Title Water effective diffusion coefficient of mango slices at different maturity stages during air drying

Author Otoniel Corzo, Nelson Bracho and Carlos Alvarez

Citation Journal of Food Engineering, Volume 87, Issue 4, August 2008, Pages 479-484

Keywords Fick's second law; Air drying; Mango; Diffusion coefficient; Activation energy

Abstract

The water effective diffusion coefficient of green and half-ripe mango slices with an average thickness of 3.0×10^{-3} m during air drying was determined. The air drying was carried out at four air temperatures of 50, 60, 70 and 80 °C and two air velocities of 1.80 and 1.91 m/s. Fick's second law of diffusion modeled the drying process and an analytical solution was obtained assuming flat geometry for the mango slice samples. Non-linear regression procedure evaluated the water effective diffusion coefficient of mango slices by minimizing the chi-squared deviation between the experimental and model predicted drying characteristics. The water effective diffusion coefficient ranged approximately from 1.74×10^{-10} to 3.15×10^{-10} m^2/s, and from 2.30×10^{-10} to 3.28×10^{-10} m^2/s, for green and half-ripe mango slices, respectively. In general, diffusion coefficient increased with increasing air temperature and velocity. Temperature dependence of the effective moisture diffusivity followed an Arrhenius relationship, regardless of air velocity and maturity stage. Diffusion coefficient at 1.80 m/s was found to be the most temperature sensitive (E_a = 22.3 kJ/mol for green mango and E_a = 9.3 kJ/mol for half-ripe mango) while that at 1.91 m/s was the least temperature sensitive (E_a = 11.4 kJ/mol for green mango and E_a = 8.7 kJ/mol for half-ripe mango).