DESIGN AND DEVELOPMENT OF AN IMPROVED SOLAR HYBRID DRYING TECHNIQUE FOR SMALL SCALE QUALITY COPRA PROCESSING

by

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ABSTRACT

Copra is an intermediate product in processing coconut oil. The objective of making copra is to stabilize the coconut kernel against microbiological attack and spoilage by reducing its moisture content to below 6%.

The objective of this study was to design and develop an appropriate solar hybrid drying technique to produce good quality white copra for small holders. White copra is produced in indirect type dryers in large scale or in kilns using charcoal. However, the cost of production in both methods is high. A new solar hybrid dryer was designed to avoid the high costs.

The solar collector. furnace and heat exchanger were evaluated separately for their performances. The efficiency of the solar collector was very low and only 4%. Solar energy was incorporated in the drying process whenever it was available. The maximum temperature raised in the solar collector was around 50 °C. Since the temperature raise was not enough to maintain the drying temperature of 60 °C, furnace energy was also incorporated at the paddy husk feeding rate of 3 kg/h.

The temperature in the drying chamber was increased up to 43 °C during the evaluation of furnace at the feeding rate of 3 kg/h and the furnace efficiency was around 43%. At the feeding rate of 5 kg/h, the temperature increase in the dying chamber was 53 °C and the furnace efficiency was 48%. Since these feeding rates were not enough to maintain the drying temperature, the third evaluation was conducted at the feeding rate of 10 kg/h. The internal temperature increased to 62 °C

in the drying chamber and the furnace efficiency was 70%. The average temperature of the furnace outlet air was recorded as 206 °C.

The final moisture content of 7% was obtained in the copra dried in the solar hybrid dryer. The dried copra was graded in to 73% white copra, 21% Milling Ordinary Grade -II (M O G-II) and the balance 6% as M O G-III (dusty copra). About 70 hours of continuous drying was needed to complete the drying process at the thermal efficiency of 10%.

The final moisture content of copra dried in the CRI copra kiln was 8% and the copra was graded as 82% M O G-I and the rest of 18% was M O G-III (burnt copra). White copra was not produced in the kiln drying. The average temperature recorded at the drying bed was 75 °C, and it took 62 hours to complete the drying process at the thermal efficiency of 16%.

The final moisture content of copra dried under direct sun was 10% and copra was graded as 25% white copra, 56% M O G-II and the balance 20% as M O G-III copra (mouldy cups). In order to bring down the initial moisture content from about 50% to 10%, it was necessary to dry copra for continuous 6 days at the thermal efficiency of 23%. Therefore, further drying is necessary to bring down the moisture to the safe moisture content of 6%.

Out of the three methods tested, solar hybrid drying was found to be the most economical technique for copra processing under local conditions.

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