Uncertainty and sensitivity analysis: Mathematical model of coupled heat and mass transfer for a contact baking process - DTU Orbit (29/12/2018)

Uncertainty and sensitivity analysis: Mathematical model of coupled heat and mass transfer for a contact baking process

Similar to other processes, the modelling of heat and mass transfer during food processing involves uncertainty in the values of input parameters (heat and mass transfer coefficients, evaporation rate parameters, thermo-physical properties, initial and boundary conditions) which leads to uncertainty in the model predictions. The aim of the current paper is to address this uncertainty challenge in the modelling of food production processes using a combination of uncertainty and sensitivity analysis, where the uncertainty analysis and global sensitivity analysis were applied to a heat and mass transfer model of a contact baking process. The Monte Carlo procedure was applied for propagating uncertainty in the input parameters to uncertainty in the model predictions. Monte Carlo simulations and the least squares method were used in the sensitivity analysis; for each model output, a linear regression model was constructed and the standardized regression coefficients (SRCs) and R² were computed. The effect of input parameters on model predictions was calculated, and the relative impact of the parameters on each of the outputs was ranked. Results of the uncertainty and sensitivity analysis can be used to prioritize future experimental efforts, as discussed for the contact baking process.

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