Mathematical modelling for the drying method and smoothing drying rate using Cubic Spline for seaweed Kappaphycus Striatum variety durian in a solar dryer

Abstract

The solar drying experiment of seaweed using Green V-Roof Hybrid Solar Drier (GVRHSD) was conducted in Semporna, Sabah under the metrological condition in Malaysia. Drying of sample seaweed in GVRHSD reduced the moisture content from about 93.4% to 8.2% in 4 days at average solar radiation of about 600W/m2 and mass flow rate about 0.5 kg/s. Generally the plots of drying rate need more smoothing compared moisture content data. Special cares is needed at low drying rates and moisture contents. It is shown the cubic spline (CS) have been found to be effective for moisture-time curves. The idea of this method consists of an approximation of data by a CS regression having first and second derivatives. The analytical differentiation of the spline regression permits the determination of instantaneous rate. The method of minimization of the functional of average risk was used successfully to solve the problem. This method permits to obtain the instantaneous rate to be obtained directly from the experimental data. The drying kinetics was fitted with six published exponential thin layer drying models. The models were fitted using the coefficient of determination (R2), and root mean square error (RMSE). The modeling of models using raw data tested with the possible of exponential drying method. The result showed that the model from Two Term was found to be the best models describe the drying behavior. Besides that, the drying rate smoothed using CS shows to be effective method for moisture-time curves good estimators as well as for the missing moisture content data of seaweed Kappaphycus Striatum Variety Durian in Solar Dryer under the condition tested.