

**ANALYTICAL STUDY TO EVALUATE THE EFFECT OF DIFFERENT SHODHANA METHODS ON BHALLATAKA****Dr. Milind P. Chatrabhuji^{*1}, Dr. Mita Mashru², Dr. Madhavi Patel³**¹PG Scholar, Dept of RSBK, Parul Institute of Ayurved, Parul University, Vadodara, GJ, India.²Professor, Dept of RSBK, Parul Institute of Ayurved, Parul University, Vadodara, GJ, India.³Associate Professor, Dept of Pharmacognosy, Parul Institute of Pharmacy, Parul University, Vadodara, GJ, India.***Corresponding Author: Dr. Milind P. Chatrabhuji**

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ABSTRACT

Bhallataka (*Semecarpus anacardium* Linn; Anacardiaceae) fruit is one of the upavisha dravya (semi poisonous drugs). It can be used only after shodhana (purification) for pharmaceutical purpose. Bhallataka can be purified with different shodhana methods as per various classical references. Here two classical references are taken viz. Rasamrutam and Rasa Tarangini. The detailed analytical study of Shuddha Bhallataka and different media used for shodhana is recorded. Performing shodhana of bhallataka by these three methods respectively, and by seeing the results of analysis of raw bhallataka and shodhita bhallataka of three different methods; it can be clearly seen that there is difference in the results of these three shodhana methods. The oil content is found in Ishtika churna (brick powder) after the process of shodhana, while solid contents of liquid media increase. That may be because of removal of toxic oily impurities from bhallataka fruits and they may be getting into the media used for shodhana. By comparing the results of analysis of these three methods, it can be said that removal of oil content; which is proportional to decrease of toxicity and increase of efficacy and safety; is seen more in the "Rasamrutam First Shodhana Method" than that of "Rasa Tarangini First and Second Shodhana Methods"

KEY WORDS: Bhallataka, Shodhana, Rasamrutam, Rasa Tarangini.**INTRODUCTION**

The word bhallataka describes the sharp attribute of the herb, in comparison to that of a javelin. It has various synonyms, describing the different properties, like anala – a fire, shophakrita one which causes oedema, krimighna - vermicide, vatari - enemy of vata etc. *Bhallataka* (*Semecarpus anacardium* Linn; Anacardiaceae) fruit is one of the *upavisha dravya* (semi poisonous drugs). Its importance and utility is increasing day by day because of its therapeutic significance in many diseases including cancer. Though the fruits of *Bhallataka* have many therapeutic values, pharmacies are scared to use this drug because of its irritant vesicating nature. The fruit contains tarry oil which causes contact dermatitis. Medically it is named as Urushiol Induced Contact Dermatitis because the chemical Urushiol is responsible for the dermatitis. If this vesicant nature is removed, the drug could be a good source for pharmaceutical industries in manufacturing many formulations containing *Bhallataka* as an ingredient.

Shodhana is the purificatory measure used in *Ayurveda* to purify toxic medicinal plants (*upavisha dravyas*) so that they can be used in medicinal form internally. *Ayurveda* advocates use of *Bhallataka* after *Shodhana*

(Purificatory procedures). There are different *Shodhana* methods mentioned in *Ayurveda*. *Rasamrutam* mentions soaking the fruits in cow's urine, cow's milk and rubbing it in brick powder. *Rasatarangini* mentions is rubbing it in brick powder and boiling in coconut water.

MATERIALS AND METHODS**Materials****1. Bhallataka Fruits**

Matured fruits of *Semecarpus anacardium* Linn., were collected as market samples from five different places, those are, two samples from Vadodara (Gujarat) and one sample from Ahmedabad (Gujarat), Junagadh (Gujarat) and Nasik (Maharashtra) each respectively. The fruits were authenticated and the best sample amongst these five was identified by macroscopic observation; it was the one collected from Nasik (Maharashtra). So, the sufficient quantities (8 kg) of Bhallataka fruits were collected from Nasik (Maharashtra).

2. Shodhana Media

Fresh Gaumutra (cow-urine) was collected from the Ataladara Swaminarayan Gashala early in the morning at around 04:15 AM every day on the days of their use. Fresh Gaududha (cow-milk) was purchased from

Ataladara Swaminarayan Gaushala in the morning at around 07:00 AM every day on the days of their use. Ishtika (dry bricks) were collected from the local area. Narikela (coconut fruits) were purchased in sufficient quantity from Parul University campus on the day of their use.

Methods

1. Bhallataka Fruits

The fruits were cleaned by removing the small fruits and other organic stuff and stored in container. Bhallataka fruits, which sink in water, are considered to be acceptable for medicinal use as per classical reference. So fruits which sunk in water were collected and dried properly. The dried fruits were used for further studies.

- Total weight Bhallataka fruits at first = 8.00 kg
- Total weight after removing small fruits = 6.06 kg
- Total weight of fruits floating in water = 2.16 kg
- Total weight of fruits sunken in water (after drying) = 3.90 kg
- From these 3.90 kg quantity of fruits, 100 gm of fruits were sampled for analytical study as Raw Bhallataka Sample. From remaining 3.80 kg quantity, 9 batches of 250 gm each were made; and three batches were taken for each *shodhana* method respectively.

They are as follows:

- Method 1: Rasamrutam *Shodhana* Method (Three batches of 250 gm each).
- Method 2: Rasa Tarangini First *Shodhana* Method (Three batches of 250 gm each).
- Method 3: Rasa Tarangini Second *Shodhana* Method (Three batches of 250 gm each).
- Remaining 1.55 kg of Bhallataka fruits were stored separately as backup if their use would be needed at anytime throughout this work.

2. Shodhana Media

- Gaumutra (cow-urine) was filtered through a cotton cloth to remove physical impurities. 750 ml of Gaumutra at each was used for batches of 250 gm of Bhallataka fruits.
- Gaudugdha (cow-milk) was not boiled and it was used as it is. 750 ml of Gaudugdha at each was used for batches of 250 gm of Bhallataka fruits.
- Ishtika (dry bricks) were made in to small pieces with the help of metal mortar and pestle. Then they were made into powder form with the help of grinder. The powder was filtered through a cotton cloth to remove any coarse particles of Ishtika and the fine powder obtained was used for this work. 750 gm of fine powder of Ishtika churna at each was used for batches of 250 gm of Bhallataka fruits.
- Narikela udaka (coconut water) was obtained from Narikela (coconut fruit) at the time of their use. 750 ml of Narikela udaka at each was used for batches of 250 gm of Bhallataka fruits before starting of boiling; and 100 ml of Narikela udaka was added

every 20 minutes to each batch during boiling procedure.

Details of Shodhana Methods

1. Rasamrutam Shodhana Method

- 250 g of sunken Bhallataka fruits, in water, were taken in three batches.
- The thalamus portion of the fruits was removed with the help of a sudi (beetle cutter). After removing thalamus, the fruits were cut into four pieces each.
- Then they were taken in plastic vessels containing 750 ml Gaumutra (cow urine) and kept for seven days.
- Every day the fruits were taken out of the media and washed with water, the used media was sampled and taken for analysis; and fresh Gaumutra (cow urine) in 750 ml was added.
- On eighth day Bhallataka was washed and shifted to the vessel containing 750 ml Gaudugdha (cow-milk) and kept for seven days.
- Every day the fruits were taken out of the media and washed with water, the used media was sampled and taken for analysis; and fresh Gaudugdha (cow milk) in 750 ml was added.
- On 15th day the Bhallataka fruits were taken out of the media and washed with water then shifted to a bag containing brick powder and rubbed thoroughly with proper precautions.
- Then it was transferred to plastic container with a total of 750 gm of brick powder and it was allowed for three days in the vessel containing brick powder.
- On 18th day brick powder in the samples was removed physically, sampled and taken for analysis; and the samples of Shodhita Bhallataka were washed with hot water to remove brick powder attached to them.
- Later, the samples were dried properly, sampled and taken for analysis.

2. Rasa Tarangini First Shodhana Method

- 250 g of sunken Bhallataka fruits, in water, were taken in three batches.
- The thalamus portion of the fruits was removed with the help of a sudi (beetle cutter). After removing thalamus, the fruits were cut into four pieces each.
- Then they were cut into four pieces and taken in to a jute bag containing brick powder and rubbed thoroughly with proper precautions.
- Then they are shifted in a plastic jar containing a total of 750 gm of brick powder.
- Every day the plastic jars were shaken / jolted very well.
- It was allowed for seven days in the plastic jar containing brick powder.
- On 8th day brick powder in the samples was removed physically, sampled and taken for analysis; and the samples of Shodhita Bhallataka were washed with hot water to remove brick powder attached to them.

- Later, the samples were dried properly, sampled and taken for analysis.

3. Rasa Tarangini Second *Shodhana* Method

- 250 g of sunken Bhallataka fruits, in water, were taken in three batches.
- The thalamus portion of the fruits was removed with the help of a sudi (beetle cutter). After removing thalamus, the fruits were cut into two pieces each.
- Then they were put in to a cotton cloth and made pottali to be used in Dola Yantra.
- Pottali were tied in the middle of iron rods and put in vertical steel-vessels of 1.25 liters capacity.
- 750 ml of Narikela Udaka (coconut-water) was poured in to the vessel and pottali were made to hang inside the media to make Dola Yantra.
- The Dola Yantra were put on gas-stove and subjected to mild heat for three hours for boiling procedure in Narikela Udaka (coconut-water).
- 100 ml of Narikela Udaka (coconut-water) was added every 20 minutes to each batch so that pottali stays completely inside the media even after the reduced quantity of Narikela Udaka (coconut-water) because of boiling.
- Temperatures of boiling Narikela Udaka (coconut-water) were measured with Infrared beam thermometer every 30 minutes. After three hours of boiling, pottali were removed from Dola Yantra and residual media were sampled after swangasheeta (self-cooling) and taken for analysis.
- The pottali were opened after swangasheeta (self-cooling).
- Later, the samples were dried properly, sampled and taken for analysis.

OBSERVATIONS

Pharmaceutical observations

- All water-sunken fruits of Bhallataka did not sink in Gaumutra on first day. Some of the fruits floated in Gaumutra while some sunk in it. This continues up to 4th day. Fifth day and onwards all Bhallataka sunk in Gaumutra.
- Appearance of Gaumutra changed when it was removed after 24 hours every day. It contained some oily part of Bhallataka each time in each batch.
- Appearance of Gaudugdha changed when it was removed after 24 hours every day. It contained some oily part of Bhallataka each time in each batch.
- Gaudugdha did not remain in its own form after 24 hours of exposure to Bhallataka. Its form changed to semisolid somewhere in between curd and paneer. This happened in each batch on every day.
- Ishtika churna when removed after *shodhana* procedure, its form changed to somewhat oily and blackish in colour in both the methods.
- Narikela udaka when obtained after boiling changed its colour completely and became hazy black in all

three batches. It contained some visible oily part of Bhallataka.

Toxicity observations

- Being an upavisha dravya, Bhallataka has very good efficacy as a medicine; as well as it also has clearly showing toxic effects while in purification stage. In this work, researcher has got toxic effects of Bhallataka at 9th day of *shodhana*; even after taking all the precautions like applying coconut oil to body parts, wearing hand gloves and face mask for protective measures. The observed toxic effects include:
 - i) Starting with a fever with chills at night, this subsided on its own without any medicine; and the other toxic effects started to be shown from the next morning.
 - ii) Itching over whole body, this did not get subside by anti-histamine medicine like chlorpheniramine maleate.
 - iii) Redness on skin with red patches, swollen patches, looking like urticaria or a viral rash. This is observed more on right upper and lower limbs.
 - iv) However burning sensation was not observed at all. Pain is very less; actually it was tenderness which started on 13th day of *shodhana* at right arm along with inflammation. This remained for two days. NSAID like ibuprofen helped a little in this.
 - v) Red patches over face subsided after a one time application of nimba kalka.
 - vi) Red swollen patches over whole body did not subside after two time application of nimba kalka; but they started to subside after five days of daily twice application of lepa made from sarshapa, daruharidra and butter.
 - vii) After 14th day; redness, inflammation and tenderness subsided; itching and dryness of skin in more severity remains for many days. Local application of coconut oil or sesame oil repetitively helps very well in this.

ANALYTICAL STUDY

Table 1: Mean of weight loss (in gm and in percentage).

		Weight loss (gm)	Mean of weight loss (gm)	Weight Loss (%)	Mean of weight loss (%)
Rasamrutam <i>Shodhana</i> Method	Batch 1	51.30	39.93	22.46	17.59
	Batch 2	37.24		16.46	
	Batch 3	31.24		13.84	
Rasa Tarangini 1 st <i>Shodhana</i> Method	Batch 1	35.35	34.31	15.35	15.28
	Batch 2	33.18		14.85	
	Batch 3	34.40		15.65	
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Batch 1	15.70	15.94	6.85	7.03
	Batch 2	15.49		6.98	
	Batch 3	16.64		7.25	

- Weight loss is observed in all the shodhana methods. It may be due to removal of oil content from the Bhallataka and it is seen more first two methods, it may be because of removal of fruits' outer surface, too.

Table 2: Organoleptic parameters.

	Colour	Odour	Touch	Form
Raw Bhallataka	Brownish black	Odourless	Greasy coarse	Very Hard
Rasamrutam <i>Shodhana</i> Method	Dark brown	Odourless	Dry coarse	Minimal hard
Rasa Tarangini 1 st <i>Shodhana</i> Method	Dark brown	Odourless	Dry coarse	Moderately hard
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Blackish	Odourless	Greasy coarse	Minimal hard

- Colour changes from blackish brown to dark brown may be because of processing with Ishtika churna (brick powder). Colour changes from blackish brown to blackish may be because of processing with Narikela udaka (coconut water) and spreading of oil from inside of fruits to the surface of them.
- Odourless Bhallataka gets goumutra Gandhi (smelling of cow urine) while processing in gomutra. But after processing them in Godugdha and Ishtika churna, they become odourless again. No odour changes were found in other two methods.
- Greasy coarse touch of bhallataka remains same after processing with liquid media but changes to dry coarse touch when processed with dry solid media like Ishtika churna (brick powder).
- Very hard form of bhallataka transforms to minimal hard after processing with liquid media but changes to moderately hard form when processed with dry solid media like Ishtika churna (brick powder).

Table 3: Loss on drying at 105°C.

		Loss on drying at 105°C (%w/w)	Mean of loss on drying At 105°C (%w/w)
Raw Bhallataka		6.32	6.32
Rasamrutam <i>Shodhana</i> Method	Batch 1	8.14	8.11
	Batch 2	8.12	
	Batch 3	8.06	
Rasa Tarangini 1 st <i>Shodhana</i> Method	Batch 1	8.57	8.56
	Batch 2	8.24	
	Batch 3	8.86	
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Batch 1	8.32	8.47
	Batch 2	8.61	
	Batch 3	8.49	

- The value of loss on drying changes from that of raw bhallataka's 6.32% w/w to 8.11% w/w, 8.56% w/w and 8.47% w/w respectively for all the three methods. Increase in the loss on drying value may be because of removal of oily content.

Table 4: Oil Content in Bhallataka.

		Oil content (%)	Mean of oil content (%)
Raw Bhallataka		29.42	29.42
Rasamrutam <i>Shodhana</i> Method	Batch 1	17.35	16.57
	Batch 2	16.59	
	Batch 3	15.78	
Rasa Tarangini 1 st <i>Shodhana</i> Method	Batch 1	21.42	21.36
	Batch 2	22.12	
	Batch 3	20.53	
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Batch 1	24.58	22.25
	Batch 2	21.85	
	Batch 3	20.32	

- Oil content is the most useful analytical parameter found in the process of bhallataka shodhana as it is inversely proportional to removal of toxic oil i.e. toxicity and directly proportional to its safety and efficacy. Here in this research, oil content result found in raw bhallataka is 29.42%. and the value get

reduced in all the methods up to 16.57%, 21.36% and 22.25% respectively. It denotes that Rasamrutam Shodhana Method removes significantly more oil content than that of both the methods of rasa Tarangini shodhana methods.

Table 5: Ash value.

		Ash value (%w/w)	Mean of Ash Value (%w/w)
Raw Bhallataka		2.85	2.85
Rasamrutam <i>Shodhana</i> Method	Batch 1	5.97	5.95
	Batch 2	6.03	
	Batch 3	5.84	
Rasa Tarangini 1 st <i>Shodhana</i> Method	Batch 1	17.98	17.37
	Batch 2	17.29	
	Batch 3	16.83	
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Batch 1	11.95	11.38
	Batch 2	11.31	
	Batch 3	10.89	

- Ash value of all the three shodhita bhallataka increases significantly. In raw bhallataka it is found to be 2.85% w/w while in shodhita bhallataka they are found to be 5.95% w/w, 17.37% w/w and

11.38% w/w respectively. It is the highest in rasa Tarangini first shodhana method, it may be because that method does not contain any type of liquid media.

Table 6: Acid Insoluble Ash.

		Acid Insoluble Ash	Mean of Acid Insoluble Ash
Raw Bhallataka		0	0
Rasamrutam <i>Shodhana</i> Method	Batch 1	3.35	3.36
	Batch 2	3.27	
	Batch 3	3.45	
Rasa Tarangini 1 st <i>Shodhana</i> Method	Batch 1	14.39	14.09
	Batch 2	14.02	
	Batch 3	13.87	
Rasa Tarangini 2 nd <i>Shodhana</i> Method	Batch 1	0.21	0.27
	Batch 2	0.29	
	Batch 3	0.32	

- There is no acid insoluble ash in raw bhallataka while it is found in the results that the acid insoluble ash values of the shodhita bhallataka are 3.36, 14.09

and 0.27. These values may be dependant as per the media used and highest in only Ishtika churna (brick powder) used method.

Table 7: Water Soluble Extractive (% w/w).

		Water Soluble Extractive (%w/w)	Mean of Water Soluble Extractive (%w/w)
Raw Bhallataka		8.87	8.87
Rasamrutam Shodhana Method	Batch 1	4.35	4.89
	Batch 2	4.97	
	Batch 3	5.34	
Rasa Tarangini 1 st Shodhana Method	Batch 1	10.57	10.15
	Batch 2	10.02	
	Batch 3	9.85	
Rasa Tarangini 2 nd Shodhana Method	Batch 1	7.38	7.79
	Batch 2	7.95	
	Batch 3	8.04	

- The water soluble extractive value of raw bhallataka that is 8.87% w/w; decreases in first and third method of shodhana up to 4.89% w/w and 7.79% w/w respectively while it increases up to 10.15% w/w in second shodhana method. It is the highest in rasa Tarangini first shodhana method, it may be because that method does not contain any type of liquid media.

Table 8: Methanol Soluble Extractive (% w/w).

		Methanol Soluble Extractive (%w/w)	Mean of Methanol Soluble Extractive (%w/w)
Raw Bhallataka		28.89	28.89
Rasamrutam Shodhana Method	Batch 1	22.45	22.44
	Batch 2	22.89	
	Batch 3	21.98	
Rasa Tarangini 1 st Shodhana Method	Batch 1	10.25	10.92
	Batch 2	11.98	
	Batch 3	10.54	
Rasa Tarangini 2 nd Shodhana Method	Batch 1	32.65	33.36
	Batch 2	33.48	
	Batch 3	33.94	

- The values of methanol soluble extractive decrease in first two methods while increases in third shodhana method. The cause behind this change can be further researched.

Table 9: pH of aqueous extractive.

		pH of aqueous Extractive	Mean of pH of aqueous Extractive
Raw Bhallataka		5.89	5.89
Rasamrutam Shodhana Method	Batch 1	7.45	7.31
	Batch 2	7.12	
	Batch 3	7.37	
Rasa Tarangini 1 st Shodhana Method	Batch 1	5.09	5.46
	Batch 2	5.48	
	Batch 3	5.81	
Rasa Tarangini 2 nd Shodhana Method	Batch 1	4.69	4.80
	Batch 2	4.74	
	Batch 3	4.98	

- pH of water soluble extractive of bhallataka increase in first shodhana while decreases in two other shodhana methods. The cause behind this change can be further researched.

ANALYSIS OF MEDIA

Table 10: pH of Gaumutra (cow-urine).

		pH	Mean of pH
Blank Sample		7.48	7.48
Day 1	Batch 1	7.05	7.04
	Batch 2	7.09	
	Batch 3	6.98	
Day 2	Batch 1	7.02	6.95
	Batch 2	6.99	
	Batch 3	6.85	
Day 3	Batch 1	7.05	6.95
	Batch 2	6.97	
	Batch 3	6.82	
Day 4	Batch 1	6.98	6.87
	Batch 2	6.84	
	Batch 3	6.80	
Day 5	Batch 1	7.02	6.98
	Batch 2	6.98	
	Batch 3	6.95	
Day 6	Batch 1	7.08	7.03
	Batch 2	7.02	
	Batch 3	6.99	
Day 7	Batch 1	7.12	7.09
	Batch 2	7.05	
	Batch 3	7.10	

Table 11: pH of Gaudugdha (cow-milk).

		pH	Mean of pH
Blank Sample		6.65	6.65
Day 1	Batch 1	5.43	5.39
	Batch 2	5.35	
	Batch 3	5.39	
Day 2	Batch 1	5.28	5.28
	Batch 2	5.34	
	Batch 3	5.21	
Day 3	Batch 1	5.12	5.08
	Batch 2	5.02	
	Batch 3	5.09	
Day 4	Batch 1	4.78	4.87
	Batch 2	4.89	
	Batch 3	4.95	
Day 5	Batch 1	5.24	5.30
	Batch 2	5.39	
	Batch 3	5.27	
Day 6	Batch 1	5.14	5.38
	Batch 2	5.65	
	Batch 3	5.35	
Day 7	Batch 1	5.12	5.12
	Batch 2	5.14	
	Batch 3	5.09	

Table 12: pH of Narikela Udaka (coconut-water).

	pH	Mean of pH
Blank Sample	5.71	5.71
Batch 1	4.78	5.00
Batch 2	5.34	
Batch 3	4.89	

- pH value of used shodhana media are recorded on daily basis for Gaumutra and Gaudugdha. They show decrease of pH in each of the samples. It may be because of removal of oil content containing anacardic acid from bhallataka fruits and getting into the media used for shodhana.

Table 13: Oil Content in Ishtika Churna.

		Oil content (%)	Mean of oil content (%)
Unused Ishtika Churna		0	0
Ishtika Churna of Rasamrutam Shodhana Method	Batch 1	3.25	3.17
	Batch 2	2.48	
	Batch 3	3.78	
Ishtika Churna of Rasa Tarangini 1 st Shodhana Method	Batch 1	5.22	4.98
	Batch 2	5.29	
	Batch 3	4.42	

- Oil content in unused brick powder is zero while it shows oil contents in results of analysis of each batch of every shodhana method that uses Ishtika churna (brick powder). This clearly says that oil content removed from bhallataka fruits comes to the media used for shodhana procedure.

Table 14: Specific Gravity at 20°C of Gaumutra (cow-urine).

Gaumutra (cow-urine)		Specific Gravity	Mean of Specific Gravity
Blank Sample		1.028	1.028
Day 1	Batch 1	1.052	1.053
	Batch 2	1.053	
	Batch 3	1.055	
Day 2	Batch 1	1.039	1.039
	Batch 2	1.037	
	Batch 3	1.041	
Day 3	Batch 1	1.036	1.036
	Batch 2	1.035	
	Batch 3	1.038	
Day 4	Batch 1	1.051	1.047
	Batch 2	1.042	
	Batch 3	1.049	
Day 5	Batch 1	1.036	1.037
	Batch 2	1.038	
	Batch 3	1.037	
Day 6	Batch 1	1.042	1.042
	Batch 2	1.046	
	Batch 3	1.038	
Day 7	Batch 1	1.039	1.037
	Batch 2	1.041	
	Batch 3	1.032	

Table 15: Specific Gravity at 20°C of Gaudugdha (cow-milk).

Gaudugdha (cow-milk)		Specific Gravity	Mean of Specific Gravity
Blank Sample		1.029	1.029
Day 1	Batch 1	1.047	1.047
	Batch 2	1.046	
	Batch 3	1.047	
Day 2	Batch 1	1.046	1.046
	Batch 2	1.046	
	Batch 3	1.047	
Day 3	Batch 1	1.045	1.046
	Batch 2	1.045	
	Batch 3	1.047	
Day 4	Batch 1	1.043	1.045
	Batch 2	1.046	
	Batch 3	1.045	
Day 5	Batch 1	1.045	1.045
	Batch 2	1.047	
	Batch 3	1.044	
Day 6	Batch 1	1.045	1.046
	Batch 2	1.044	
	Batch 3	1.048	
Day 7	Batch 1	1.047	1.046
	Batch 2	1.048	
	Batch 3	1.044	

Table 16: Specific Gravity at 20°C of Narikela Udaka (coconut-water).

Narikela Udaka (coconut-water)	Specific Gravity	Mean of Specific Gravity
Blank Sample	1.020	1.020
Batch 1	1.049	1.046
Batch 2	1.047	
Batch 3	1.043	

- Specific gravity of the media used for shodhana increases in each batch of every shodhana method. It indicates about increase in the contents that are heavier than the media itself gets in to media from the bhallataka. Details about them can be further researched.

Table 17: Total Solid Contents (%w/w) of Gaumutra (cow-urine).

Gaumutra (cow-urine)		Total solid contents (%w/w)	Mean of total solid contents (%w/w)
Blank Sample		4.990	4.990
Day 1	Batch 1	10.246	10.513
	Batch 2	10.351	
	Batch 3	10.942	
Day 2	Batch 1	9.614	9.641
	Batch 2	9.964	
	Batch 3	9.346	
Day 3	Batch 1	8.656	8.745
	Batch 2	8.616	
	Batch 3	8.962	
Day 4	Batch 1	7.629	7.487
	Batch 2	7.316	
	Batch 3	7.516	
Day 5	Batch 1	6.649	6.744
	Batch 2	6.621	
	Batch 3	6.962	

Day 6	Batch 1	5.635	5.374
	Batch 2	5.135	
	Batch 3	5.351	
Day 7	Batch 1	5.125	5.483
	Batch 2	5.632	
	Batch 3	5.691	

Table 18: Total Solid Contents (%w/w) of Gaudugdha (cow-milk).

Gaudugdha (cow-milk)		Total solid contents (%w/w)	Mean of Total solid contents (%w/w)
Blank Sample		13.73	13.73
Day 1	Batch 1	25.41	24.73
	Batch 2	23.65	
	Batch 3	25.14	
Day 2	Batch 1	23.45	24.22
	Batch 2	24.26	
	Batch 3	24.95	
Day 3	Batch 1	22.64	24.63
	Batch 2	26.62	
	Batch 3	24.62	
Day 4	Batch 1	23.26	25.48
	Batch 2	27.56	
	Batch 3	25.62	
Day 5	Batch 1	23.45	24.65
	Batch 2	26.24	
	Batch 3	24.25	
Day 6	Batch 1	24.69	24.32
	Batch 2	25.61	
	Batch 3	22.65	
Day 7	Batch 1	22.98	24.72
	Batch 2	26.23	
	Batch 3	24.96	

Table 19: Total Solid Contents (%w/w) of Narikela Udaka (coconut-water).

Narikela Udaka (coconut-water)	Total solid contents (%w/w)	Mean of Total solid contents (%w/w)
Blank Sample	4.5	4.5
Batch 1	10.12	10.14
Batch 2	9.85	
Batch 3	10.45	

Total solid contents of media used for shodhana increases in each batch of every shodhana method. It indicates about increase in the solid contents in the liquid media from the bhallataka. Details about them can be further researched.

DISCUSSION

Three batches of bhallataka were processed by the shodhana method mentioned in Rasamrutam and Rasa Tarangini. Weight loss was observed in all the samples. This loss may be due to the reduction of the oil content in the fruits. The media Gaumutra (cow-urine) is reported for its antimicrobial, antibacterial etc. Gaudugdha (cow-milk) is recommended as one of the antidote for bhallataka blisters. Ishtika Churna (brick powder) is having adsorbent property; by which it

absorbs irritant oil in the fruit. The methanol soluble extractive was 28.89% w/w in raw Bhallataka and 22.44% w/w, 10.92% w/w, and 33.36% w/w; in shodhita Bhallataka of three shodhana methods respectively. There is difference between raw and shodhita Bhallataka. It reveals that after shodhana the methanol soluble extractives are reducing. The ash value of processed nut was more when compared to raw. Ash value of raw Bhallataka was 2.85% w/w and in shodhita Bhallataka they were 5.95% w/w, 17.37% and 11.38% w/w respectively. The increase in ash value may be due to the residue of the brick powder and/or solid contents of Narikela udaka (coconut water). The ash value represents the inorganic salts present in the drug. Extracts obtained by exhausting crude drugs are indicative of approximate measures of certain chemical compounds they contain

the diversity in chemical nature and properties of the drug. More percentage of oil got reduced by soaking the fruits in the Rasamrutam Shodhana method. The brick powder is having the adsorbing nature, so some percentage of oil may be absorbed by the brick powder. Its value is seen by the result of analysis of oil content in processed brick powder of first two methods. While boiling with coconut water, it was clearly seen than oil from the fruits was being removed by boiling and started floating on the surface of coconut water. There are probable chances that some chemical changes might have taken place due to the various media like gomutra, Godugdha, Ishtika churna and Narikela udaka etc used for its purification. Total solid contents increased in all the methods as per the reports.

CONCLUSION

Bhallataka has been used since a long time of history for medicinal purpose. It is used only after its shodhana is done. There are many methods of shodhana of bhallataka available in classics, traditional methods and modern science methods. Classical methods of bhallataka shodhana consist of mainly of two references viz Rasamrutam and Rasa Tarangini. The media used for shodhana and procedure of shodhana are different in Rasamrutam Shodhana method and both shodhana methods of Rasa Tarangini. Performing shodhana of bhallataka by these three methods respectively, and by seeing the results of analysis of raw bhallataka and shodhita bhallataka of three different methods; it can be clearly seen that there is difference in the results of these three shodhana methods. Thus, alternate hypothesis H1 is accepted and null hypothesis H0 is rejected. More overly, there is significantly difference in the results of analysis of media used for shodhana, before and after. It clearly indicates that some chemical changes might have happened during the shodhana processes of bhallataka. The oil content is found in Ishtika churna (brick powder) after the process of shodhana, while solid contents of liquid media increase. That may be because of removal of toxic oily impurities from bhallataka fruits and they may be getting into the media used for shodhana. By comparing the results of analysis of these three methods, it can be concluded that removal of oil content; which is proportional to decrease of toxicity and increase of efficacy and safety; is seen more in the "Rasamrutam First Shodhana Method" than that of "Rasa Tarangini First and Second Shodhana Methods" So, it can be better to use Rasamrutam Shodhana Method for Bhallataka Shodhana; which consists of more steps and complex processes. Further studies can be conducted to evaluate the clinical efficacy and safety for the use of shodhita bhallataka, done shodhana by different shodhana methods.

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