Title CFD simulation of effects of operating parameters and product on heat transfer and moisture loss in the stack of bagged potatoes

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Abstract

The heat and mass transfer within the stacked bags of potato depend on many parameters of both product and operating conditions. Most important of these are: rate of metabolic heat generation, porosity of the bulk medium, diameter of the product, resistance of the product skin preventing moisture loss, and temperature as well as RH of the storage air. Therefore, the effect of the parameters of the product and the operating conditions on heat and mass transfer in the stack of bagged potatoes during the transient cooling and at steady state were studied using the CFD modeling approach. It was found that increasing the porosity of the bulk medium as well as product diameter reduced the product temperature and moisture loss during the cooling. The metabolic heat of respiration and storage air temperature increased the temperature of the product and moisture loss during the transient cooling and steady state. Moisture loss and RH in the bulk medium increased with increasing the skin mass transfer coefficient. Increasing the storage air temperature linearly increased the average product temperature at steady state. It was also observed that in comparison to storage air temperature, the RH of the storage air had more influence on the moisture loss from the product. The cool-down time was decreased with the increase in bulk medium porosity, product diameter and metabolic heat of respiration. It was found that large variations in moisture loss could be expected if the characteristics of the product and storage conditions varied from the prescribed ones.