wt. of *Muktashukti*		Max. Temp (C)	Time duration	Wt. or Loss after Purification (g)	% loss
	Before Purification	After Purification				
A	500g	482.1g	102	3hr	17.9g	3.58%
B	500g	480.2g	102	3hr	19.8g	3.96%
C	500g	481.3g	102	3hr	18.7g	3.74%
Average	**500g**	**481.2g**	**102**	**3hr**	**18.8g**	**3.76%**

Before Heating in EMF*, Muktashukti* was dull white and slightly hard. After 1st Heating in EMF, the whitish-colored material converted into an off-white color and became brittle, and due to this, *Muktashukti* was powdered very easily. During the levigation process, Alovera juice was frequently added because the mixture was drying quickly. The mixture became greyish-white in color, and a typical smell was observed. Pellets were blackish grey before Heating in EMF. After the 5th *Heating in EMF*, Pellets were found to be soft and Greyish. Materials became grey, very fine, soft, and smooth. Classical characteristics of *Bhasma*, like *Rekhapurnatva (*powder should enter into the lines of fingers) and *varitaratva(*powder should float on water*),* were observed. After the incineration processes, the obtained quantity of *Muktashukti* was 495g average gain and loss was 55g. The percentage of Gain was 90%, and Loss was 10%. The loss may occur due to the reduction of particle size and carbonization of the drug. The results are shown in Table no.2.

Table no.2: Results obtained during the *Muktashukti* incineration procedure

No. of *Heating in EMF*	Wt. of Pellets (g)		Max. Temp. (^{0}C)	Alovera juice required	Color of Pellets after *Heating in EMF*	Wt. or loss after *Heating in EMF*(g)	% loss
	Before *Heating in EMF*	After *Heating in EMF*					
1st	550g	537g	678°C	-	Whitish	13g	2.36%
2nd	537g	525g	678°C	180ml	Blackish	12g	2.23%
3rd	525g	513g	678°C	180ml	Blackish	12g	2.28%
4th	513g	504g	678°C	180ml	Blackish	9g	1.75%
5th	504g	495g	678°C	180ml	Blackish	9g	1.78%

After the completion of preparation, *Muktashukti Pishti* was a white color, fine with a rose fragrance. The obtained quantity of *Muktashukti Pishti* was 615g and the Loss was 85g. The percentage of gain was 87.86% (average of three and the loss percentage was 12.14%. Weight loss may occur due to some *pishti* material adhering to the Edge runner mill machine while levigation. The results are shown in Table no.3

Table no.3: Results obtained during the *Muktashukti Pishti* procedure

No. of Levigation	Wt. of *Pishti*		Rose water required	Time Required for Levigation	Color of *Pishti* after Levigation	Wt. loss after Levigation (g)	% loss
	Before Levigation	After Levigation					
1st	700g	695g	150ml	3hrs	Whitish	5g	0.71%
2nd	695g	691g	150ml	3hrs	Whitish	4g	0.57%
3rd	691g	686g	150ml	3hrs	Whitish	5g	0.72%
4th	686g	682g	150ml	3hrs	Whitish	4g	0.58%
5th	682g	677g	150ml	3hrs	Whitish	5g	0.73%
6th	677g	672g	150ml	3hrs	Whitish	5g	0.73%
7th	672g	668g	150ml	3hrs	Whitish	4g	0.59%
8th	668g	664g	150ml	3hrs	Whitish	4g	0.59%
9th	664g	660g	150ml	3hrs	Whitish	4g	0.60%
10th	660g	656g	150ml	3hrs	Whitish	4g	0.60%
11th	656g	652g	200ml	3hrs	Whitish	4g	0.60%
12th	652g	648g	200ml	3hrs	Whitish	4g	0.61%
13th	648g	644g	200ml	3hrs	Whitish	4g	0.61%
14th	644g	640g	200ml	3hrs	Whitish	4g	0.62%
15th	640g	636g	200ml	3hrs	Whitish	4g	0.62%
16th	636g	632g	250ml	3hrs	Whitish	4g	0.62%
17th	632g	628g	250ml	3hrs	Whitish	4g	0.63%
18th	628g	624g	250ml	3hrs	Whitish	4g	0.63%
19th	624g	621g	250ml	3hrs	Whitish	3g	0.48%
20th	621g	618g	250ml	3hrs	Whitish	3g	0.48%
21st	618g	615g	250ml	3hrs	Whitish	3g	0.48%

Pharmaceutical study photos

Fig.no.1: Raw *Muktashukti*

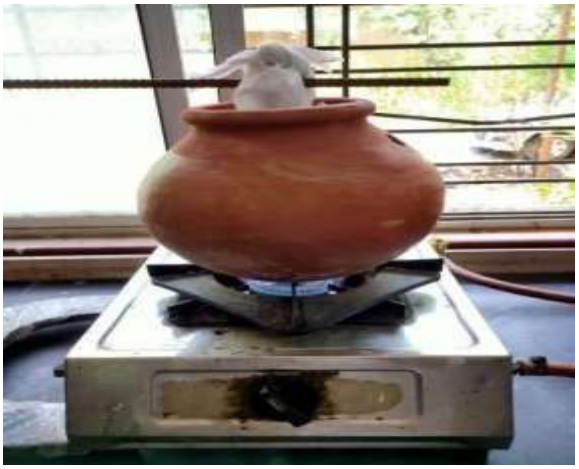

Fig.no.2: *Kanji*

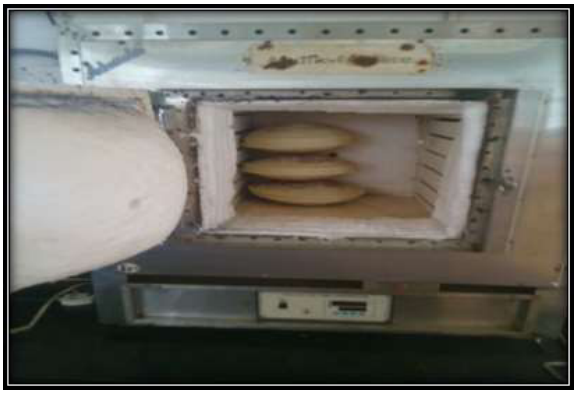

Fig.no.3: *Heating in EMF*in Muffle furnace

Fig.no.4: Final *Bhasma* Obtained

Fig.no.5: *Bhavana* in Edgerunner mill

Fig.no.6: Final *Pishti* Obtained

4 DISCUSSION

Most drugs under *Sudhavargiya Dravyas* are animal products, especially those of marine origin. They contain extrinsic contaminants such as manure and the tissues of various species. The purification technique should cleanse these impurities. According to *Rasatarangani,* Sour gruel was utilized as a liquid medium for the purification procedure[10]. Due to continuous heat in the Swinging apparatus, the liquid media is reduced. However, to maintain the position of the bundle in liquid media, more liquid must be added. An average of 7 liters of sour gruel was required to purify 500g of *Muktashukti*. *Muktashukti* pieces turned bright white after purification. The average weight loss observed was 18.8 gm from 500gm, i.e., 3.76% loss during the purification of *Muktashukti*. The water-soluble material may get dissolved into the liquid media and leak through the pores of the cotton cloth bundle during the purification process. Some particles could be lost during the washing process after purification. Time, heat, and liquid media used during the process play an important role in every chemical reaction. The specific heating pattern is performed in a prescribed liquid medium for a specific duration under a specific heat in swinging apparatus. The fluids specified in the swinging apparatus for fomentation contain sour gruel, which aids in breaking the substance, dissolving impurities, and scraping stuck tissues[11]. The specific media used was acidic so that the alkaline material may dissolve. This chemical process was enhanced with temperature. Apart from that, the *Muktashukti* become more brittle with this process. As a result, *Muktashukti* is treated for purification to remove adhesive material and to make it suitable for incineration. *Muktashukti* received Alovera juice levigation in Edge runner mill. Each levigation required an average of 180ml of Alovera juice. It exposes minute particles of the substance to liquid media. The qualities of the media penetrate the content. It finely grinds the coarse powder of the material and prepares it for further incineration processing. It causes unique and appropriate physicochemical changes and offers trace elements for synthesizing *Bhasma*[12]. Edge runner mill was used here because it allowed for regular rotation, pressure, and friction[13], which were difficult to manage while administering levigation manually utilizing mortar & pestle. Pellets were prepared after levigation with Alovera juice and dried in the shade. One pellet weighed 6 to 8 g on average, had a diameter of 2.0 to 2.3 cm, and a thickness of 0.4 to 0.6 cm. The uniformity cannot be maintained as they were prepared manually. While using the muffle furnace, 678 ^{0}C temperatures were given. *Marana* (incineration) of *Muktashukti* was performed using EMF (Electrical Muffle Furnace) because the traditional method of *Heating in EMF* necessitates collecting cow dung cakes, which are difficult to obtain in the present period, and most pharmacies employ EMF for *Bhasma* preparation. As a result, it is required to utilize the same equipment to determine the characteristics and efficacy of a substance. Furthermore, using an EMF (Electrical Muffle Furnace) is more convenient for establishing standard operating procedures due to the ease of watching and recording temperature[14-16]. After 1st Heating in EMF, the pellets were found hard to break, with a cracking sound and off-white color observed. After 2nd & the 3rd heating in EMF, the pellets were easy to break; the color was greyish from the outside, but the inner side was slightly off-white. The *bhasma* was smooth in touch and passed classical tests like *Rekhapurnatwa (penetration of the powder in the lines of fingers), Sukshmatwa(softness)*, etc. In 4th heating in EMF, *Rekhapurnatwa and Sukshmatwa* were observed with Greyish color of *bhasma*; another test was not observed; hence further *heating in EMF* was given again. After *the 5th Heating in EMF,* materials became bright Grey color, fine, soft, more light, and classical characteristics of *Bhasma* like *Rekhapurnatwa, Varitaratva, Sukshmatwa, and Shlakshnatwa* were observed. The final weight of *Muktashukti bhasma* was 495g, i.e., 55g less than the quantity taken; a 10% loss occurred. This Loss could be attributed to water evaporation and the combustion of organic or inorganic components. The difference may be related to process Loss. To obtain the nano-sized powder of *Muktashukti*, the pharmaceutics process *Pishti kalpana* was used. *Pishti* was produced to stabilize the inherent features of the medication with a massive reduction in particle size, facilitating drug penetration at the cell level [17-20]. The levigation process was carried out in an Edge runner mill because the pressure could not be properly applied in Mortal and Pestle. The impregnation of rose water into *pishti* was accomplished through particle size reduction using a 21-day levigation technique in an Edge runner mill. This particle size reduction method may improve solubility, bioavailability, and therapeutic dosage[21]. *Pishti* retained *Muktashukti*'s mild potency despite the lack of a heating procedure, like in *Bhasma*. The *MSP* was delicate and fine, with a rose aroma, after the 3rd levigation. Following the 12th levigation, tests such as *Rekhapurnatva and Sukshmatva* were observed. At the end of the 21st levigation, all tests passed, and *Varitaratva* was witnessed, indicating the fineness and perfection of *pishti*. 87.86 % yield and 12.14 % loss were observed during MSP preparation. Weight loss may occur as some *pishti* material may adhere to the Edge runner mill machine while providing Levigation. *Bhasma* and *pishti* both are claimed as nano particles[22, 23]. Bhasma preparation and Pishti formulations involve a series of methods, which should be followed properly to convert the inorganic material into a form acceptable by body[24,25,26,27].

5 CONCLUSION

Muktashukti is a widely accessible *sudhavarga* medicine with a high concentration of calcium compounds. 7 liter of *Kanji* was sufficient for 500g of *Muktashukti* purification by 3hrs fermentation in the Swinging apparatus. The *Muktashukti* obtained after purification was 96.24%, and the average loss in 3 batches was 3.76%. *MSB* can be prepared by Alovera juice levigation in EMF by giving 5 *Heating in EMF*, applying 678 ºC temperatures, which yield 90% *Bhasma* and 10% weight loss. *MSP* can be prepared by Rose water levigation in an Edge runner mill for 21 days 3hrs, which yields 87.86% *Pishti* and 12.14% weight loss. The Ayurvedic processing impregnates new molecules in *Bhasma and Pishti* from herbal media used for levigation. The different processes involved help in conversion of raw material into a fine nano form of medicine. These methods of levigation and heating should be followed properly to obtain good quality end products.

6. AUTHOR CONTRIBUTION STATEMENT

Dr.Shweta Kamble conceptualized and executed the study, and Dr. Anita Wanjari contributed to manuscript preparation.

7. CONFLICT OF INTEREST

Conflict of interest is declared none.

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