Title Kinetics and modeling of whole longan with combined infrared and hot air

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Abstract

The aim of this research was to evaluate the effects of operating variables on the drying behavior of whole longan undergoing a combined infrared and hot air drying process, to determine its kinetic parameters, and to develop drying kinetic models. The single-layer drying experiments were carried out at infrared powers of 300, 500 and 700 W, drying air temperatures of 40, 60 and 80 °C, and air velocities of 0.5, 1.0 and 1.5 m/s. The samples were dried until attaining a final moisture content of 0.2 kg water/kg dry solid. The results show that the drying had a short constant rate period followed by a falling rate period in all cases. The drying rate and product temperature were significantly influenced by infrared power, temperature and velocity of ambient air. In the constant rate period, the mass transfer coefficient varied from 3.646×10^{-3} to 1.914×10^{-2} m/s. It increased with increasing infrared power, but decreased as air velocity and air temperature increased. In the falling rate period, theoretical and semi-empirical drying kinetic equations were used to describe the drying kinetics of the product. It was found that the overall effective diffusion coefficient and drying constant varied from 7.012×10^{-11} to 6.681×10^{-10} m^2/s and 0.026 to 0.234 h^{-1}, respectively. Both parameters increased with increasing infrared power and air temperature, but decreased with increasing air velocity. Combined regression equations developed to predict the drying kinetic parameters (h_D, D_{eff} and k) for all three models gave a fairly good fit.