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Design, development and performance evaluation of waste fired copra dryer

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ABSTRACT

The present study was conducted in Dapoli taluka of Ratnagiri district to evaluate the conventional drying practices of copra making. Coconut is dried under gradual change of temperature from 55 to 70ºC In order to give the better solution for copra making rather than conventional methods a small-scale lab model of combined combustion and drying unit was designed, fabricated and tested for drying purpose. The maximum temperature recorded in the drying chamber due to heating was 70º C during the test period. The furnace was fired with coconut waste *i.e.* coconut husk and coconut shells. The moisture content of the coconut was reduced from 55 % w.b. to 6 % w.b. in the drying period. It was observed that average 35 hours required for the drying of 25 kg of copra with average 120 kg of fuel. The quantity of drying air required was 900 kg throughout drying period. The efficiency of the dryer was calculated by taking three trials of drying. The thermal efficiency of the dryer was observed to be 25.20 %. The copra was graded as 55 % white copra, 31 % brown copra and 14 % dusty copra. Although the thermal efficiency is not so satisfactory, the dryer was found better compared to traditional methods due to the quality of final product and the ability to perform under adverse environmental conditions.

Key words : Development, Performance, Evaluation, Waste fired, Copra dryer.

Copra is one of the major traditional products processed from coconuts. Traditionally drying is performed either using a direct fired kiln or under direct sun to reduce moisture content of the coconut meat from 50 % to 6 % (Wet basis) in order to reduce the weight, prevent microbiological deterioration and concentrate oil. However copra being a typical coastal product sophisticated dryers are not available suited to local conditions (Patel, 1982, 1984). In Konkan region there are two traditional methods for coconut drying one is direct sun drying and another is Chula or kiln drying. The coconut growers unable to undertake the drying of copra using sun drying during the monsoon conditions due to heavy rainfall with annual rainfall of about 3500 to 4000 mm for a long period of 100 to 120 days. In addition to this drying of copra with help of sun-drying does not give better quality product. It is observed that sun drying resulted in sub standard products with dark coloured skin, damages due to fungus growth and poor keeping quality due to high moisture content (Annmalai *et al.,* 2002). Also the unhygienic conditions in the open spaces and roadsides by the dust and other impurities affect the quality of copra, which in turn lowers the quality of copra oil and also the value. The method of drying over the fire also does not yield good quality copra since there is no control over the drying process besides the discolouration and sooty smell produced by direct contact with the smoke. Both these methods required a large clean yard for drying and labour required for frequent turning of the copra during the process of drying. Efforts were made to design and develop the coconut dryer using agricultural waste (coconut husk) as a fuel suited to Konkan region. The dryer (indirect heated) was designed to dry fresh coconut meat from 45-55% moisture content (wet basis) to 6 % moisture content (Sudaria, 1993).

METHODOLOGY

The dryer was designed considering local environmental conditions, product hygiene, and low maintenance.

Design of the dryer:

The dryer consisted of drying chamber, heating chamber including fuel tray, blower and exhaust port (Fig. 1).

Drying chamber:

The drying chamber was designed based on the amount of coconut to be dried, density of coconut and the thickness of bed. The dryer was designed to dry a batch of 50 number coconuts *i.e.* 100 halves of coconut weighing approximately 25 kg coconut meat. Amount of moisture to be removed from wet coconut of was 60 % M.C. was estimated using relation:

$$W_w = W_g \times \frac{M_i - M_f}{100 - M_f}$$

where, W_g is Initial mass of the wet coconut, kg; M_i and M_f are the Initial and final moisture content of the coconut. Total energy of heat required to evaporate the