Application of temperature-thickness superposition technique in sliced Turmeric (*Curcuma longa*) drying

Abstract

Kinetics of sliced turmeric drying was characterized by using the semi-theoretical models through the determination and comparison of effective diffusivity, drying rate constants and kinetic parameters at different drying temperature (40-70°C) and turmeric sample thickness (3-10mm). Among the semi-theoretical models, Midilli-Kucuk model was best fitted with R^2 value in the range 0.9917-0.9997 and SSE value in the range of 0.0011-0.0055. The drying rate constant of the different drying models was found to increase with drying air temperature. For the generalization of Midilli-Kucuk model across temperature and thickness the methods of temperature-thickness superposition technique and generalization of drying rate constant are employed. The increased drying rate at higher temperature is explained by increase in effective diffusivity with the raise in drying temperature; whereas decrease in drying rate with the increase in slice thickness is explained by decrease of drying surface area to volume ratio with increase in thickness. The colour quality of powdered dry turmeric was characterized by Response Surface Methodology (*RSM*). Response Surface Methodology revealed the optimized conditions of drying for the colour quality of the ground turmeric product considering the drying air velocity and sample thickness as significant factors influencing the response. The optimized conditions for colour quality of ground product were a drying temperature of 70°C, air velocities of 0.50 to 0.85 m/s and sample thickness of 3mm, which resulted in least colour change of 0.70 to 0.86.

Keywords: *semi-theoretical model, drying kinetics, Midilli-Kucuk model, diffusion model, RSM*