ABSTRACT

In this research work, a study has been conducted to determine the moisture diffusivity in food-slab and batch drying processes by application of different Artificial Neural Network (ANN) models. This study will help in automatic monitoring and process-scheduling of batch drying process as follows. The drying parameters for desired final moisture can be estimated from the measured discrepancy of moisture content at the end of the previous batch of the load. This procedure can be used to tune the parameters for the subsequent loads and hence can enhance the drying quality effectively. For this study, slab drying experiments were carried out on potato pieces to create a data base of instantaneous mass of the dried product. For deep-bed simulation the data were taken from the experiments on barley drying process carried out in Boyce (1965). The Artificial Neural Network (ANN) models were used for (1) prediction of moisture-content at different drying times with inputs as velocity, temperature, humidity, sample-thickness and time, and (2) prediction of moisture diffusivity. The predictions of the moisture diffusivity by the following methods were compared: (1) developing ANN model using drying data from slope method, and (2) inverse-mapping-solution of Fickian diffusive model by a Recurrent Neural Network (RNN) using drying data. The contribution of this study is the second method of the prediction of the moisture diffusivity. This method of determination of diffusivity permits incorporation of detailed physical processes accompanying a convective drying process. Hence, this method is able to overcome the major limitations of the slope method. The concept of semi-physical ANN modeling as an RNN is also extended to deep-bed drying of grains to estimate the drying constant of the grain as a function of temperature. It was found that the drying rate relation developed on the basis of the air temperature measurement can predict the final moisture with acceptable accuracy.

Key words: Artificial neural network, recurrent neural network, diffusivity, slope method, slab drying, deep bed drying