*Economics of Hot Air Drying of Wet Coconuts for Oil Recovery – Possible Improvements

B. S. RAMACHANDRA
Central Food Technological
Research Institute,
Mysore-13

INTRODUCTION

In India the total production of coconut is estimated to be 5500-6000 million nuts per year. Of the total production 65-70% finds use in the fresh form (1) in daily cookery (2) as tender coconuts and (3) for the production of desiccated coconuts. About 30% of the produce is dried and processed for oil recovery. It is indicated that about 3 lakh tonnes of copra is produced for recovery of oil.

Most of the milling copra is produced by sun drying and kiln drying methods. Exact figures on quantity produced by mechanical hot air drying are not available. If there is rain during sun drying period, in spite of protecting from rain, mold attack and darkening will take place due to high moisture and humidity conditions. Smoke dried copra is brown in colour and has a characteristic smoky odour. The copra produced by the above two methods is invariably of lower quality when compared to mechanical hot air dried product. The quality of oil produced has a direct bearing on the quality of copra crushed.

In the context of dwindling edible oil resources it will be very desirable to produce a good quality copra which assures good quality oil, thereby avoiding the refining losses of an inferior quality of oil, produced by crushing bad quality copra. Good quality copra can only be produced by mechanical hot air drying.

In this paper an attempt is made to highlight the advantages of mechanical hot air drying to produce good quality copra for oil recovery and possible improvements that could be made by drying the wet disintegrated mass (like D. C. production) to produce a very good quality grating in a very short drying time (less than an hour). Economics of mechanical hot air drying of disintegrated wet kernel is also outlined.

PRODUCTION OF DRY COPRA FROM WET COCONUTS FOR OIL RECOVERY

The wet coconut kernel contains 45-50% moisture. About 7000 numbers of fresh coconuts will produce 1 tonne of copra. Mature coconuts are broken into two cups and the cups are dried in the sun or in kilns to produce copra.

SUN DRYING: The wet cups with shell intact are placed on trays or on mats and the kernel exposed to direct sunlight for drying. After a day or two of sun drying, the kernel gets loosened from the shell so that it could be scooped out with a metal lever. At this stage the moisture level will be 25-35% from the initial level of 45%. The kernel is further dried in the sun for a period of another 4-5 days depending upon the

* Paper presented at the National Seminar on Processing and Marketing of Coconuts held at Bangalore on 19 - 20 April 1987.

sunlight after which the level of moisture will be 6-7%. If it rains, drying is interrupted and mold infection is likely to occur and quality of copra produced suffers. About 7 days of total sun drying time is required to produce copra from wet kernel.

KILN DRYING: During rainy months, the cups are dried on an elevated platform by means of smoke gases generated by burning husk and shells. Since the smoke comes in direct contact with the kernel and ventilation also is poor the copra is brownish in colour and has smoky odour. The quality of oil recovered is also inferior. About 48 hrs. of kiln smoke drying is required to reduce the moisture to 6-7%.

HOT AIR DRYING: Bin type dryers are being used in which warm air at a temperature of 50-65 C is blown through the bed of cups. Each bin holds 7000-20,000 nos. of coconuts and produces 1-3 tonnes of copra per batch. The drying time will be 24 hrs. After 6 hrs. of drying the kernel can be scooped out of the shell and subsequently the kernel is dried for a further period of 14-16 hrs. to produce dry copra. These dryers normally use firewood, fuel oil or steam for heating air. Since the air circulation is good, drying time is just half when compared to smoke kilns and copra produced is bright in colour and oil recovered is of very good quality.

DRYER DETAILS: These dryers are of masonry construction, fitted with grates for supporting the bed of coconuts. Below the grate a plenum chamber is located for flow of air. A mechanical blower is provided for forcing the hot air through the bed of coconut cups. The air is normally heated in a firewood fired furnace or in a steam heated finned heat exchanger. With steam heating the temperature control is easier. The base of the dryer will be 8-20 sq metres in area and coconut bed height will be upto 1 metre. The cost to produce 1 tonne of copra is estimated to be Rs. 2000 or Rs. 2 per kg. of copra produced. Considering the copra price to be Rs. 20 per kg. the conversion cost will be about 10% of the cost of copra.

POSSIBLE IMPROVEMENTS: In the above method of drying in the cup form the drying time will be 20-24 hrs. Since the kernel will be 1-1.5 cm. thick the drying is basically diffusion controlled and is not influenced much by temperature and velocity of air. Studies have shown that when small pieces are put for drying the time is considerably brought down. Cut pieces of 1.5 cm. size will dry during 3-4 hr. time and coconut shreads or strands dry within 40-50 minutes.

Since dry copra has to be disintegrated before being processed in the expeller for oil recovery, it will be very desirable to disintegrate the wet coconuts and dry them in a very short time. This has the following advantages: (1) Energy for disintegrating wet kernel is less when compared to dry milling of copra. (2) Drying time will be less than one hour. (3) Copra and oil produced will be of better quality and the oil produced will fetch a premium price. (4) Continuous drying system could be adopted as done in case of tea industry.

All desiccated coconut plants in the country are utilizing semi continuous venitian type of dryers for the production of desiccated coconut. These dryers have a capacity of producing 500-750 kg. of dry product per shift or about two tonnes of dry product per day during 3 shifts. Installing 5 numbers of such dryers will produce 10 tonnes of dry coconuts per day which could be milled in an expeller having 500 kg/hr. of throughput for oil recovery.

A scheme for the production of 10 tonnes of dehydrated coconut gratings per day is given on the following page with details regarding infrastructure required and economics of the plant.

A SCHEME FOR PRODUCTION OF DRY GRATINGS FROM WET COCONUT KERNEL

Capacity of the plant: 10 tonnes of dry coconut gratings/day of 3 shifts (300 days/year)

		Rs. (lakhs)
A.	Capital investment: (6000m²) land and building (1000m²)	15.00
B.	Fixed capital on plant (erected cost) [disintegrators, dryer, boiler plant and other accessories]	12.00
C.	Furniture	0.5
D.	Pre-operative expenses	2.00
E.	Deposits, etc.	1.00
F.	Contingencies	2.00
G.	Working Capital margin	14.00
	Total outlay	46.50

			lakhs
H.	Security: Land & Building	—	15.00
	Plant and machinery	—	12.00
	Contingency	—	2.00
	Total		29.00
I.	Term loan from bank: (75% of security)		22.00

Estimated cost of production (Annual)

				Rs. (lakhs)
1.	Coconuts (21×10^6 nos.) @ Rs. 2000/1000 nos.			420.0
2.	Utilities (a) Electric power: (1400 units/day) @ Re. 1/unit		4.20	
	(b) Steam 27 tonnes/day @ Rs. 200/tonnes		16.20	
	(c) Water 5000 litres/day @ Rs. 2/1000 l		0.05	20.45
3.	Labour & supervision			21.00
4.	Maintenance & repairs, 2% on building		0.30	
	5% on plant		0.60	0.90
5.	Operating supplies, 20% on M & R			0.20
6.	Taxes & Insurance, 2% on & fixed assets			0.55

7.	Overheads expenditure 20% as L & S		4.20
8.	Depreciation : 5% on building	0.75	
	10% on plant	1.20	1.95
9.	Administrative expenses		1.00
10.	Financial expenses		
	a) Interest on L. T. loans, Rs. 22 lakhs @ 12%	2.64	
	b) Interest on W. C. M., 45 lakhs @ 18%	8.10	10.74
11.	Total cost of production,		
	Annual production 3000 tonnes		
	Hence cost of production/tonne	$= \frac{481 \times 10^5}{3000}$ = Rs. 16,000/tonne	

Assuming the wholesale price of copra to be at Rs. 18,000/tonne the drying cost can definitely be absorbed by the product. It is recommended that the Coconut Development Board should take steps to popularise mechanical drying of copra for oil recovery. Incidentally the gross earnings as profit at this indicated capacity will be Rs 60 lakhs