

ABSTRACT

Drying of black tea was thoroughly studied by developing characteristic drying curves for tray and vacuum drying of orthodox and CTC tea at three selected temperatures of 65, 75 and 85°C. Constant rate and falling rate periods of drying were identified and drying mechanism during falling rate period was determined. For both orthodox and CTC tea, duration of drying was shorter in case of vacuum drying than tray drying. Drying time was reduced at elevated temperatures. The moisture loss during falling rate period was very low as compared to the constant rate drying period. The data obtained from tray and vacuum drying of orthodox and CTC tea were fitted to four thin layer drying models viz. Lewis, Page, Handerson & Pabis and modified Page models. Page model provided best fitness as it showed the highest value of coefficient of determination (R^2) and the lowest values of chi square (χ^2) and root mean square error (RMSE).

Effects of different parameters of drying such as level of vacuum inside the drying chamber (mm Hg), plate temperature ($^{\circ}\text{C}$) and loading rate ($\text{kg dry solid. m}^{-2}$) on tea quality viz. redness index (Δa) and yellowness index (Δb) of tea liquor and aroma index of dried tea were studied. For CTC black tea, highest value of redness index (Δa) was obtained at moderate vacuum (670-700mm Hg) and high plate temperature (95 $^{\circ}\text{C}$); but in orthodox, highest redness was obtained at high vacuum level (730 mm Hg) and moderate temperature (85 $^{\circ}\text{C}$). Highest value of yellowness index (Δb) for CTC tea was obtained at high vacuum (724 mm Hg) and at moderate plate temperature (85 $^{\circ}\text{C}$) and the same was obtained for orthodox tea at low vacuum (670 mm Hg) and extreme plate temperatures such as 75 and 95 $^{\circ}\text{C}$. Drying at higher levels of vacuum resulted higher aroma in CTC tea. But in orthodox, more escape of aroma was observed at higher vacuum (730 mm Hg) level as the leaves were largely loose fragments.

Vacuum drying parameters were optimized to obtain maximum values of Δa , Δb and aroma index. For orthodox tea, the optimized values of the independent parameters viz. vacuum level, plate temperature and loading rate were 672.35 mm Hg, 75 $^{\circ}\text{C}$ and 0.15 kg dry solid m^{-2} respectively and the values of predicted dependent parameter, Δa , Δb and aroma index were 13.84, 3.94 and 8.89 respectively. For CTC tea the optimized values of independent parameters were 722 mm Hg, 75 $^{\circ}\text{C}$ and 0.18 kg dry solid m^{-2} respectively

and the values of predicted dependent parameter, Δa , Δb and aroma index were 19.83, -2.33 and 9.38, respectively.

Heat utilization efficiency of vacuum dryer was 64.73 % for orthodox tea and 52.4 % for CTC tea.

Key Words: Vacuum dryer; Orthodox; CTC; Quality of tea; Heat utilization efficiency