Arecanut and Spices Bulletin 7 (3): PP. 59-63

POST HARVEST TECHNOLOGY OF ARECANUT

S. Shivashankar, A. G. Mathew and C. P. Natarajan

(Central Food Technological Research Institute, Mysore-570013)

India is the biggest producer of arecanut (*Areca catechu* Linn) with an annual production of 1,51,700 tonnes. It is used both at ripe stage and green stage. In India the custom of chewing *paan supari* holds a unique place in the habits of people. Chewing is known to increase the production of saliva and gastric juice and to aid digestion in general. It also helps to improve the mouth odour and is good against nausea.

Arecanut is consumed both in raw stage and after processing. In different states, different types are used for chewing. In Kerala, Assam and northern parts of West Bengal, the ripe fruit in its unprocessed form is the chewers favourite. In most of western and northern parts of India, dried whole ripe nuts, *chali*, and its half cut form, *parcha*, are extensively used. In the states of Andhra Pradesh, Karnataka and Tamil Nadu, processed green nut, *Kalipak*, is popular[1]. The range of variation of chemical constituents at green and ripe stages are presented in Table 1.

Processing of arecanut

Fresh ripe arecanuts

The fresh ripe arecanut is the favourite form in which the masticatory is used in two of the major growing areas, namely Kerala and Assam. The nut in the fresh, moist form is so much liked in these regions that people have evolved rather crude methods of preservation. In Kerala, nuts are preserved in water and such nuts are known as *"neetadaka"*. The nut contains mainly polyphenols, polysaccharies, fibre and fat but the husk contains easily fermentable substances such as pectin and sugars. These will be easily attacked by bacteria when steeped in water. This results in removal of firmness of husk and discolouration of the bright orange red colour of the skin to a dirty brown colour. However, the nut inside will be left in good condition except for the fact that the foul putrifying smell of the husk infiltrates to the nut also. In Assam pit storing is common. Such nuts are known as *bura tamul*. While covered with mud, husk gets attacked by fungus. In pit storing, the white coloured core and the portions between the brown veins are also to some extent destroyed.

A method of preserving ripe arecanuts by steeping in mixed preservative solution has been developed by CFTRI[2]. The method consists of washing freshly harvested areca fruits in chlorinated water (100 ppm of chlorine) to remove adhering dirt. The fruits are then blanched in boiling 0.2% calcium chloride solution to minimise surface microbial load and to preserve the firmness of husk. This treatment also destroys the enzymes in the husk. The fruits are then kept immersed in a steeping solution containing 0.1% sodium benzoate and 0.2% potassium metabisulphite acidified to a pH of 3.5 to 4.0 using hydrochloric acid.

Physical and chemical analysis have indicated that the fruits can be stored in fresh condition for 10 to 12 months.[3] The fruits maintained their fresh bright colour, shine and firmness of skin. Stored fruits were free from foul smell and the nuts were moist and unaffected, as far as signficant constituents are concerned.

Dried ripe nuts

The most extensively used trade type of arecanut is prepared by drying ripe arecanuts. Ripe fruits with the husk are dried in the sun by spreading evenly in single layers on dry level grounds for 35-40 days. The fruits are turned over at regular intervals to ensure uniform drying. To facilitate easy drying, sometimes the outer skin is peeled off at three places. The dried fruits are dehusked and sent to market as dry whole nuts known as *"Chali"* or *"Kottapak"*. Depending upon the size, there are various grades and preferences in different regions. The well-known grades of *chali* in descending order of size are known as *moti, srivardhan, jamnagar* and *jini*.[5] Other characteristics which are valued are, uniformity in size;

absence of immature nuts, surface cracking, husk sticking, fungus and insect attack, and good cutting feel, inside structure and taste.[4,6] Lack of attention during drying, unexpected rains and unsuitable wet drying yards contribute to onset of fungal infection and result in poor final product. In some areas of Kerala and Assam, harvest season coincides with the monsoon and sun drying will not be practicable. The main producing areas of *chali* nuts are Kerala, Karnataka, Assam and Maharashtra. It is also produced in countries like Bangla Desh, Malaysia and Sri Lanka.

To facilitate drying and dehusking, sometimes areca fruits are cut longitudinally into two halves and are dried in the sun for about 10 days with the husk.[7] Thereafter the kernels are scooped out and again given a final drying. By splitting, the number of days of sun drying can be reduced by about half. This type is known as *Parcha* and is produced mainly in Kerala and Karnataka. In Karnataka its production is concentrated in South Kanara, Sirsi and Kumta areas, whereas in Kerala its production is largely confined to Kasaragod, Nedumangad and Kottayam areas. Smaller quantities of this type are produced in Assam, Maharashtra and West Bengal. In West Bengal they are processed in parts of Cooch-Bihar and Jalpaiguri Districts.

Mechanical through-flow drier has been recommended for making of *chali* and *parcha*.[8] In this the drying can be completed in about 60 to 70 hours spread over 7-8 days at progressively increasing temperatures between 45 to 70°C. The drying schedule consists of successive 8 hours drying period followed by 16 hours of equillibriation outside the drier. A drier capable of holding 4500 to 5000 big sized fruits was fabricated. The parts of the drier are a drying chamber with 4 perforated trays, a heat exchanger fuel furnace and a centrifugal blower.

Kalipak

Kalipak is an important class of processed arecanut made from nuts of about 6 to 7 months maturity.[1,7] Kerala and Karnataka are the main processing centres. The immature nut will be soft and a finger nail can easily be pressed into. Outer skin of the husk will be dark green in colour. The processing in nutshell consists of dehusking, cutting the soft nuts into pieces, boiling the cut pieces with water or thin extract from a previous boiling, *kali* coating and drying. Depending upon the number of cuts, there are different types representing pieces of various shapes and sizes. *Api* or *unde* is one type which is processed without any cutting. *Batlu* or *ottavettu* is cut transversely into two halves. *Choor* is a variety which is produced after several longitudinal cutting. Depending upon the thickness of the longitudinal pieces, there are sub-groups such as *mukka choor, eda choor, petti choor* etc. in descending order of thickness. *Podi* is another variety where nuts are cut both transversely and longitudinally 3 to 4 times. *Erazel* and *chalakudi* are respectively thin slices produced by silicing the nuts transversely or longitudinally. A good worker can cut about 6-8 kilograms tender nuts per hour.

During the boiling operation that follows, usually the same batch of water is used for boiling 2 or 3 batches of cut arecanuts. Since the extract so obtained is concentrated to make *kali*, this process gives a thicker starting material. After boiling, the pieces are smeared with *kali*. In some cases, *kali* coating is repeated to get a good glossy appearance.

The extracts obtained from processing is concentrated about 10 fold by boiling over open fire to produce *kali*. The main extractives are polyphenols and they get progressively concentrated. Table 2 gives the analysis of the extracts and final *kali*.[3] Fungus growth and thickening of the top layer are the main problems during storage of kali. When *kali* is stored in closed containers, the quality remains good.

In interior Karnataka, usually the boiling and *kali* coating operations are combined into a single operation. For this, the cut nuts are boiled with a thicker extract, which in these parts are known as *"Chogaru"*.

Both sun drying and oven drying are restorted to by the processers of *kalipak*. Where monsoon is active, sun-drying is not possible. Nuts to be dried are kept on a false-bottom resting over open fire. Drying will be faster. Although discolouration is not a defect smoky off-flavour is not desirable. A well-dried product with a dark brown colour is preferred. Other desirable qualities in *kalipak* are crisp chewing feel, glossy appearance, a well toned astringency and absence of over mature nuts and consequent fibrousness.[6]

Sagopalm nut is used as a adulterant in *kalipak*. The cut pieces have a surface appearance similar to arecanut. These pieces on *kali* coating can be judiciously used as an adulterant. Chemical analysis (Table 3) however shows that sagopalm nuts have lower polyphenol and fat contents, but have higher polysaccharides and fibre contents.[4] Other adulterants used after *kali*-coating are sweet potato & tapioca, but they are comparatively easier to identify.

Iylon is an unboiled variety made from green arecanuts.[5,7] Here the nuts are cut transversely into 5 or 6 discs and dried without *kali*-coating. Normally the nuts used here will be a few weeks more mature than those used for *kalipak*. Tamil Nadu and Andhra Pradesh are important consuming areas. Some of the grades in increasing maturity and therefore decreasing grade are *chittanum, virivu* and *kora*. Another unboiled type is *nayampak,* is made from immature arecanuts after cutting once transversely and drying.

It has been estimated that out of the calculated market surplus of 1 lakh tonnes of arecanut produced in 1963-64, 75% was consumed after processing.[7] *Chali* and *parcha,* the dried ripe varieties constitute 41% of the total production. The remaining are processed varieties from green nuts. *Api* represents about 6.7%, *batlu* 6.5%, *choor* 9.1%, *iylon* 4% and *nayampak* 3%. Tables 4A & 4B give the range of variation in physical and chemical constituents of important processed varieties.[9]

Scented supari

There are many varieties of scented *suparis*. The processing consists of breaking dried arecanut into bits, blending with flavour mixture and packaging. In some cases, the bits are roasted in ghee or oil, but this practice has been more or less abandoned these days, because of problems of rancidity. The flavouring varies very much depending upon the region. Usually, it is a closely guarded secret.

Those which are popular in South India are made from *kalipaks* like *batlu*. Spices and synthetic flavours are added. Nowadays it appears that instead of raw spices, essential oils are preferred because of the convenience of blending. Rose essence is used in most of the cases. Coconut gratings which were used in earlier days are now avoided because these become the starting point of microbial attack. Saccharin is not generally used. In rare cases crystal sugar is added to sweeten the product. These are usually packed in butter paper.

Scented *suparis* which are made in North and Central India can be divided into two types. Those made from *chali* and those made from *kalipak*. The former is more popular. Both the types are sweetened with saccharin. However, proposed changes in food regulations, may not allow indiscriminate use of saccharin in future. Very often food colours are also used besides flavours. Roasting in oil and addition of pieces of coconut or spieces are not done. These are normally packed in plastic strips. Tin and aluminum pouches are used for bulk packing of scented *supari*.

While *kalipaks* and scented *suparis* are used as a masticatory alone, *chali* and ripe arecanuts which leave a large fibrous residue in the mouth are used along with betel leaf and slaked lime. Ready-made combination of these are known as *beeda* and often flavoured with spices like cloves, coconut grating and sugar crystals. In North India it is common to use *katha,* the extract of *Acacia catechu* in *paan-beedas*.

Chemical Constituents

The most important constituents are polyphenols which constitute about 20% of the dried arecanuts. Paper chromatography combined with reaction with specific reagents has shown that these polyphenols are entirely flavan-ols. The monomeric components include about 10% of (+) catechin, 2.5% of (−) epi catechin, 12% of (+) leucocyanidin and 1.3% of another isomer of leucocyanidin out of the total polyphenols.[10] The remaining are made up of complex flavonoids of varying degrees of polymerization. By acid hydrolysis and study of the reaction products, they are found to have predominantly leucocyanidins and traces of catechin and leucopelargonidin.

The main taste characteristic of arecanut is astringency which is contributed by polyphenols. On studying the organoleptic properties of various fractions, it was found that monomeric catechin and leucocyanidin are both very astringent compared to slightly lesser astringency of polymeric fractions.[11,12] Pure catechin solution has an earthy odour reminiscent of freshly removed roots and is reddish compared to the yellowish colour of leucocyanidin fractions.

When treated with alkali, these polyphenols get converted to coloured *O*-quinones which on further oxidation slowly becomes dull brown. The colour and spectral characteristics of the chew containing arecanut and slaked lime are similar to the latter. Therefore, leucocyanidins are to be considered mainly responsible for the colour of the chew, by getting converted to *O*-quinone under the influence of alkaline autoxidation and subsequent secondary reactions. Abundant quantities of leucocyanidins are present in arecanut, both in monomeric and polymeric forms.

Arecoline is the most important of areca alkaloids which are all derivatives of tetrahydronicotinic acid. Arecoline has a parasympathetic stimulant action. It induces intestinal peristalsis and is poisonous to round

worm. Arecoline and its hydrobromide are, therefore, used in veternary preparations as a vermifuge. Because of toxicity in larger doses, they are not used in human medicines. The arecoline content will be usually below 1% on dry basis.[9]

The percentage of fat in dry ripe arecanut ranges normally between 9 and 15%. Sample of arecanut fat showed a melting point of 38°C, saponification value of 236.4 and iodine value of 59.0.[11] In physical properties like appearance and consistance it resembles *vanaspathi*. Other major constituents are polysaccharides and fibres which are higher in more mature stages.

Because of the increase in the production of arecanut and consequent fall in prices, efforts are being directed to finding alternate uses for arecanut by separating various chemical constituents and putting them to specific uses, such as polyphenols for tanning, alkaloid for medicinal purposes and fat for consumption or soap making. However, it has to be borne in mind that, despite some fall in price of arecanut, it is still quite too high to utilise arecanut as a raw material for such technological purposes.

There has been no conclusive evidence of oral cancer caused by chewing. However, there is need to do systematic survey in this direction. Because of the extremely low quantities of arecanut taken, nutritional advantages may not be much, except that chewing increases digestive secretions, which may help in digestion. However, the important thing to a chewer is, that it gives a pleasant feeling of contentment.

References

1. V.S. Govindarajan Processing of Arecanuts. Booklet issued by India Central Arecanut Committee, Calicut.
2. A.G. Mathew, S.D. Venkataramu and V.S. Govindarajan *Indian J. Technol.* 1964, *3*, 90.
3. A.G. Mathew, S.D. Venkataramu, S.A. Jaleel, V.S. Govindarajan and V. Subrahmanyan *Arecanut* J. 1963, 14, 51.
4. Annual Report of the Arecanut Technological Laboratory, CFTRI, Mysore. (Indian Central Arecanut Committee, Calicut) 1959-60, 1960-61 and 1961-62.
5. Report of Marketing of Arecanuts and Betelnuts, Directorate of Marketing and Inspection. Nagpur, 1961.
6. S. Dhanaraj, A.N. Sankaran and A.G. Mathew. *J. Food Sci. Technol*, 1970, *7*, 123.
7. K. Shamanna. Report on the preparation of the various types and grades of arecanut and the demand in the different regions of distribution and consumption in India. The Regional Office (Arecanut and Spices Development) Calicut.
8. E.S. Nambudiri, V.S. Govindarajan and V. Subrahmanyan. *Arecanut J.* 1963, *14*, 95.
9. S. Shivashankar, S. Dhanaraj, A.G. Mathew, S. Sreenivasamurthy, M.N. Vyasamurthy and V.S. Govindarajan, *J. Food Sci. Technol.* 1969, *6*, 113.
10. A.G. Mathew, H.A.B. Parpia and V.S. Govindarajan, *Phytochemistry* 1969, *8*, 1543.
11. A.G. Mathew, Chemistry Studies of Astringent Plant Products with Special Reference to Polyphenols. Ph.D. Thesis. University of Kerala, Trivandrum 1968.
12. A.G. Mathew, 8th International Symposium IUPAC. New Delhi Feb. 1972, *B 34*, 131.
13. A.G. Mathew, *J. Food Sci. Technol.* 1971, *8*, 140.
14. A.G. Mathew, S. Shivashankar, Fazlulla Khan and C.P. Natarajan *Arecanut Spices Bull.* 1974, *6*, 31.

TABLE 1

Range of variations of the chemical constituents of green and ripe arecanuts

Constituents*	Green (Kalipak stage)	Ripe
Moisture content	69.4—74.1	38.9—56.7
Total water extractives	32.9—56.5	23.3—29.9
Polyphenols	17.2—29.8	11.1—17.8
Arecoline (Extraction method)	0.11—0.14	0.12—0.24
Fat	8.1—12.0	9.5—15.1
Crude fibre	8.2— 9.8	11.4—15.4
Total polysaccharides	17.3—23.0	17.8—25.7
Crude protein	6.7— 9.4	6.2— 7.5
Ash	1.2— 2.5	1.1— 1.5

*Constituents expressed as percentage values (except moisture) calculated as dry basis.

TABLE 2

Analysis of liquid after boiling and Kali

	Liquid after 1st boiling	Liquid after 2nd boiling	*Kali*
Polyphenols	2.5	4.8	47.3
Total solids	3.4	5.1	—

TABLE 3

Analysis of arecanut and sagopalm

Constituents %	Arecanut dried-green	Sagopalm dried
Moisture%	12.01	14.50
Tannins	33.90	7.51
Total water extractives	52.73	13.69
Fat	8.70	0.32
Crude Fibre	7.32	23.63
Arecoline	0.28	0.04
Ash	2.51	1.21

TABLE 4A

Range of Variation of Physical Characteristics

Types/Trade Names	No. of samples analysed	Limits—Range of variation						
		Length		Diameter		Nuts/pieces per kg.	Volume per nut/piece in cc.	% Floating
		Measurement (in cms.)	Standard deviation	Measurement	Standard deviation			
1. Chali	68	0.9—3.3	0.19—0.37	0.8—3.4	0.02—0.38	92—840	1.1—12.0	0—75
2. Parcha	19	1.1—3.0	0.15—0.30	1.3—3.1	0.14—0.31	220—522	1.7—4.5	0—58
3. Iylon	26	..	..	0.9—3.0	0.09—0.36	800—2832	0.4—1.3	0—33
4. Api	54	0.6—2.9	0.02—0.30	0.7—3.6	0.03—0.40	158—1054	1.1—6.5	0—90
5. Batlu	31	..	..	1.0—2.9	0.02—0.27	452—1712	0.7—2.7	0—53
6. Choor	34	1.0—3.5	0.15—0.40	0.1—2.7	0.03—0.45	912—16260	0.1—1.1	0—71
7. Erazel	9	..	..	..	..	..	..	..
8. Chalakudi	3	..	..	1.5—3.0	0.25—0.30	1144—1332	0.8—0.9	0
9. Nuli	5	..	..	..	..	1296—3012	0.4—0.8	5—23

TABLE 4B

Range of Variation in Chemical Constituents

Types/Trade Names	No. of samples analysed	Range of Variation									
		Moisture %	Total water extractives %	Polyphenols %	Arecoline % (Steam-distillation method)	Fat %	F.F.A. on fat %	Crude fibre %	Total Polysaccharide %	Ash %	Acid insoluble ash %
1. Chali	65	5.46—12.23	19.63—39.19	7.32—34.93	0.11—0.72	4.87—24.35	0.74—74.09	7.09—17.42	14.29—26.25	1.19—2.54	Nil—0.28
2. Parcha	18	6.15—14.28	28.37—36.43	11.73—24.99	0.12—0.54	12.29—18.14	1.98—22.94	7.96—14.25	13.02—27.30	1.34—2.08	Nil—0.088
3. Iylon	25	7.80—10.86	28.67—60.54	19.59—45.94	0.14—0.69	6.80—18.11	2.65—47.63	5.38—13.30	13.54—28.19	1.35—2.65	Nil—0.16
4. Api	54	7.40—11.00	23.03—53.28	15.19—41.25	0.15—0.90	5.32—18.52	0.65—45.65	5.38—18.50	9.22—28.24	1.01—2.53	Nil—0.19
5. Batlu	31	7.89—13.38	28.28—69.61	22.42—55.21	0.10—0.88	4.33—17.89	0.51—57.25	3.14—12.30	14.20—26.99	1.48—2.37	Nil—0.10
6. Choor	33	5.20—11.63	32.43—66.03	24.92—43.69	0.14—0.87	5.91—17.78	0.93—20.11	5.10—15.15	11.13—28.08	1.19—3.32	Nil—0.153
7. Erazel	9	7.67—11.64	29.85—57.42	16.87—38.01	0.21—0.75	5.48—12.25	2.06—75.97	5.87—8.72	13.14—26.58	1.48—4.97	Nil—1.17
8. Chalakudi	3	9.16—10.15	49.78—56.99	31.95—39.29	0.35—0.93	7.05—10.48	2.69—33.17	5.32—14.87	22.08—26.94	2.34—3.61	Nil—0.08
9. Nuli	6	9.17—10.58	53.01—72.44	38.98—47.92	0.63—0.91	3.66—13.78	0.97—5.07	3.75—6.00	16.43—22.68	2.13—3.24	0.002—0.16