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Pharmaceutical Standardization

Pharmaceutical standardization of *Jala Shukti Bhasma* and *Mukta Shukti Bhasma*

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Abstract

Shukti is an important component of *Sudha* Varga, which is considered as the latest class in the field of *Rasa Shastra*. Two types of *Shukti* have been mentioned in *Rasa Shastra* texts i.e. *Jala Shukti* and *Mukta Shukti* according to the availability. In present study, an attempt has been made to develop a standard manufacturing procedure (SMP) of *Jala Shukti Bhasma* and *Mukta Shukti Bhasma*. Five batches of *Jala Shukti Bhasma* and *Mukta Shukti Bhasma* were prepared and standardization was attempted by maintaining batch manufacturing records of individual batches. During pharmaceutical procedures like *Shodhana*, *Bhavana*, *Marana*, etc. due care of temperature, its duration, percentage of weight gain or loss and the cost factor of the end product, etc. were considered. The average weight loss observed was 12.08 g i.e. 2.42% and 14.62 g i.e. 2.92% during *Jala Shukti* and *Mukta Shukiti Shodhana* respectively. Average weight loss found was 38.94 g i.e. 7.79% in *Jala Shukti Bhasma* while in *Mukta Shukti Bhasma,* it was 35.24 g i.e. 7.05%. At the end of the pharmaceutical procedure, it was found that *Mukta Shukti Bhasma* is 2.8 times costlier than *Jala Shukti Bhasma*.

Key words: *Bhasma*, *Jala Shukti*, *Marana*, *Mukta Shukti*, *Shodhana*

Introduction

Ancient *Acharyas* of *Rasa Shastra* had included *Shukti* in different *Vargas* like *Shukla Varga*,[1] *Shodhaniya Gana*,[2] *Shweta Varga*,[3] *Uparasa*,[4] *Uparatna*,[5] *Shankhadi Vigyaniyam*[6] etc. but later on in the 20th century A.D., it was included under *Sudha Varga* due to the predominance of calcium or *Sudha*. First time the author of *Ayurved Prakasha*[7] has mentioned two types of *Shukti* (*Jala Shukti* and *Mukta Shukti)* along with their synonyms, *Shodhana* and therapeutic uses accepted these in detail. Almost all authors of *Rasa Shastra* have mentioned two types of *Shukti*. In *Rasa Tarangini*, *Shukti* is described in detail under the broad heading of *Shankhadi Vigyaniyam*. Further two types of *Mukta Shukti* i.e. broad and circular and ear-like (*Karnikakara*) according to their shape. Among those, *Karnikakara Mukta Shukti* is the best variety and should be used in medicine. If it is not available, the first variety can be used as the substitute of the second variety but it is of lower quality.[8]

There are some controversies regarding *Jala Shukti* and *Mukta Shukti*. *Jala Shukti* is easily available and cheaper, while *Mukta Shukti* is not easily available and costlier than *Jala Shukti*. *Jala Shukti* is mostly procured from fresh water, while *Mukta Shukti* is procured from sea water. In this attempt, *Jala Shukti Bhasma* and *Mukta Shukti Bhasma* were prepared in order to develop a Standard Manufacturing Procedure (SMP).

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Materials and Methods

Collection of raw materials

Jala Shukti was collected from Gomati river bank near Jaunpur, Uttar Pradesh. *Mukta Shukti* was procured from Prabhas Patan near Veraval, Gujarat. *Nimbu* (*Citrus medica* (Linn.) Burm. F) was purchased from the local market of Jamnagar. *Kumari* (*Aloe vera* Tourn. ex Linn.) was collected from the botanical garden of Gujarat Ayurved University, Jamnagar [Figures 1, 2].

Shodhana of Ashuddha Jala Shukti and Mukta Shukti:
For *Shodhana* of both *Shukti*, 500 g was taken in each batch and *Nimbu Swarasa* was used as media for *Swedana*. *Nimbu Swarasa* was prepared as per the *Sharangadhara Samhita*.[9] Before processing it was washed with potable water properly, then cut in two pieces with knife. The cut part of the *Nimbu* was put in an in extractor and compressed to collect *Swarasa* which was filtered through a cotton cloth. The details of observations and results are presented in Table 1. The *Shodhana* process of both

Shukti was carried out as per the *Rasatarangini*.[10] Details of ingredients and their ratio used in the *Shodhana* process have been shown in Tables 2 and 3. *Ashuddha Jala Shukti* was made into small pieces, kept in two folded white clean cotton cloth and *Pottali* was prepared [Figure 3]. It was suspended in *Dola Yantra* containing 3 L of *Nimbu Swarasa* (lemon juice) and mild heat was applied to boil *Nimbu Swarasa* which was maintained for 3 h. When the level of *Nimbu Swarasa* decreased, again extra 1 L (average) was added. After completion of processing, heating was stopped and left for self-cooling. Then the *Pottali* was opened and *Shukti* pieces were washed thoroughly with hot water and dried. Similar procedure was followed for *Mukta Shukti Shodhana*. The observation and results obtained during the *Shodhana* process have been presented in Tables 4,5 and Figures 4,5.

Figure 1: ***Ashuddha Jala Shukti***

Figure 3: ***Shodhana by Dola Yantra***

Table 1: Quantity of *Nimbu Swarasa* obtained

Batches	Quantity of *Nimbu Swarasa*	Average quantity of *Nimbu Swarasa*
For *Jala Shukti Shodhana*		
A_1	4.100 L	4.140 L
A_2	4.220 L	
A_3	4.140 L	
A_4	4.040 L	
A_5	4.200 L	
For *Mukta Shukti Shodhana*		
B_1	4.000 L	4.144 L
B_2	4.100 L	
B_3	4.120 L	
B_4	4.220 L	
B_5	4.280 L	

Marana of *Shuddha Jala Shukti* and *Mukta Shukti*

First Puta

Shoddhita materials (*Shuddha Jala Shukti* or *Mukta Shukti*) were kept in *Sharava* in one layer and *Sharava Samputa* was prepared. After that, *Sharava Samputa* was allowed to dry in sunlight. The

Figure 2: ***Ashuddha Mukta Shukti***

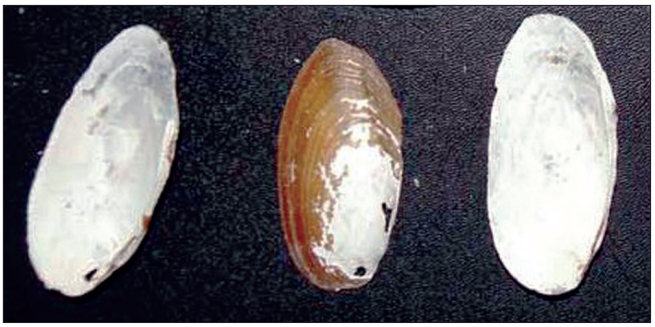


Figure 4: ***Shuddha Jala Shukti***

Table 2: Ingredients and their quantity for *Jala Shukti Shodhana*

Ingredient	Quantity per batch	Total quantity	Proportion
Ashuddha Jala Shukti	500 g	2.500 kg	1
Nimbu Swarasa	4 L	20 L	8

Table 3: Ingredients and their quantity for *Mukta Shukti Shodhana*

Name	Quantity per batch	Total quantity	Proportion
Ashuddha Mukta Shukti	500 g	2.500 kg	1
Nimbu Swarasa	4 L	20 L	8

Sharava Samputa was subjected to *Puta Paka* in the conventional *Puta* i.e. *Gaja Puta*. After placing ignited cow dung cakes and filling two-thirds of the pit with 60 cow dung cakes, *Sharava Samputa* was kept on them and the remaining one-third part was filled with 40 cow dung cakes to cover *Sharava Samputa*. After complete burning of all the cow dung cakes, the pit was allowed to self-cool. On the next day, after self-cooling of *Sharava Samputa*, it was opened and *Jala Shukti* pieces - *Mukta Shukti* pieces were collected carefully and weighed.[11] The results obtained during the first *Puta* have been presented in Tables 6,7 and Figure 6.

***Second** Puta*

Kumari Swarasa was extracted by *Nishpidana* (expression) *Vidhi*.[9] Leaves of *Kumari* were washed in tap water; thorny ridges and apex were cut by knife. Mucilaginous pulp was separated from the leaves with the help of knife and pulp was churned in mixer and then strained through cotton cloth. The results are presented in Table 8.

Jala Shukti powder - *Mukta Shukti* powder (obtained after 1st *Puta*) was levigated with *Kumari Swarasa* in porcelain mortar until it formed a thick paste [Figures 7,8] and become suitable for making *Chakrikas* (pellets). Small amount of levigated doughy mass was made into flat and round-shaped *Chakrikas*. The prepared pellets were kept on a plastic sheet for drying.

After proper drying of *Chakrikas*, they were weighed and kept in an earthen *Sharava*. That *Sharava* was covered by another earthen *Sharava* and the junction between the two *Sharavas* was sealed by a cotton cloth smeared with *Mulatani Mitti* and again allowed to dry completely. The remaining procedure was carried out the was similar to first *Puta*. The observations and results obtained during the second *Puta* have been presented in Tables 9,10 and Figures 9-12. The final product was powdered and sieved through 120 # mesh to obtain fine *Bhasma*. Then *Jala Shukti Bhasma* or *Mukta Shukti Bhasma* was filled inside '0' no. (500 mg in volume) gelatine capsules for oral administration.

Average temperature pattern

The temperature of *Puta* during *Marana* procedure of *Jala Shukti* and *Mukta Shukti* was recorded at regular intervals of 15 min for 6 h. During *Jala Shukti Bhasma* preparation, the average peak temperature observed was 859.80°C and 852.6°C in the first and second *Puta* respectively, whereas in *Mukta Shukti Bhasma* preparation the peak temperature was found to be 850.80°C and 849.20°C in the first and second *Puta* respectively. The temperature pattern observed during the first *Puta* and second *Puta* of both *Bhasma* are presented in Graphs 1 and 2.

Discussion

For the *Shodhana* procedure, each batch of *Jala Shukti* and *Mukta Shukti*, 500 g were taken and average four l of *Nimbu Swarasa* was required for each batch to complete *Swedana* process. The ratio of materials and liquid media required was 1:8.

Figure 5: ***Shudhha Mukta Shukti***

Figure 6: ***Shukti* after 1st *Puta***

Table 4: Results obtained during the process of *Jala Shukti Shodhana*

Processing stage	Weight of *Jala Shukti* (g)						Average wt. loss	
	A_1	A_2	A_3	A_4	A_5	Average	In g	In %
Before *Shodhana*	500	500	500	500	500	500	12.08	2.42
After *Shodhana*	483.5	490.6	491.3	488.0	486.2	487.92		

Table 5: Results obtained during *Mukta Shukti Shodhana*

Processing stage	Weight of *Mukta Shukti* (g)					Average weight (g)	Average wt. loss (g)	Average wt. loss in (%)
	B_1	B_2	B_3	B_4	B_5			
Before *Shodhana*	500	500	500	500	500	500	14.62	2.92
After *Shodhana*	481.8	486.2	487.4	482.0	489.5	485.38		

Figure 7: *Bhavana* procedure of *Jala Shukti* powder with *Kumari Swarasa* after 1st *Puta*

Figure 8: *Bhavana* procedure of *Mukta Shukti* powder with *Kumari Swarasa* after 1st *Puta*

Figure 9: *Jala Shukti Chakrikas* after 2nd *Puta*

Figure 10: *Mukta Shukti Chakrikas* after 2nd *Puta*

Table 6: Results obtained during the first *Puta* of *Jala Shukti Bhasma*

Batch	Wt. of *Jala Shukti*		Average *Upalas*	
	Before 1st *Puta* (g)	After 1st *Puta* (g)	Wt. (kg)	No.
A_1	483.50	471.20	12.50	100
A_2	490.60	474.90		
A_3	491.30	476.40		
A_4	488.00	474.20		
A_5	486.20	472.00		
Average	487.92	473.74		

Table 7: Results obtained during the first *Puta* of *Mukta Shukti Bhasma*

Batch	Wt. of *Mukta Shukti*		Average *Upalas*	
	Before 1st *Puta* (g)	After 1st *Puta* (g)	Wt. (kg)	No.
B_1	481.80	470.30	12.74	100
B_2	486.20	473.60		
B_3	487.40	473.20		
B_4	482.00	469.80		
B_5	489.50	475.90		
Average	485.38	472.56		

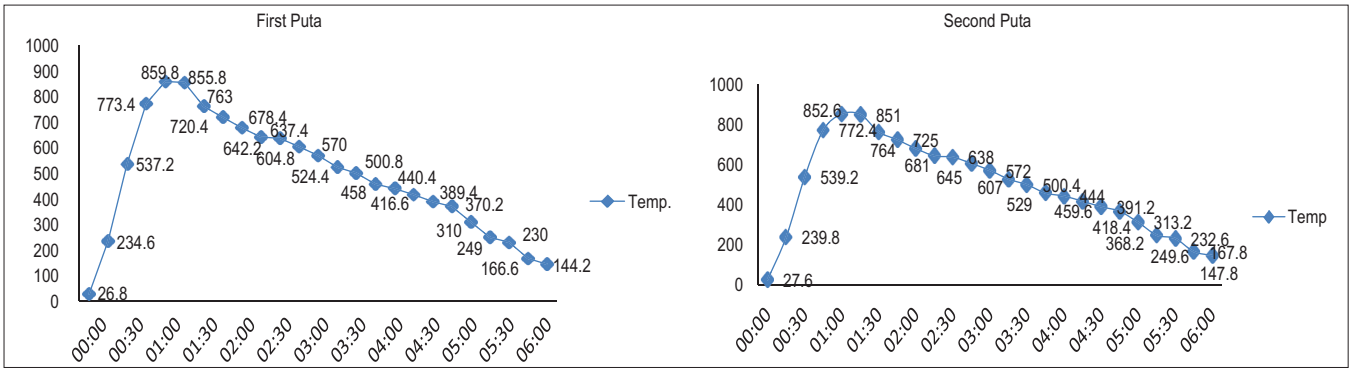
Average 4 L *Nimbu Swarasa* was obtained from 8 kg of *Nimbu*. During *Shodhana* procedure, it was observed that the color of media i.e. *Nimbu Swarasa* changed from yellow to turbid yellow and more viscous which may be due to the reaction between the media and the substance. The temperature of the media was maintained between 105°C and 110°C throughout the procedure. A whitish powder-like substance was deposited at the bottom of the *Dola Yantra* suggesting the escape of impurities

Table 8: Result obtained during processing of *Kumari Swarasa*

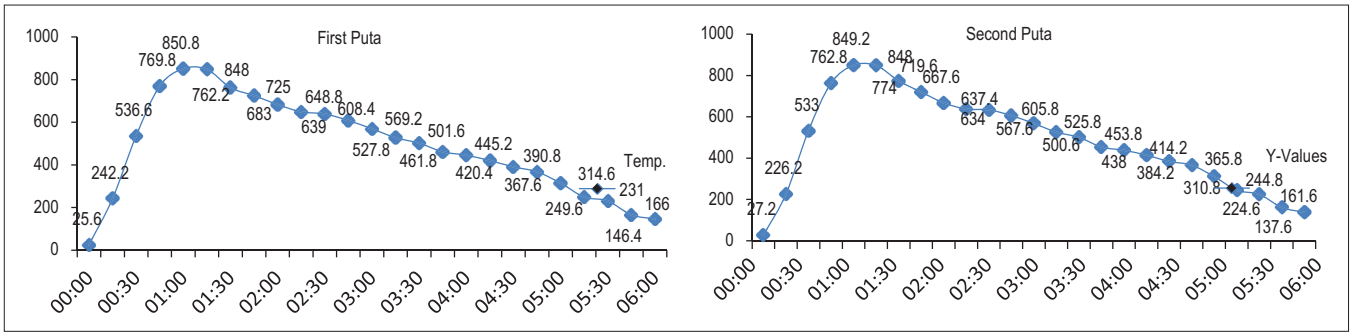
Wt. of *Kumari* Leaves (after cutting) in g	*Kumari Swarasa* obtained (ml)
1000	520
2000	1055

Figure 11: ***Jala Shukti Bhasma***

Figure 12: ***Mukta Shukti Bhasma***



Graph 1: Average temperature pattern observed during *Jala Shukti Bhasma* preparation (Temp. in ^{0}C at Y axis, time in hours at X axis)



Graph 2: Average temperature pattern observed during *Mukta Shukti Bhasma* preparation (Temp. in ^{0}C at Y axis, time in hours at X axis)

Table 9: Results obtained during the second *Puta* of *Jala Shukti Bhasma*

Batch	Wt. of *Jala Shukti Bhasma*		Average *Upalas*	
	Before 2nd *Puta* (g)	After 2nd *Puta* (g)	Wt. (kg)	No.
A_1	471.20	458.50	12.50	100
A_2	474.90	463.20		
A_3	476.40	464.60		
A_4	474.20	461.00		
A_5	472.00	458.00		
Average	473.74	461.06		

Table 10: Results obtained during the second *Puta* of *Mukta Shukti Bhasma*

Batch	Wt. of *Mukta Shukti Bhasma*		Average *Upalas*	
	Before 2nd *Puta* (g)	After 2nd *Puta* (g)	Wt. (kg)	No.
B_1	470.30	463.00	13.28kg	100
B_2	473.60	466.30		
B_3	473.20	464.80		
B_4	469.80	461.50		
B_5	475.90	468.20		
Average	472.56	464.76		

through the pores of the *Pottali*. After *Shodhana*, it was noticed that *Jala Shukti* pieces became whiter with shining and became smooth while *Mukta Shukti* pieces became bright white with rainbow-like shining and smoothness.

The average weight loss observed was 12.08 g i.e. 2.42% and 14.62 g i.e. 2.92% in *Jala Shukti* and *Mukta Shukti Shodhana* respectively [Tables 4,5]. It may be due to removal of impurities that dissolved and escaped through the pores of *Pottali* during *Shodhana* procedure. Some particles may be lost during washing with hot water after *Shodhana*.

For the first *Puta*, a fixed amount of cow dung cakes (100 in number) was taken for average 487.92 g of *Jala Shukti* and 485.38 g of *Mukta Shukti*. Average weight of 100 *Upalas* was found to be 12.62 kg. After the first *Puta*, *Jala Shukti* and *Mukta Shukti* pieces became pale white in color, brittle and soft. Shining was disappeared but fragility attributed after 1st *Puta*. The average weight loss observed was 26.26 g i.e. 5.25% after the first *Puta* in the preparation of *Jala Shukti Bhasma* and 27.44 g i.e. 5.49% in the preparation of *Mukta Shukti Bhasma*. After that *Jala Shukti* and *Mukta Shukti* pieces were powdered well and taken for further procedure i.e. *Bhavana*.

Jala Shukti powder and *Mukta Shukti* powder were levigated with *Kumari Swarasa* in porcelain mortar with the help of pestle until it formed a thick paste and was suitable for making *Chakrikas* (pellets). Total 250 ml of *Kumari Swarasa* was used for levigation and was done continuously for 3 h. Extra *Kumari Swarasa* was added from time to time for maintaining proper levigation. Levigation was done properly with uniform and sufficient pressure to make the materials fine. The pellets were made uniform in shape and size for proper heat exposure. After drying, the average weight of one *Chakrika* was observed 8 to 10 g, the average diameter was 2.0 to 2.5 cm and thickness was 0.5 to 0.7 cm.

For the second *Puta*, fixed amount of *cow dung* cakes (100 in number) were taken for average 473.74 g of *Jala Shukti* and 472.56 g of *Mukta Shukti*. Average weight of 100 *Upalas* was found to be 12.89 kg. After the second *Puta*, *Chakrikas* of *Jala Shukti Bhasma* were found to be soft, fragile, smooth and white in color while *Chakrikas* of *Mukta Shukti Bhasma* were found to be more smooth and bright white in color. After powdering of the *Jala Shukti Bhasma* became white whereas *Mukta Shukti Bhasma* became bright white [Table 11]. Both *Bhasma* became fine, soft and smooth and they had passed classical parameters like *Rekhapurnatwa*, *Varitaratwa*, *Gatarasatwa*, *Sukshmatwa*, *Mridutwa* [Table 12]. Regarding *Sudha Varga*, no specific parameters are described in the classics of *Rasa Shastra* for *Bhasma Pariksha* except the color of *Bhasma*. *Rasa Tarangini* has mentioned the color of *Shukti Bhasma* as '*Himakundendu Samkasham*' i.e. white which was observed in both *Bhasma* after the second *Puta*.

The average weight loss was found to be 38.94 g i.e. 7.79% in *Jala Shukti Bhasma* after the second *Puta* while in the *Mukta Shukti Bhasma* it was observed to be 35.24 g i.e. 7.05%. This loss may be due to vaporization of water and burning of some organic or inorganic materials. The peculiar odor observed during levigation with *Kumari Swarasa* disappeared after the second *Puta* in both *Bhasma*.

Varitaratwa was attempted to evaluate in both the samples of *Shukti Bhasma* by following the classical method as explained in *Rasa Ratna Samuchaya*. In general, this test is not mentioned in classical literature, though the authors tried to evaluate it. The *Varitaratwa* test was observed to be positive in *Mukta Shukti Bhasma*, while it was mild in *Jala Shukti Bhasma*, it may be due to some difference regarding its inorganic chemical elements. *Rekhapurnatwa* was observed in both *Bhasma* after the second *Puta* indicating fineness of *Bhasma*.

Table 11: Classical physical parameters of both *Bhasma*

Parameter	*Jala Shukti Bhasma*	*Mukta Shukti Bhasma*
Varna	White	Bright white
Sparsha	Soft, smooth	Soft, smooth
Rasa	Tasteless	Tasteless
Gandha	Odorless	Odorless

Table 12: Classical chemical parameters of both *Bhasma*

Parameter	*Jala Shukti Bhasma*	*Mukta Shukti Bhasma*
Rekhapurnatwa	Positive	Positive
Varitaratva	Positive	Mild positive
Sukshmatwa	Positive	Positive
Mridutwa	Positive	Positive

At the end of the pharmaceutical procedure, it was found that *Mukta Shukti Bhasma* is 2.8 times costlier than *Jala Shukti Bhasma*.

Conclusion

1. 51.75% *Nimbu Swarasa* (average 4.142 l) acquired from 8 kg lemon is sufficient for 500 g of *Jala Shukti* or *Mukta Shukti Shodhana* by *Swedana Vidhi* i.e. ratio of materials and liquid is 1: 8.
2. To convert 500 g batches of *Shukti* into *Bhasma*, minimum 100 cow dung cakes in the first and second *Puta* were required and peak temperature observed for *Jala Shukti* was 859.8°C and for *Mukta Shukti* was 850.8°C.
3. There is no significant color difference between *Jala Shukti Bhasma* and *Mukta* Shuikti *Bhasma* i.e. white and bright white respectively. *Varitaratwa Bhasma Pariksha* was found positive in both the *Bhasma*.

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हिन्दी सारांश

जल शुक्ति एवं मुक्ता शुक्ति भस्म का औषधीय मानकीकरण

कीर्तिकुमार जी. परमार, गालिब, बी. जे. पटगिरी

शुक्ति सुधावर्ग का एक महत्वपूर्ण द्रव्य है, जिसे रसशास्त्र के क्षेत्र में बहुत समयपश्चात समाविष्ट किया गया । रसशास्त्र के ग्रन्थों में मुक्ता की उत्पत्ति या अनुत्पत्ति के आधार पर शुक्ति के दो प्रकार बताये है, जलशुक्ति और मुक्ताशुक्ति । प्रस्तुत शोधपत्र में जलशुक्ति भस्म और मुक्ताशुक्ति भस्म के लिये प्रमाणित निर्माण प्रक्रिया विकसित करने का प्रयास किया गया है । अतः जलशुक्ति भस्म और मुक्ताशुक्ति भस्म दोनों के पांच–पांच वर्ग बनाये गये हैं और प्रत्येक वर्ग में प्राप्त तथ्यों के आधार पर निर्माणात्मक मानकीकरण को विकसित किया गया है । शोधन, भावना, मारण इत्यादि प्रक्रियाओं के दौरान उष्णतामान, समय, भार वृद्धि या ह्रास का प्रतिशत प्रमाण, मूल्य अवमान इत्यादि बातों को भी ध्यान में रखा गया है । जलशुक्ति शोधन और मुक्ताशुक्ति शोधन में क्रमशः २.४२ %(१२.०८ ग्राम) और २.९२%(१४.६२ ग्राम) भार ह्रास हुआ । द्वितीय पुट के बाद जलशुक्ति भस्म और मुक्ताशुक्ति भस्म में क्रमशः ७.७९%(३८.९४ ग्राम) और ७.०५%(३५.२४ ग्राम) भार ह्रास मिला ।