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Thermophysical Properties and Kinetic Study of Dioscorea bulbifera

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Abstract : This research focused on the modeling of the convective drying of aerial yam using finite element methods. The thermo-gravimetric analyzer was used to determine the thermal stability of the sample. An aerial yam sample of size 30 x 20 x 4 mm was cut with a mold designed for the purpose and dried in a convective dryer set at 4m/s fan speed and temperatures of 68.58 and 60.56°C. The volume shrinkage of the resultant dried sample was determined by immersing the sample in a toluene solution. The finite element analysis was done with PDE tools in Matlab 2015. Seven kinetic models were employed to model the drying process. The result obtained revealed three regions in the thermogravimetric analysis (TGA) profile of aerial yam. The maximum thermal degradation rates of the sample occurred at 432.7°C. The effective thermal diffusivity of the sample increased as the temperature increased from 60.56°C to 68.58°C. The finite element prediction of moisture content of aerial yam at an air temperature of 68.58°C and 60.56°C shows R^2 of 0.9663 and 0.9155, respectively. There was a good agreement between the finite element predicted moisture content and the measured moisture content, which is indicative of a highly reliable finite element model developed. The result also shows that the best kinetic model for the aerial yam under the given drying conditions was the Logarithmic model with a correlation coefficient of 0.9991.

Keywords : aerial yam, finite element, convective, effective, diffusivity
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