Abstract

The effect of low ambient temperature condition on the thin layer drying behavior of medium variety paddy (*Oryza sativa Linn)* was studied. Six different types of thin layer drying models were fitted with the experimental data. Among which, *Midilli-Kucuk model* gave the best fitted data for describing the drying behavior of this type of paddy with R^2 value ranging from 0.9861 to 0.9969. Drying rate constant k increased with the increase in drying temperature as the driving force for heat and mass transfer is enhanced by the high temperature. In order to find out superior result, generalization of the *Midilli-Kucuk model* was done. Two approaches (i) globalization of drying rate constant and (ii) the technique of master curve were used as obtained by superposition of temperature. In this technique, temperature shift factor (a_T) was used to generate a single master curve expressing moisture ratio as a function of reduced time, t' ,product of time (t) and temperature shift factor (a_T). Superposition technique gave best fit with a R^2 value of 0.998 than the global drying constant model. This technique gave superior result than the best mathematical model. Effective diffusivity linearly increased with increase of temperature where its range varied from $1.89X10^{-10} m^2/s$ to $5.41X10^{-10}$ m^2/s The value of activation energy of this type of paddy varied from $5.83X10^{+04}$ to $6.01X10^{+04}$ kJ/mol. Sorption isotherm analysis of the paddy was done by dynamic method with the use of water activity meter.ANN modeling was done in order to describe the sorption isotherm behaviour of this type of paddy. It was done by developing a program in MATLAB-R2009a software. ANN modeling with architecture of 2-7-1 showed best fitted result with a R^2value of > 0.99 and a very less MSE value. An in bed dryer was designed for the deep bed drying of the paddy in Assam. In this dryer, three levels namely top, middle and bottom layer were designed at a distance of 10cm for each level. The drying experiment was carried out at 35^0C by maintaining proper air velocity and heating arrangement. For analysing the deep bed drying behaviour of paddy Finite difference method was used. By using generalized thin layer drying equation and emc obtained from the ANN modelling of sorption isotherm analysis of the paddy, a matlab program was developed in order to predict the moisture and temperature profile at each depth. Hence, with the help of this program, deep bed drying analysis of the paddy was done under low ambient temperature conditions.

Keywords: *Thin layer drying, sorption isotherm, in bed drying, ANN modeling, finite difference method*