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Mathematical Modelling of Thin Layer Drying Kinetics of Freeze-Dried Carrot Slices

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ABSTRACT

This study was conducted to investigate the effect of heating plate temperature, slice thickness on drying kinetics of carrot slices and to evaluate the best model predicting by the drying kinetics during drying. Data were analyzed to obtain diffusivity values from the period of falling drying rate. Five mathematical models were used for describing the thin-layer drying behaviour of carrot slices. Using an experimental setup designed to simulate an freeze dryer, the experimental results were obtained at three heating plate temperatures (40, 50 and 60 °C) and slice thickness (2, 4 and 6 mm). In order to estimate and select the appropriate drying model, six different models which are semi-theoretical and/or empirical were applied to the experimental data and compared. The goodness of fit was determined using the coefficient of determination (R^2), reduced chi square and root mean square error (RMSE). Among the models proposed, the logarithmic model was found to best explain thin layer drying behaviour of the freeze-dried carrot slices as compared to the other models over the experimental temperature range. By increasing the drying air temperature, the effective moisture diffusivity values increased.

Keywords: Freeze-drying, Plate temperature, Drying kinetics

How to Cite