Transport Properties Of Cellular Food Materials Undergoing Freeze-Drying

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Abstract

The samples of sliced and mashed apples were freeze-dried by controlling their surface temperatures over the usual pressure range of commercial operations. The surface of sliced samples could not be maintained at above 10°C in order to prevent the frozen layer from melting, while that of mashed samples was allowed to heat up to 70°C.

Thermal conductivities and permeabilities were determined by applying the uniformly-retreating-ice front model to the dried layer of the samples undergoing freeze-drying. The values of permeability for the mashed samples were found to depend on the ice-crystallization time during freezing. The results indicated that the drying rate of sliced samples was limited by the transfer rate of water vapor flowing through the dried layer. A cellular structural model is proposed for predicting the permeability of the dried layer, based on the resistance of the cell membrane to molecular transfer of water vapor.
Keywords: Cellular structural model; Drying characteristics; Mashed apple; Permeability; Sliced apple; Thermal conductivity