Suez Canal University

Faculty of Agriculture

Agricultural Engineering Department

Some Engineering Factors Affecting Solar Drying of Date

By

SALWA OSMAN SOLIMAN

B.Sc., Agric Engineering, Suez Canal University, 2011

Thesis

Submitted in Partial Fulfillment of
the Requirement for the Degree of

Master of Science

In

Agricultural Science
(Agricultural Engineering)

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Abstract

The present study was carried out through the period of September 2015 at the Department of Agricultural Engineering, Faculty of Agriculture, Suez Canal University to evaluate the effect of three different geometric shapes of solar dryers on drying behavior of date palm (Hayani) at three different levels of air velocities (0.5, 1, 1.5 m/s) and two different date conditions (peeled and unpeeled date). The studied different dryers shapes are, Quonset shape (SD1), gable-even-span shape (SD2) and pyramidal shape (SD3). The dryers thermal performance was also analyzed. The tested dryers were operated under two different conditions; the first one was without load (1) the second was loaded with freshly harvested date (2). The obtained results revealed that for the dryers operated without load, the overall thermal efficiency were (55.6, 52.2 and 51.1%), (62.04, 58.6 and 57.1%) and (50.6, 47.6 and 46.2% for the three studied dryer (SD1, 2 and 3) at air velocity of 0.5, 1, 1.5 m/s, respectively. However, the daily average thermal efficiency for the three loaded solar dryers (SD1, SD2 and SD3) were (29.67, 28.11 and 24.63%), (31.85, 30.54 and 29.95%) and (19.29, 18.45 and 18.14%) in case of drying peeled date at air velocity of (0.5, 1, 1.5 m/s), respectively. While the corresponded values for the un-peeled date were (24.73, 22.96 and 20.18%), (26.18, 26.01 and 24.56%) and (18.06, 17.45 and 17.04%) respectively. Meanwhile, for the loaded dryers, the recorded drying times ranged from (13 to 18 h), (15 to 20 h) and (16 to 21 h) for the peeled date dried at the (SD1, 2 and 3) dryers respectively. The corresponding drying times for the un-peeled date ranged from (16 to 23 h), (18 to 25 h) and (19 to 27 h) respectively compared with 43 and 51h for peeled and un-peeled date dried by the traditional sun drying method. In general, the Quonset shape solar dryer (SD1) operated at air velocity of 1 m/s showed the best results in terms of highest thermal efficiency, shortest drying time and best final quality of the dried dates.

Keywords: Greenhouse type solar dryer - Thermal performance analysis - Date

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