“IMPROVING THE SMALL - SCALE EXTRACTION OF COCONUT OIL”

Common Fund for Commodities Project FIGOOF / 01,

Coconut Oil Production using the Intermediate Moisture Content Method

Country Manual - Sri Lanka

by

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INTRODUCTION

The process and procedure described in this Manual relate to the application of the Intermediate Moisture Content (IMC) Method to the small-scale manufacture of coconut oil, and is the outcome of a Project entitled “Improving the Small-Scale Extraction of Coconut Oil”. This Project was jointly funded by the Common Fund for Commodities, Amsterdam, The Netherlands, the Natural Resources Institute, Chatham Maritime, U.K., and technical collaborators in Tanzania, Côte d’Ivoire, Ghana, India, Sri Lanka and Indonesia.

Disintegrated coconut kernel, dried in the sun to a moisture level of 11.2%, when subjected to pressure in a 525 psig press, yields coconut oil at an extraction efficiency exceeding 60%. The total cost of equipment required is estimated to be below Rs. 20,000/= ($US 350). The daily capacity/throughput of a production unit with one press is 105 coconuts and would yield 16½ bottles (750 ml.) of oil 10.5kg of press cake.

The process outline is given Annex I.

EQUIPMENT REQUIRED

1. Four standard table mounted Rotary Hand Graters each costing about Rs.400/= ($US8)

2. Bridge type Press, (see Annex 2), costing about Rs.18000/= ($US300)

3. Thin metal sheets (1 mm Gauge) of 20 sq. metres for drying coconut gratings, costing about Rs. 4000/= ($US65)

4. Stainless steel heating pan of 8 - 10 litres capacity, two half litre funnels for filtering, two 25 litre plastic cans, 750 ml. plastic/glass bottles and woven polypropylene bags costing about Rs.3000/= ($US50)

5. Weighing Scale (10 kgs max.) costing about Rs.5,000/= ($US85)

6. Packing and storage facilities - bottles, sacks, wooden crates, etc.

RAW MATERIALS

Grated coconut kernel from mature coconuts, prepared in the manner described in the operating procedure, is used as raw material.

LAND / WORKING AREA / BUILDING

A. Drying Area - open space - 110 sq.metres

B. Shed - having an area of - 10 m x 7 m = 70 sq. metres (low cost construction), to accommodate:
   1. Coconut Splitting and Grating Area (manually operated table mounted graters) - 5 sq.metres
   2. Pressing Area (Bridge Press) - 5 sq.metres
   3. Oil Collecting Area - 5 sq.metres
   4. Oil Filtering Area - 10 sq.metres
   5. Oil Heating Area (for moisture removal) - 10 sq. metres
      (The oil produced contains moisture; to remove this oil is heated in a pan using solid fuel. Safety gloves should always be worn when handling hot oil.)
   6. Oil and Press Cake Storage Area - 40 sq.metres
      (This Storage Area is required for storing dried raw material, coconut oil, press cake, tools implements, and accessories. The store should be lockable.)
OPERATING PROCEDURE

1. Select 35 mature, seasoned coconuts
2. Remove the husks.
3. Split them into equal halves, using blunt edge of kitchen knife.
4. Scrape out the kernel by holding each half cup against the rotating blade of the Grater.
5. Collect the scrapings from the 35 coconuts in a plastic bucket.
6. Spread the scrapings on the thin metal sheet in the drying area and dry in the sun.
7. Dry the coconut gratings to a moisture level of 11.2%. To confirm that the correct moisture content has been reached, apply the “squeeze test”*, as follows:

Take a handful of material successively from each sample and squeeze it in one hand as tightly as you can. If the moisture content is too low (the coconut is too dry) you will produce no oil. If it is too high (the coconut is still too wet) the oil that comes out between your fingers will look creamy. If the moisture content is correct, you will be able to squeeze out clear oil with your hand.

* Developed by Dan Etherington, Australian National University.
8. Load the dried material into a woven polypropylene bag and place it in the cage of the Bridge Press.
9. Position the pressure plate to move within the cage and screw down.
10. Gradually increase the pressure on the material until the oil begins to flow.
11. Wait a few minutes until the oil flow has ceased and then screw pressure plate down further to apply additional pressure until oil flow begins again.
12. Wait a few minutes for oil flow to cease before applying further pressure.
13. Repeat this sequence until maximum pressure is reached.
14. Attach extension bar, supplied with the machine, and repeat steps 10 to 13.
15. Collect the oil that comes out of the spout at the base of the cage, into a can.
16. When oil flow has finally ceased, unscrew the pressure plate and remove the Press Cake.
17. Re-dry the press cake to 11.2% moisture by spreading it on the metal sheet and exposing to the sun.
18. Apply the “squeeze test”, as before, to confirm that the correct moisture content has been reached.
19. Re-press the material to extract more oil by following steps 8 to 16 above.
20. Collect oil from the 1st and 2nd pressings and heat it in the Stainless Steel pan to remove the moisture. The oil is dry when no more steam is produced. Take care not to overheat, as this will darken the oil and spoil its flavor.
21. After the oil had cooled to room temperature, filter it using funnel plugged with cotton wool.
22. Store the filtered oil in 10 litre cans, until it is transferred to the 750 ml. bottles for sale.
23. Dry the Press Cake* by spreading in the sun, to a moisture level of below 10%, and store in bags for sale.

PRODUCT RECOVERIES (per batch of 35 coconut processed)

1. Coconut oil - 5.5 bottles (3.71 kg)
2. Oil cake - 3.5 kg
3. Green Husks - 35 full husks
4. Coconut shell - 35 whole shells

PRODUCT PACKING STORAGE

Initially store in the oil in 10 litre cans. Subsequently transfer into 750 ml. bottles and store in wooden crates for delivery/transport. The press cake, dried to below 10%, is stored in polypropylene bags (5 kgs). Coconut husks and shells are stored in the open yard until collection by dealers.

MARKET FOR PRODUCTS

1. Coconut oil - Retail sale in 750 ml. bottles through village grocery shop/community centers shops.
2. Press cake - Retail sale in 5 kg packs through local forage shops.
3. Husks and shells - sold through dealers.

* Press cake: The solid residue left after pressing.
TYPICAL FINANCIAL ANALYSIS for SRI LANKA.

Annual Trading Budget

Variable Expenses

(1) Coconuts : 35 coconuts per batch per press per day X 6 batches X 300 days at Rs. 6 per nut = 378,000
(2) Dehusking : 63000 coconuts at Rs. 150/= per 1000 nuts = 9,450
(3) Wages : (for splitting, scraping, drying, pressing & handling) at Rs. 150/= per day X 4 workers X 300 days = 180,000

Total Variable Expenses = 567,450

Sales Value of Output

4.1 Oil : (5.5 bottles/batch) X 6 batches X 300 days X (Rs. 47/bottle) = 465,300
4.2 Press cake : (3.5 kg/batch) X 6 batches X 300 days X Rs. 12/kg = 75,600
4.3 Shells : at Rs. 250/1000 shells X 63000 shells = 15,750
4.4 Husks : at Rs. 300/1000 husks X 63000 husks = 18,900

Total Sales Value of Output = 575,550

Operating Profits = 8,100

Overhead Expenses

(5) Depreciation

5.1 Press at 5% p.a. = 1500
5.2 Shed 10% p.a. = 500
5.3 Miscellaneous 20% p.a. = 400

Total Depreciation = 2400

(6) Interest

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<th>Interest on fixed</th>
<th>Interest on working capital</th>
<th>Total</th>
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Operating profits less overheads (that is depreciation + interest)

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<td><strong>Total</strong></td>
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(a) Daily Stock record

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(b) Daily financial record
# DAILY PRODUCTION RECORD

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<tr>
<th>Date</th>
<th>No.of Coco. used/day/batch</th>
<th>Batch Wt. of grated kernel (kg)</th>
<th>After drying upto 11-12% moisture batch Wt. (kg)</th>
<th>Wt. of oil After 1&lt;sup&gt;st&lt;/sup&gt; press (kg)</th>
<th>Batch Wt.of 1&lt;sup&gt;st&lt;/sup&gt; press oil cake upto 11-12% moisture (kg)</th>
<th>Wt.of oil after 2&lt;sup&gt;nd&lt;/sup&gt; press (kg)</th>
<th>Oil cake (after 2&lt;sup&gt;nd&lt;/sup&gt; press) (kg)</th>
<th>Total oil (kg)</th>
<th>Observation on quality of oil</th>
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OIL EXTRACTION BY INTERMEDIATE MOISTURE CONTENT METHOD
PROCESS OUTLINE

HARVESTED NUTS

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HUSKING

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SPLITTING

↓

GRATING

↓

DRYING IN SUN

PRESSING

↓

OIL

↓

OIL CAKE

HUSK

COCONUT WATER

COCONUT SHELL
i. Screwed Block
ii. Handle — Do not use extended bars other than the one supplied with the machine.
iii. Basket
iv. Main Screw
v. Thrust Bearing
vi. Bearing housing top
vii. Bearing housing
viii. Piston
ix. Oil collecting Tray
x. Locating Bracket
xi. Support Bracket
xii. Machine foot.