

# Specific Energy Consumption of Onion Slices During Hot-air Convection, Infrared Radiation and Combined Infrared-Convection Drying

## Journal of Applied Science and Agriculture

Authors

Hany S EL-Mesery, Gikuru Mwithiga

Publication date

2014/11/17

Article history: Received 30 September 2014 Received in revised form 17 November 2014 Accepted 25 November 2014 Available online 13 December 2014

Keywords: Specific energy consumption, Onion slices, Infrared radiation, Hot air convection, Drying methods, Combined infrared and hot air.

Total energy requirement and specific energy consumption for drying of onion slices were evaluated using various drying methods including hot-air convection, infrared radiation and hot air convection-infrared combination drying. Onion slices with initial moisture content of 7.31 g water/g dry solids, were dried to a final moisture content of 0.07 g water/g dry solids. Energy and specific energy consumption under the different drying conditions of the onion slices were compared. In particular, the experiments were carried out in convective dryer at three air temperature levels of 50, 60 and 70 °C and three air velocity levels of 0.5, 1.0 and 2.0 m/s. Experiments in the infrared dryer were done at three air velocity of 0.5, 0.7 and 1.0 m/s. For combination of infrared and hot-air convection drying, there were three air temperature levels of 40, 50 and 60 °C and three air velocity levels 0.5, 0.7 and 1 m/s while the infrared intensity was set at 0.15, 0.20 and 0.30 W/cm<sup>2</sup>. Results of data analysis showed that the lowest and highest energy consumption levels in drying onion slices were associated with the hot air convection-infrared combination (IR-HA) and convection (HA) dryers, respectively. Specific energy consumption in the hot air dryer showed a downward trend with increasing air temperature and an upward trend with increasing air velocity. In infrared (IR) drying, it was observed that increasing the air velocity increases the drying time and consequently the amount of energy consumed. However, a reduction in energy IRHA was noted with increasing infrared intensities under combination drying relative to infrared drying alone. Therefore, IR-HA drying of onion slices proved to have the lowest specific energy consumption and therefore the most efficient.