Preservation Techniques for Coconut Haustorium

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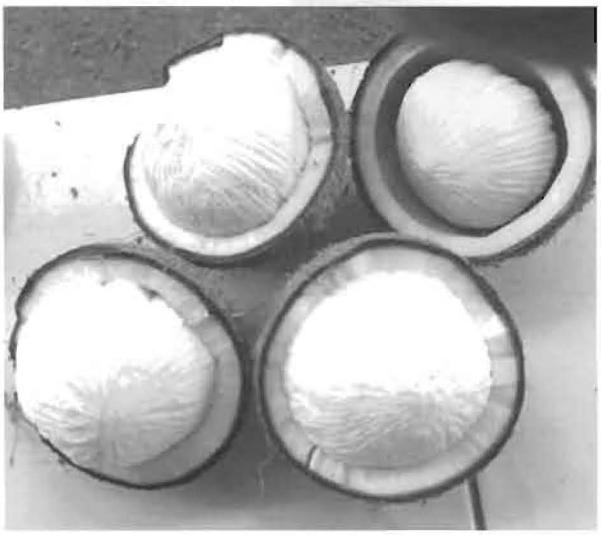
In Botany and Mycology, a haustorium is a structure that grows into or around another structure to absorb water or nutrients. Anatomically, coconut is composed of four distinct parts; the outer fibrous exocarp or husk, the highly lignified endocarp or shell, the white solid endosperm or kernel, and a large central cavity filled with liquid endosperm i.e coconut water. On germination the basal part of embryo, which is embedded in solid endosperm near the germinating pore of coconut, enlarges to form a cotyledonary structure called haustorium. Haustorium enlarges and fills the entire water cavity in 20-24 weeks after germination. During this period it mobilizes nutrients in endosperm and nourishes germinating embryo. Coconut kernel, water and haustorium are edible parts of coconut. Analysis of coconut haustorium revealed that it contains proteins, minerals, alkaloids, polyphenols and growth promoting substances.

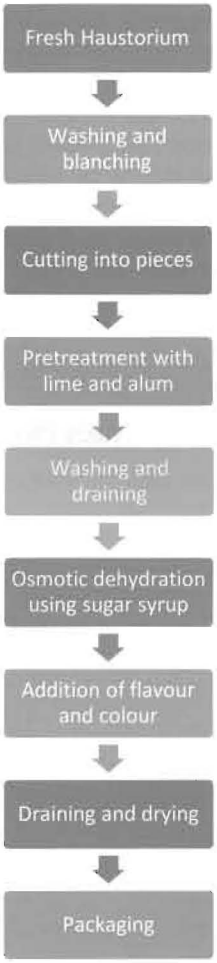
Most of the farmers are facing the problem of sprouting of edible coconuts due to long term storage. Most of the sprouted coconuts may fail to grow as seedling. With a view to improve the utilization of Coconut haustorium (Pongu), CDB Institute of Technology (CIT) has undertaken a study of processing of coconut haustorium to develop some novel value-added products which are having commercial value and extended shelf life. CIT has succeeded in making products like haustorium candy, haustorium instant stew mix and haustorium based health mix (Protein rich). The products developed were found to be organoleptically acceptable for their colour, appearance, flavour, taste, texture and overall acceptability on the nine point Hedonic scale by a panel of ten judges. Value addition of coconut haustorium will not only reduce losses but will also enhance the income of farmers.

Nutritional analysis conducted at CIT, Vazhakulam revealed that coconut haustorium is rich in protein with around 2% protein content. So it has significance in the vegetarian diet as a rich source of protein.

Studies were undertaken by CIT to develop some novel value-added products namely Haustorium candy, Haustorium based health mix etc inorder to increase the utilization of haustorium

Table I: Nutritional Value of Coconut Haustorium	
Parameter	Value
Ash	1.05 ± 0.2%
Soluble sugar	44.2 ± 4.6%
Starch	24.5 ± 3.2%
Protein	5.50 ± 0.3%
Fat	1.99 ± 0.9%
Soluble dietary fibre	5.72 ± 0.4%
Insoluble dietary Fibre	20.3 ± 1.9%
Phenolics	146 ± 14.3 mg
(Source: Journal of food Chemistry – October 2016 issue)	





Pre preparation of raw material

Sprouted dehusked coconuts were obtained from a coconut farmer and rest of the ingredients were purchased from open market. The nuts were cut open and haustorium was taken out, prewashed and blanched to sterilize the raw material. Haustorium is now ready for the preparation of candy and health mix.

Haustorium candy

Haustorium candy is a jelly like product obtained by treatment of haustorium in sugar syrup. The washed haustorium is sliced into 1 inch sized pieces. Pretreatment with 1 % calcium hydroxide solution followed by 1 % alum solution is required for giving firmness to the meat. The pre treated haustorium slices are washed in running water and drained. The slices are then dipped in 50^{o} brix sugar solution for 2-3 hours.

The mixture is boiled by adding citric acid until the solution attains 650 brix and is kept for 24 hours. Osmotic dehydration will takes place and the brix will come down to about 45^{o}. This is again reheated to bring the brix level to 70^{0}. Next day, a decrease in the brix level is observed which is again reheated to bring the brix level to 70^{0}. The mixture is then cooled, followed by addition of food flavours and colours into the sugar solution. Flavours like lemon, litchi, pineapple, guava, strawberry, mango, chilli, chilli-pepper, lemon-mint etc were tried and are found suitable for the candy. The mixture is then kept for 10-12 hours for the absorption of flavour and colour.

The treated haustorium slices are removed from the syrup and drained completely. The drained slices are finally dried in hot air oven at $70\text{-}80^{0}$C temperature until it attains 3% moisture level. The novel product, haustorium candy has an excellent taste and appearance. It is sweet, chewy and is in a ready to eat form.

Packaging

Haustorium candy is hygroscopic in nature. Therefore selection of high moisture barrier packing materials is essential. Since the candy has an attractive appearance, transparent packaging materials are preferred.



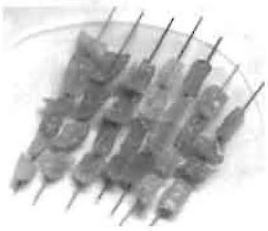




Table II: Conversion ratio of fresh haustorium to candy			
Wt. of Raw haustorium	Weight with respect to raw haustorium		
	Sliced haustorium	Slices after Osmotic Dehydration with sugar syrup	Haustorium candy
99.2 g	96 g (96.7%)	121.7 g (122.6%)	91.66 g (92.4%)

Table III: Nutritional evaluation of Haustorium Candy		
S.no:	Parameter	Value (%)
1	Moisture	3
2	Fat	Nil
3	Total ash(Minerals)	0.3
4	Carbohydrates	94.2
5	Protein	0.2
6	Crude fibre	0.7
(Data generated at CIT, Aluva)		

Protein Health Mix

Health mix has been formulated using coconut haustorium and VCO residue as major ingredients. Freshly harvested haustoriums are washed, sliced and blanched in 0.05% KMS solution. Ingredients used are arrow root powder (22%), Haustorium powder (20%), Virgin Coconut Oil residue (20%), Sprouted green gram powder (8%), Milk powder (10%), Sugar (20%), flavor and salt. All the ingredients were dried separately at 90°C for 1-2 hours in a hot air oven dryer. The dried ingredients are then powdered and packed in laminated aluminium foil pouches.

Table IV: Nutritional evaluation of Protein health mix		
S.no:	Parameter	Value (%)
1	Moisture	6
2	Fat	4.5
3	Total ash(Minerals)	2.71
4	Carbohydrates	68
5	Protein	17.5
6	Crude fibre	0.9
(Data generated at CIT, Aluva)		

Coconut haustorium can be used as a source of dietary protein due to its nutritional significance. More studies need to be undertaken at pilot scale level for identifying the possibilities for commercial exploitation of this product ■