

DRYING BEHAVIOUR OF HAYANI DATE VARIETY USING INFRARED RADIATION

By

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B.Sc. Agric. Sci. (Agricultural Engineering), Fac. Agric., Cairo Univ., 2012

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APPROVAL SHEET

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ABSTRACT

A study was carried out to test and evaluate the use of infrared radiation as heat energy source for drying date palm. Where in this study an infrared dryer was developed and tested at the laboratory of the Department of Agricultural Engineering, Faculty of Agriculture, Cairo University. The initial moisture content of the freshly harvested hayani date was 58.5 % (w.b.). High moisture hayani date was dried (infrared method and convection heating method) by using infrared radiation intensity included four different levels of infrared radiation intensity (0.649, 0.973, 1.093 and 1.161 kW/m²), three different levels of air temperature (40, 50 and 60°C) and three different levels of air velocity (0.5, 1 and 1.5 m/s). However, the experiments of convection heating method were conducted at three levels of inlet air temperature of about (40, 50 and 60°C) and three levels of air velocity of (0.5, 1 and 1.5 m/s) without infrared.

The drying behavior was simulated using two different thin layer models (Lewis and Henderson and Pabis). The studied models were compared for simulating and predicting the change in date palm moisture during drying process content was then assessed. The obtained results showed that, both of the examined models could describe the drying behavior of dates satisfactorily under the range of studied treatments. On the other hand, the Lewis's model considered more proper for describing the drying behavior and predicting the changes in moisture content of date more than the Henderson and Pabis's model. Meanwhile, drying constant of Lewis's model (k_L) increased with the increasing of radiation intensity and air temperature and the decreasing of air velocity for the infrared drying. While, for the convection drying with the increasing of air temperature and air velocity. Increased the quality tests when used the infrared drying method in terms of sensory quality, the total and reducing sugar, the total phenolic content and the rehydration ratio. Also, the quality tests of dried whole date fruits showed that, at radiation intensity 1.161 kW/m², air temperature 50°C with air velocity 1 m/s showed the best treatment in terms of quality, drying time and mathematical analysis, while dried half date fruits, at radiation intensity 1.161 kW/m², air temperature 40°C with air velocity 1 m/s showed the best treatment in terms of quality, drying time and mathematical analysis.

Key words: Infrared, Convection heating, Mathematical modeling, Drying, Date palm, Moisture content.

DEDICATION

I dedicate this work, to my parents and my spouse for all the support they lovely offered during my post-graduate studies.

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Thanks and praise to the merciful Allah, who gave me the patience to conduct this research.

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