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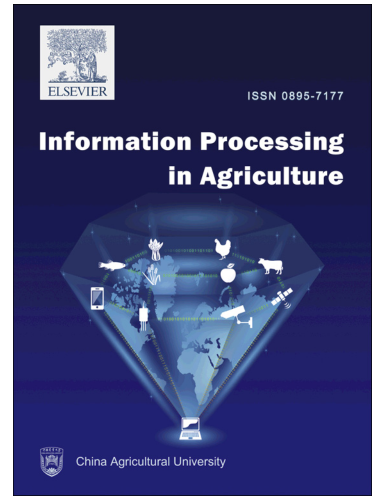

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Analyzing drying characteristics and modeling of thin layers of peppermint leaves under hot-air and infrared treatments

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ABSTRACT

The drying kinetics of peppermint leaves was studied to determine the best drying method for them. Two drying methods include hot-air and infrared techniques, were employed. Three different temperatures (30, 40, 50 °C) and air velocities (0.5, 1, 1.5 m/s) were selected for the hot-air drying process. Three levels of infrared intensity (1500, 3000, 4500 W/m^2), emitter-sample distance (10, 15, 20 cm) and air speed (0.5, 1, 1.5 m/s) were used for the infrared drying technique. According to the results, drying had a falling rate over time. Drying kinetics of peppermint leaves was explained and compared using three mathematical models. To determine coefficients of these models, non-linear regression analysis was used. The models were evaluated in terms of reduced chi-square (χ^2), root mean square error (RMSE) and coefficient of determination (R^2) values of experimental and predicted moisture ratios. Statistical analyses indicated that the model with the best fitness in explaining the drying behavior of peppermint samples was the Logarithmic model for hot-air drying and Midilli model for infrared drying. Moisture transfer in peppermint leaves was also described using Fick's diffusion model. The lowest effective moisture diffusivity (1.096×10^{-11} m^2/s) occurred during hot-air drying at 30 °C using 0.5 m/s, whereas its highest value (5.928×10^{-11} m^2/s) belonged to infrared drying using 4500 W/m^2 infrared intensity, 0.5 m/s airflow velocity and 10 cm emitter-sample distance. The activation energy for infrared and hot-air