Abstract

Tomato (*Lycopersicon esculentum* Mill) is one of the most important vegetable crop cultivated all over the world for its fleshy fruits. The present study aimed to evaluate the physical and drying quality of three categories of tomato viz. under-ripe, ripe and over-ripe categories, using a computer vision system (CVS). CVS based measurement of color, and projection areas have been considered for the evaluation of tomato quality.

For standardization of the CVS system, a feed forward neural network model (NN_1) was developed to convert the CVS read RGB values of a standard colour card to give manufacturer given L*a*b* values of the card with accuracy percentage of 99%. The best results showed with excellent abilities were at 30 hidden units with a R^2 of 0.9980 and MSE of 0.00021. Based on the color, a neural network (NN_2) was developed to identify the ripening stages of tomato, 105 number of tomato were classified in their 3 ripening stages with an accuracy of 96%, with 30 hidden neurons and a 100 % classification was done when a threshold value of 0.7 was used for test sample size of 15. Also with the help of simple discriminant analysis technique, it was possible to correlate area with weight with an accuracy of 99%, using neural network based classifier (NN_3), with 3 hidden neurons. This approach can be helpful in online grading of tomato on the basis of size.

Drying kinetics of tomato was evaluated using six models viz. Exponential Equation, Page's model, Power equation, 2nd Order Polynomial equation, Handerson and Pabis and Midilli-Kucuk model. Models were evaluated on the basis of low SSE, RMSE and χ^2 test and it was found Midilli-Kucuk showed best fit. Also, it was observed from model constant *A* that most drying of tomato takes place in falling rate, as value of *A* lies between 0.9 to 1.014. Through response analysis of fully factorial experimental design, it was also concluded that temperature has highest effect on drying kinetics than size. Also a color degradation of tomato during drying was studied using ΔE value obtained by using NN_1, and it was found that color degradation follows first order reaction kinetics, with an average R^2 value of 0.9130.

Also a Box–Behnken design was used to optimize drying conditions in fluidized bed dryer, three responses viz. moisture content, rehydration ratio and ΔE obtained were fitted to quadratic model using Design expert 8.0.7.1 and model showed a good fit with a R^2 of 0.9731, 0.9544 and 0.8955 respectively.. Drying time has highest effect moisture content and ΔE of tomato cubes where as size has highest effect on rehydration ratio. By using optimization tool of Design expert (RSM), optimized sample was obtained with a minimum moisture content, high rehydration ratio and low ΔE. A shelf life study of samples stored in LDPE storage was also done and it showed that highest color change occurs during first 10 days of storage then after color change was small both at room temperature and 40°C.

Keywords: *computer vision system, artificial neural network, Midilli-Kucuk model, box–behnken design.*