

#### Abstract:

The variability in temperature that occurs between hazelnuts during roasting was investigated. A deterministic model (based on the analytical solution for a spherical solid body) of unsteady state heat transfer in a hazelnut was developed. The mean and standard deviation in the thermal and physical properties of hazelnuts have been measured before and after the roasting process. Hazelnuts were roasted individually for 500 seconds in a conventional fan oven. The mean and standard deviation in hazelnut temperature versus time during a roasting process have been experimentally quantified. The Monte Carlo method was applied to the analytical solid sphere heat transfer model to estimate temperature variability assuming the thermal and physical properties are normally distributed. The Monte Carlo simulation gave satisfactory predictions of mean hazelnut temperature versus time. The simulation provided a good estimate of the standard deviation in hazelnut temperature versus time for the initial stages of roasting. The prediction of standard deviation for the times over 350 seconds of roasting was not as good. One probable reason for the poor prediction of standard deviation in temperature for the final stages of the process was shown to be the changes in the thermal properties of hazelnuts during roasting. The development of a model to predict the distribution in hazelnut temperatures during the roasting process is necessary for the optimisation of the industrial roasting process.