ORIGINAL ARTICLE

Effect of *Kala-Prakarsha* (curing) on *Semecarpus anacardium* Linn. fruits

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Abstract

Introduction: Ayurveda advocates certain procedures like *Kala-Prakarsha* (curing) for certain drugs before their administration. *Bhallataka* (*Semecarpus anacardium* Linn.) is one such drug, which is to be processed through curing procedure. Although this is an important procedure, preliminary pharmacognostical differences before and after curing procedure of *Bhallataka* fruits is not available. **Objectives:** Considering this, it is planned to evaluate preliminary pharmacognostical and physicochemical changes that take place in *Bhallataka* fruit before and after curing. **Materials and Methods:** Fresh *Bhallataka* fruits were collected and grouped into two. The first batch was analyzed in fresh state, while the second batch was processed for curing. **Results:** The result showed a reduction in oil globules, decreased the number of papillae and shrunken lysigenous cavities in cured *Bhallataka* as compared to fresh one. Physicochemical parameters showed that ash value of fresh *Bhallataka* is 2.57% w/w as compared to cured one, i.e., 3.055% w/w. **Conclusion:** It can be claimed that curing brings certain changes in the raw material like that of *Bhallataka.*

Key words: *Bhallataka*, curing, *Kala-Prakarsha*, pharmacognosy, *Semecarpus anacardium*

INTRODUCTION

Bhallataka (*Semecarpus anacardium* Linn.) is the common tree found throughout the country, especially in *Himalayas* and hotter parts of Indian dry and moist deciduous forests.[1] The fruit is useful in treating many diseases and its utility is well documented in Ayurvedic texts. Therapeutically useful part of *Bhallataka* is its fruit and oil extracted from it. However, the oil is an irritant and causes blisters and inflammation on direct contact. Contact with its vapors also may manifest blisters in sensitive individuals. Classics have emphasized on *Kala-Prakarsha* (curing),[2] i.e. storage of fruits in heap of *Hordeum vulgare* Linn. for 4 months.[3] However, no published reports are available on the effect of curing on quality or efficacy of *Bhallataka* fruits. Considering this, it was planned to evaluate the preliminary pharmacognostical and physicochemical changes that take place while curing of *Bhallataka* fruits.

MATERIALS AND METHODS

Collection and Selection of Drugs

About 20 kg of fresh *Bhallataka* fruits were collected from Jalna (19.83° N 75.88° E) Maharashtra, India during *Shucho-Shukre* (April-May), 2013.[3] Moreover, these fruits were grouped into two. The first batch was used in fresh state, while the second batch was used after the process of curing. Examination for *Aprashasta* (unacceptable) and *Prashasta* (acceptable) fruits was done as per the methods explained in the classics.[3,4] All the fruits were immersed in potable

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water stand still in a glass jar. The fruits that settled down were collected carefully and further used in the study. While the floated fruits were discarded as they are unacceptable[4] [Figure 1 and Table 1]. The individual weights of *Prashasta* and *Aprashasta Bhallataka* fruits also taken [Table 2]. The acceptable fruit in fresh state was denoted as fresh *Prashasta Bhallataka* (FPB) group, subjected for Microscopic evaluation.

Figure 1: Examination for selection of fruits. (a) Unripe fruits of *Bhallataka,* (b) fresh plucked fruits of *Bhallataka,* (c) *Prashasta* (acceptable) - *Aprashasta* (unacceptable) examination of fruits, (d) shade drying of fruits, (e) *Prashasta* (acceptable) difference between true and false fruit, (f) *Aprashasta* (unacceptable)

Processing Stages of Curing Experiment

Fresh-*Bhallataka* fruits were subjected for the curing procedure. They were kept in *Yavarashi* (heap of barley fruits) in an aluminum container of 50 cm length, 35.5 cm breadth, and 55 cm width. Around 4.5 cm inside from the walls of the box, another cabin was prepared by placing thermocol sheets for the maintenance of uniform temperature. The bottom of the container was filled with barley fruits of 4.5 cm thickness followed by alternative layers of *Bhallataka* and barley fruits. Uppermost layer was made with barley and the container was covered with lid and kept aside undisturbed for 4 months. The entire experiment was carried out in between May 30, 2013 and September 30, 2013. At that time, the environmental temperature was about 40°C, whereas inside the box it was 35°C. The layers were carefully collected at the end of the period [Figure 2]. The acceptable fruits after curing process were denoted as cured *Prashasta Bhallataka* (CPB) group, subjected for microscopic evaluation.

Methods

Macroscopical evolution/organoleptic characters

Organoleptic characters such as size, shape, color, and odor of both the fresh and cured *Bhallataka* were recorded.[5,6] Sensory characters such as *Shabda* (sound), *Sparsha* (touch), *Rupa* (appearance), and *Gandha* (smell) were also observed and recorded.

Table 1: The results obtained after examination of *Prashasta-Aprashasta Pariksha* (Acceptable unacceptable examination)

Bhallataka Batch no.	Sample (g)	Acceptable (g)	Unacceptable (g)	Physical-impurity (%)
Fresh *Bhallataka* batch				
Batch 1	2000.00	1601.00	391.00	0.40
Batch 2	2000.00	1553.00	430.00	0.85
Batch 3	2000.00	1615.00	360.00	1.25
Batch 4	2000.00	1526.00	468.00	0.30
Average	2000.00	1573.75 (78.68%)	412.25 (20.61%)	0.70
Cured *Bhallataka* batch				
Batch 1	2062.00	1602.40	456.60	0.145
Batch 2	2060.00	1606.20	453.60	0.01
Batch 3	2063.00	1626.40	436.00	0.03
Batch 4	2062.00	1657.60	403.20	0.58
Average	2061.75	1623.15 (78.72%)	437.35 (21.21%)	0.191

Table 2: Individual weight of fresh and cured *Bhallataka* fruits

Serial number	Fresh *Bhallataka* (g)		Cured *Bhallataka* (g)	
	Acceptable (*Prashasta*)	Unacceptable (*Aprashasta*)	Acceptable (*Prashasta*)	Unacceptable (*Aprashasta*)
1	3.463	2.364	2.715	1.870
2	2.064	2.983	2.444	2.553
3	3.418	2.217	2.351	2.524
4	2.693	2.442	3.147	2.491
5	2.411	1.965	2.230	2.224
6	2.382	2.165	2.635	1.996
7	1.858	2.364	2.379	2.567
8	2.426	2.129	2.666	1.826
9	2.107	1.889	2.442	2.122
10	2.562	2.170	2.717	2.288
Average	2.5384	2.2688	2.5726	2.2461

Figure 2: Curing experiment. (a) Aluminum box covered inside with wrapped thermocol, (b) box with another cabin prepared from plane thermocol sheets, (c) fresh *Bhallataka* batch before curing, (d) *Bhallataka* filled in-between Barley fruits, (e) completion of the process of preservation, (f) closed box for 4 months

Microscopic evaluation

Transverse sections (T.S.) of FPB and CPB groups of *Bhallataka* fruits were prepared for microscopic examination. First observed in distilled water and then with stain made up of phloroglucinol and concentrated HCl solution. Comparison between the *Bhallataka* fruits was studied by taking T.S. and powder microscopical characters under different magnifying lenses. Microphotographs were taken using the Carl-Zeiss trianacular microscope.[5,7]

Powder microscopy

Both fresh and cured *Bhallataka* fruits were scrapped up to cotyledon. The obtained powder was mounted first in distilled water and then in stain. Characters were recorded, and microphotographs were taken.[7,8]

Physicochemical evaluation

In physicochemical evaluation both the groups were used to assess the moisture content, ash values, total ash content, acid insoluble ash and extractive values; alcohol soluble extractive value, water soluble extractive value and hexane soluble extractive values were determined. The percentage w/w values were calculated with reference to air dried drug.[6,8]

Phytochemical evaluation

Water, methanol, and hexane soluble extractive values were used for preliminary phytochemical screening with a set of various chemical tests as per standard method.

OBSERVATIONS AND RESULTS

Morphology of Fruit

Fruits are laterally flattened - obliquely ovoid smooth 2.5-3.0 cm long, resinous, drupe nut, green when young, black when ripe, seated on a fleshy,1.5-2.0 cm long and broad, yellow-orange, and sweet astringent receptacle [Figure 3].

Figure 3: Macroscopy of *Bhallataka* fruits. (a) *Bhallataka* plant with fruits, (b) unripe fruits, (c) matured ripe fruit with fleshy acrescent cupular hypocarp, (d) difference between true and false fruit, (e) longitudinal measurement of fruit, (f) horizontal measurement of fruit

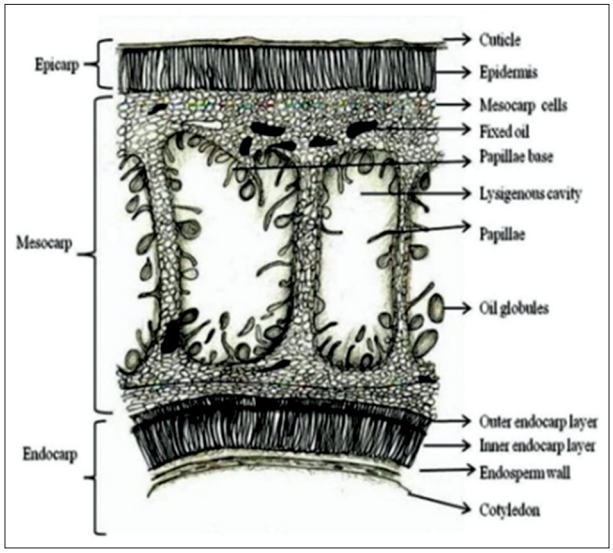

Figure 4: Transverse section of fruit

Organoleptic Characters

Organoleptic characters such as color and odor of fresh (*Prashasta* and *Aprashasta*) and cured (*Prashasta* and *Aprashasta*) *Bhallataka* fruits were recorded and depicted in Table 3.

Table 3: Organoleptic characters of acceptable and unacceptable fruits of *Bhallataka*

Senses	Acceptable fruits	Unacceptable fruits
Shabda (sound)	Fruits appear heavy	Fruits appear light
Sparsha (touch)	Soft and shiny (lustrous)	Rough and wrinkled
Rupa (appearance)	Oval shaped	Flattened
Rasa (taste)	NA	NA
Gandha (smell)	Smell of Barley fruits in cured fruits	Faintly smell

NA: Not available

T.S. of Fresh *Bhallataka*

The fruit is divided into three layers, i.e., epicarp, mesocarp, and endocarp[9] [Figure 4].

Epicarp

Epicarp shows epidermis consisting of a single layer of elongated cells arranged radially. Epidermis is covered above with a thin layer of cuticle.

Mesocarp

Epicarp is followed by mesocarp, consisting of a big zone of parenchymatous cells arranged in numerous layers approximately 40-50 layers. Just below the epidermal cells, few layers of big parenchymatous cells, and few layers of parenchymatous cells below are smaller in size. These are then differentiated into big cavities called lysogenous cavities. The lysogenous cavities are seen with a number of papillae and oil globules.

Endocarp

Endocarp is differentiated into two layers. The outer layer is small and the inner layer is big. Both layers have similar cells. The innermost endocarp layer is formed by elongated cells arranged radially in thick manner. Below this, cotyledons are seen with proteins and fixed oil.

T.S. of Cured *Bhallataka* Fruits

Epicarp

There is no change seen in epicarp of cured *Bhallataka.*

Mesocarp

The lysigenous cavities of cured *Bhallataka* were shrunken with less number of papillae and oil globules. Most of the

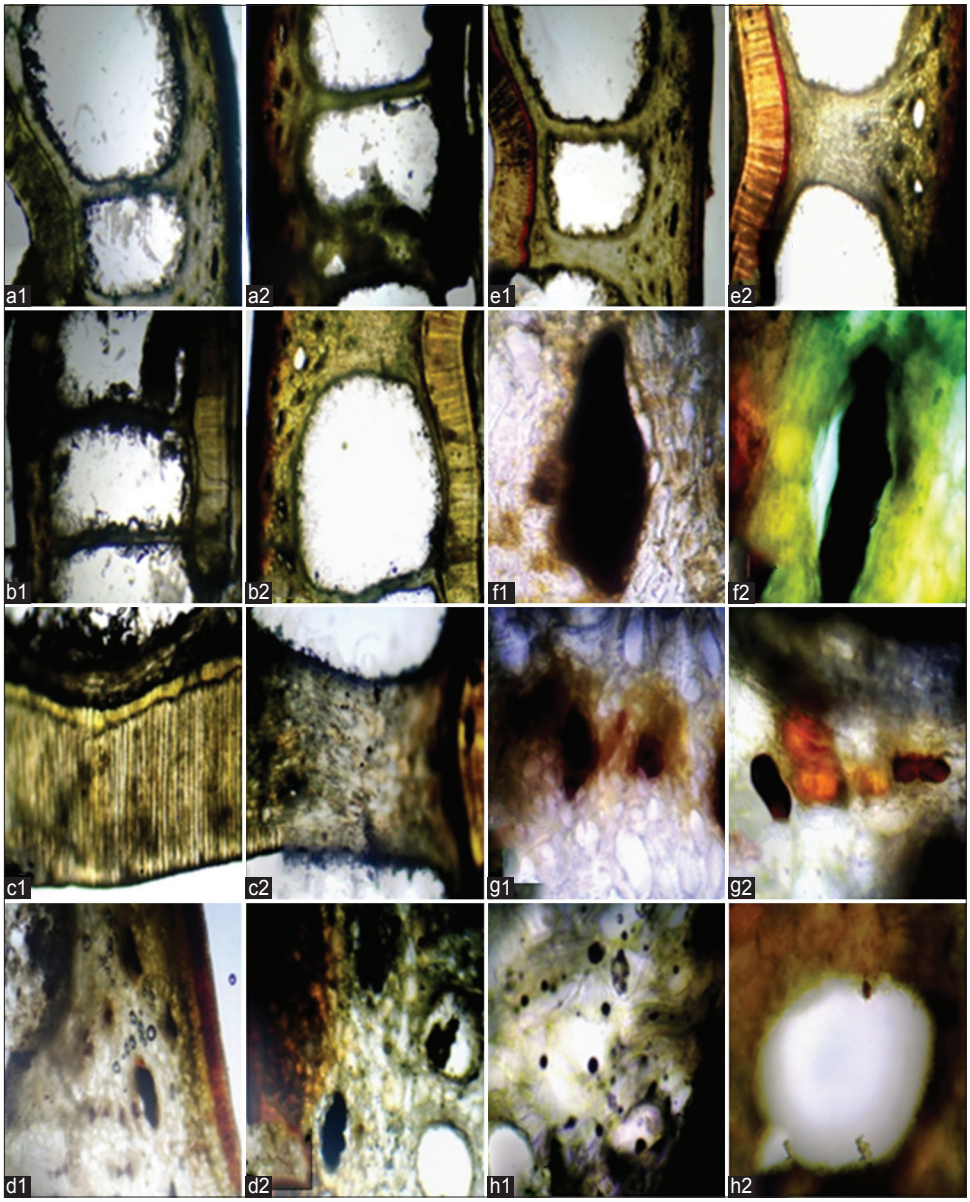

Figure 5: Transverse section of fresh and cured *Bhallataka*. (a1) Epicarp, mesocarp with endocarp of fresh *Bhallataka* fruit, (a2) epicarp, mesocarp with endocarp of cured *Bhallataka* fruit, (b1) mesocarp with papillae and large quantity of oil of fresh fruit, (b2) mesocarp with less quantity of papillae, (c1) papillae with oil globules in fresh *Bhallataka* fruit, (c2) papillae with oil globules in cured *Bhallataka* fruit, (d1) epidermis mesocarp with oil filled lysogenous cavities, (d2) epidermis, mesocarp with partially filled or empty lysogenous cavity, (e1) Cuticle epidermis mesocarp with fully filled lysogenous cavity of fresh *Bhallataka* fruit, (e2) Cuticle epidermis mesocarp with empty or partially filled lysogenous cavity of cured *Bhallataka fruit,* (f1) Lysogenous cavity fully filled with fixed oil in fresh *Bhallataka* fruit, (f2) Lysogenous cavity shrunken with air space in cured *Bhallataka* fruit, (g1) Vascular bundles in fresh *Bhallataka* fruit (g2) Isolated fixed oil content in cured *Bhallataka* fruit, (h1) Starch grain – stained in fresh *Bhallataka* fruit, (h2) Lysogenous empty cavity in cured *Bhallataka*

cavities were ruptured and the fixed oil became clumped, reduced and spread out to the other regions as compared to fresh fruits.

Endocarp

Endocarp appears same except that in cotyledons reduction of fixed oil was seen [Figure 5].

Powder Microscopic Characters

Fresh Bhallataka

The characters were like mesocarp with fixed oil with tannin content, epidermal cells with a large amount of fixed oil with tannin content, fragment of endosperm with cotyledon, large quantity of fixed oil, papillae with fixed oil, and

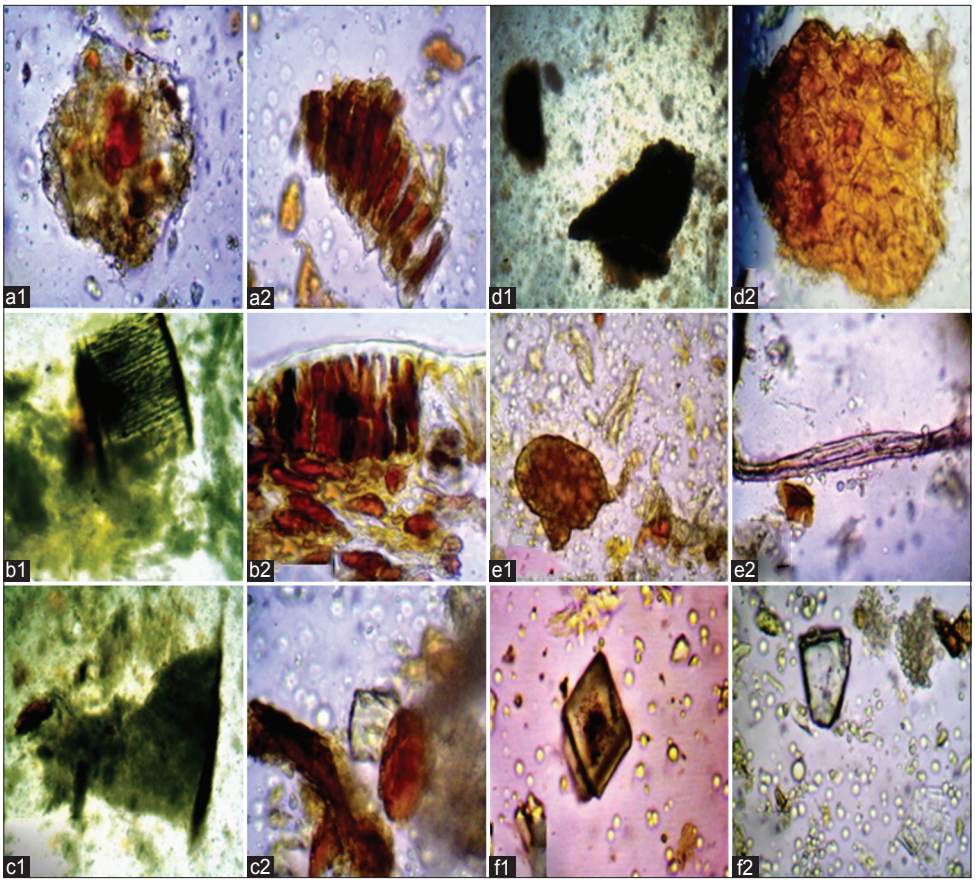

Figure 6: Powder microscopy of fresh and cured *Bhallataka* fruits (a1) mesocarp with fixed oil with tannin in fresh fruit. (a2) Epidermal cells fixed oil with tannin content in cured fruit. (b1) Epidermis cells with large amount of fixed oil with tannin content in fresh fruit. (b2) Epidermal cells with isolated fixed oil with tannin content in cured fruit. (c1) Fragments of endosperm with cotyledon in fresh fruit (c2) prismatic crystal in cured fruit, (d1) Fixed oil in large quantity in fresh fruit. (d2) Mesocarp cells in cured fruit. (e1) Papillaes with fixed oil in fresh fruit. (e2) Calcium oxalate crystals in cured fruit. (f1) Calcium oxalate crystals in fresh fruit. (f2) Simple fibers in cured fruit.

Table 4: Physicochemical parameters of fresh and cured *Bhallataka* fruits in both the acceptable and unacceptable forms

Sample	Loss on drying 110°C	Ash value (% w/w)	Water soluble extractive (% w/w)	Methanol soluble extractive (% w/w)	Hexane soluble extractive (% w/w)
FPB	8.066	2.574	7.92	32.72	32.24
FAPB	8.448	1.878	8.00	28.16	31.28
CPB	6.653	3.055	8.32	38.16	37.36
CAPB	8.126	1.751	7.68	38.48	41.20

FPB: Fresh *Prashasta Bhallataka*, FAPB: Fresh *Aprashasta Bhallataka*, CPB: Cured *Prashasta Bhallataka*, CAPB: Cured *Aprashasta Bhallataka*

calcium oxalate crystals was observed in powder microscopy [Figure 6].

Cured Bhallataka

The characters present in mesocarp layers such as stone cells, crystals, aleurone grains, papillae, oil globule, and fixed oil were observed in powder microscopy. Characters like fixed oil with tannin content, epidermal cells with a large amount of fixed oil with tannin content and fragments of endosperm with cotyledon were present in fresh *Bhallataka* powder microscopy while epidermal cells fixed oil with tannin content, isolated fixed oil and prismatic crystals were observed in cured *Bhallataka* fruits [Figure 6].

Papillae's with fixed oil and calcium oxalate crystals were observed in fresh *Bhallataka,* whereas mesocarp cells, calcium oxalate crystals and simple fibers were observed in cured one.

Physicochemical parameters

The results of physicochemical analysis, qualitative tests of fresh and cured *Bhallataka* fruits is mentioned in Tables 4 and 5.

Table 5: Qualitative tests of fresh and cured acceptable fruits

Parameters	Aqueous extract	Methanolic extract
Tannins		
FPB	+	+
CPB	+	+
Steroids		
FPB	–	+
CPB	–	+
Phenolic compounds		
FPB	+	–
CPB	+	–
Flavonoids		
FPB	+	–
CPB	+	–
Amines		
FPB	+	–
CPB	+	–

–: Absence, +: Presence, FPB: Fresh *Prashasta Bhallataka*, CPB: Cured *Prashasta Bhallataka*

Table: 6 Weight of *Bhallataka* before and after curing

Sample batch	Before curing (g)	After curing (g)
Batch 1	2024	2062
Batch 2	2024	2060
Batch 3	2025	2063
Batch 4	2024	2062
Average	2024.3	2061.7

DISCUSSION

Samskara is preferred to improve, enhance, modify and weaken undesired qualities in a drug so that required qualitative alteration occurs. *Kala-Prakarsha* (curing) is one such important *Samskara* that plays a major role in propagating desired qualities in substances. During the time of curing, certain alterations in the drug take place that is possibly responsible for its potency. About 4 months duration is specified for curing the fruits of *Bhallataka*.

In fresh *Bhallataka*, big lysigenous cavities were seen, whereas in cured fruits, they were shrunken and also number of papillae and oil globules was found reduced. It may be due to the compactness of region or environment, where *Bhallataka* fruits were placed. At the end of the process, the temperature was around 34°C. Maintenance of thermoregulation occurs due to this procedure in a natural way because it has been observed that if *Bhallataka* fruits are stagnating simply it takes the insects and wood worm, particularly in that 4 month rainy season where humidity too much increased.

T.S. of cured *Bhallataka* shows cells filled with oil globules in fresh *Bhallataka,* whereas not much or emptied cells in cured one. More papillae were seen in fresh one as compared to cured one. In epidermis mesocarp with lysogenous cavities were extensively filled with fixed oil in fresh one where as shrunken cells, reduction of oil or empty cells were seen in cured one. Oil is the major content of *Bhallataka,* which is reported to be reduced after classical *Shodhana* process.[10] However, curing maintains the quantity of *Bhallataka* oil. Weight of cured *Bhallataka* fruits was also increased during the curing period mentioned in Table 6. Weight of *Prashasta Bhallataka* (acceptable) has been found more about 2.5 g, whereas *Aprashasta Bhallataka* (unacceptable) has been found 2.2 g on average.

Water soluble extract is less than methanol soluble and hexane soluble extractive values. It is because oil present in *Bhallataka* is insoluble in water, whereas soluble in methanol and hexane so while preparing the sample oil dissolves with these two solvents and when this sample evaporates, leftover oil leads to more values in comparison to water.

The preliminary phytochemical analysis shows the presence of different functional groups such as steroids, phenolic compounds, flavonoids, and tannins in both the samples.

CONCLUSION

Cured *Bhallataka* (CPB) fruits showed reduced amount of oil globules, papillae and shrunken lysogenous cavities as compared to fresh one (FPB). The reduced oil globules infer reduced proportion of urushiol, the substance responsible for adverse reactions, further making clear that the possibilities of adverse events are less with treated fruits. It can be said that curing alters the properties of *Bhallataka* as compared to fresh one and makes the fruit suitable for safe use. As this is a preliminary study, the nature, quantification of different functional groups altering after the process of curing was not attempted, that may be analyzed in further studies. Suitable pharmacological and clinical studies also may be initiated to evaluate the actual therapeutic efficacy of cured and raw samples.

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