Modeling and Simulation of Smoking and Drying of Protein-based Food Products

KHOZIN N. (1), HELDMAN D. (1)
1 Ohio State University, Columbus , United States

A mathematical model for simulation of simultaneous heat and mass transport was developed to describe the smoking and drying of protein-based food products in an industrial smokehouse. In this model, the governing equations for heat and mass transfer for a solid cuboidal body were numerically solved using a finite element technique. In addition, a kinetic model was coupled to the heat and mass transfer computations to simultaneously predict the development of product surface color in terms of the browning index (BI) during the drying process. This provides predictions of moisture content, temperature, and surface color profiles of the product in a space-time domain during the smoking and drying process as a function of various operating conditions.
Predictions compared well with the experimental values, suggesting that the proposed numerical model can be used with confidence for the simulation of transport phenomena in optimizing the design and operation of smokehouses that minimizes process time while achieving the desired surface color. The study has depicted the significance of establishing optimal and controlled smoking and drying conditions because the effects of the key operational parameters on processing time and the associated changes in product surface color were found. The modeling strategy proposed here can be extended to other food products and different quality indices.