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Drying Kinetics and Colour Change of Mango Slices as Affected by Drying Temperature and Time

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Abstract

Thin-layer drying behaviour of mango slices (var. Kent) was investigated in a laboratory scale dryer, using heated ambient air temperatures of 60, 70 and 80°C at a constant air velocity of 1.5 m/s and 3mm slice thickness. Besides the effects of drying air temperature on the drying characteristics, drying time and quality of dried products were determined. Drying curves obtained from the experimental data were then fitted to three well-known semi-empirical thin-layer drying models (Lewis model, Page model and Henderson & Pabis model). Model constants and coefficients were determined by nonlinear regression method. All the models were compared according to statistical parameters. Among the drying models investigated, the Page model satisfactorily described the drying behaviour of mango slices. The effective moisture diffusivity varied from 4.97×10^{-10} to 10.83×10^{-10} m²/s. Results indicated that drying took place in the falling rate period. The results have shown that, increasing air temperature causes shorter drying times. The combined effect of drying temperature and time on colour and re-hydration ratio were also evaluated. The colour was measured from the surface and expressed in the Hunter L*a*b* system. Moreover, the total colour change (ΔE), chroma (colour saturation), hue angle and browning index (BI) were determined. L* and b* parameters were found to decrease as affected by drying temperature and drying time, whereas a* parameter increases. Results also indicated that drying time has significant effect on colour change and rehydration ratio. The lowest total colour change and highest rehydration ratio were obtained at drying air temperature of 80°C then 70°C and finally 60°C with drying time of 3, 5 and 7 hours, respectively. In contrast to common practice, drying at elevated air temperature (80°C), instead of 60°C for a longer time, was optimal, since significant colour changes of mango slices were not observed. Moreover, at increased temperature, drying time was considerably shortened from about 7 h to 3 h, resulting in significant extension of drying capacity.

Keywords: drying models, mango, re-hydration ratio, thin-layer drying