Title Mathematical Modeling of Near-infrared Radiation Thin -layer Drying of Soybean

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Abstract

The mathematical model for describing thin layer drying of soybean under combined near-infrared radiation (NIR) and hot-air fluidized-bed drying was developed. The drying conditions are as follows: the combination of NIR powers between 2-8 kW and hot-air temperature at 40 °C, hot-air velocities between 3.6-6.8 m/s, soybean bed depth of 9 cm, initial moisture content of soybean of approximately 37 % dry basis and equilibrium moisture content (Me) obtained from the equation of Tia et al., (1990). The experimental drying parameters were applied in the thin-layer drying equations. Namely, Page, Two term and Midilli equation. These models were compared with the experimental results by basing on coefficient of determination (R2) and residual mean square error (RMSE). Apparently, the Midilli equation model was found to satisfactorily describe the drying behavior of soybean, providing the highest R2 (0.9999) and the lowest RMSE (0.0066). This equation was represented in the form of moisture ratio as follows: MR = 1.0122(VP)-0.00337exp (-(0.0297778+ (0.0019445) (VP)) t0.6703-(0.00597) (VP)) + (0.00189-(0.0000493(VP))) t