Title Transport phenomena modelling during produce cooling for optimal package design: Thermal sensitivity analysis

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Abstract

Mathematical modelling of transport phenomena was performed to assess the cooling of produce with respect to package design during forced convection cooling. Nine different vent designs including 1, 2, 3 and 5 vents corresponding to 4 different vent areas of 2.4, 4.8, 7.2 and 12.1%, respectively, were simulated. More uniform produce cooling with less cooling time was obtained where there were properly distributed vents on package walls with enough opening area. Experimental validations were performed considering produce centre temperature at 4 positions inside 3 different ventilated packages. Good agreement between experimental and simulated temperatures was obtained with mean absolute error of 2.2 °C considering all the 3 vent configurations. The study showed that for a suitable package design, with respect to different vent areas and positions on package walls, it is necessary to consider both produce cooling time as well as cooling uniformity during the cooling operation.