

DRYING CHARACTERISTICS OF COFFEE IN AN INDUSTRIAL SCALE HEAT PUMP DRYING SYSTEM

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Coffee is one of the most popular beverages in the world and its quality is greatly depending on nature of drying. This study was conducted to assess the drying characteristics of coffee beans in an industrial batch type heat pump dryer. Heat pump drying systems outperformed to produce high quality products at optimum energy efficiency. Moisture content and colour change of coffee beans in the entire drying process were examined. Further, the physical properties of coffee beans such as bulk density, true density, and volume reduction were examined. The moisture content of coffee beans was reduced from $70.04 \pm 3.43\%$ (wb) to $8.72 \pm 4.68\%$ (wb) in the lowermost layer in 85.5 h. The colour of coffee beans was ranged from $L^*=50.38$, $a^*=-13.14$, and $b^*=30.81$ to $L^*=27.83$, $a^*=6.04$, and $b^*=7.48$ in the lowermost layer. The bulk density of the batch showed a considerable reduction from 0.515 gcm^{-3} to the lowest 0.347 gcm^{-3} . Similarly, the true density varied from 1.074 gcm^{-3} to 0.679 gcm^{-3} . The weight per unit area also showed a considerable reduction from 6.263 kgm^{-2} to 1.940 kgm^{-2} . The results indicated that the moisture content and colour of coffee beans showed a significant difference in different layers of coffee in the drying chamber. Heat pump dried coffee beans in the lowest layer achieved the standard dried coffee bean moisture content. Also, the colour of coffee beans on the lowest layer did not change significantly. Standard dried coffee bean having premium characteristics contains 8 to 12% (wb) moisture. In this dryer, quality characteristics showed significant differences in the drying chamber. Therefore, to obtain coffee beans having desired characteristics for whole batch, several modifications such as flipping or stirring the lot and placing a lid with an appropriate exhaust pipe to retain a uniform temperature within the drying chamber can be recommended to improve the drying efficiency.

Keywords: Coffee, Drying, Heat pump