Extending Engineering Simulations to Scientists: Food Safety and Quality Prediction Using COMSOL Multiphysics® and LiveLink™ for Excel®

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Abstract

The objective of this study was to develop an easy to use interface in Excel® that connects to not only the solvers in COMSOL Multiphysics®, but also existing databases of food properties, foodborne pathogenic microorganisms kinetics, and chemical kinetics (see Figure 1), creating a comprehensive simulation software to predict food safety and quality. This study builds on the previous work of Halder et al. (2010) by updating databases and increasing the flexibility and versatility afforded from the LiveLink™ for Excel® available from COMSOL. The food database groups over 8000 foods from the 2012 USDA Natl. Nutrient Database into 14 food groups while including the pathogen and chemical kinetics databases from Halder et al. (2010). The user-interface easily allows the user to select the food, pathogen, and chemical name and then press a visual basic application (VBA) macro button that retrieves the food properties and kinetic equations for the user based on the food. Effective transport properties are then automatically calculated for the user inside COMSOL. The extension of macros significantly improves the data retrieval process, instead of the laborious task of searching through the databases for values and then calculating transport properties.

The main features of the user interface (see Figure 2) are that it includes an easy to use meshing algorithm, seamless data retrieval through VBA macros, easy input for boundary conditions, and post processing plotting already set-up for the user. This easy to use interface has been set up for several food processes with a focus on safety and quality with the main purpose of having the user only deal with the most critical of input parameters for their work, whether it be in industry, extension, or academia.

Reference

A. Halder et al. Development of Associations and Kinetic Models for Microbiological Data to be Used in Comprehensive Food Safety Prediction Software, Journal of Food Science, 75(6) R107-R120 (2010)

Figures used in the abstract

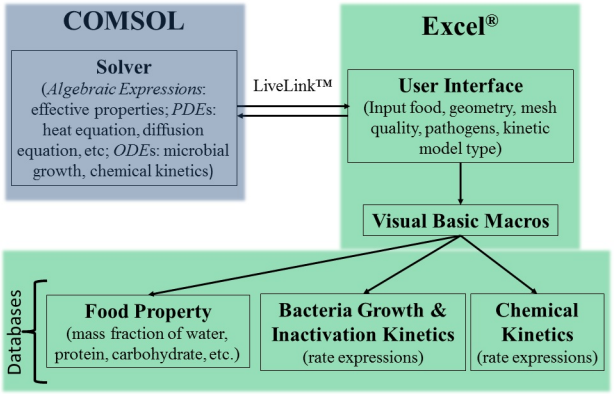

Figure 1: Design of food safety software

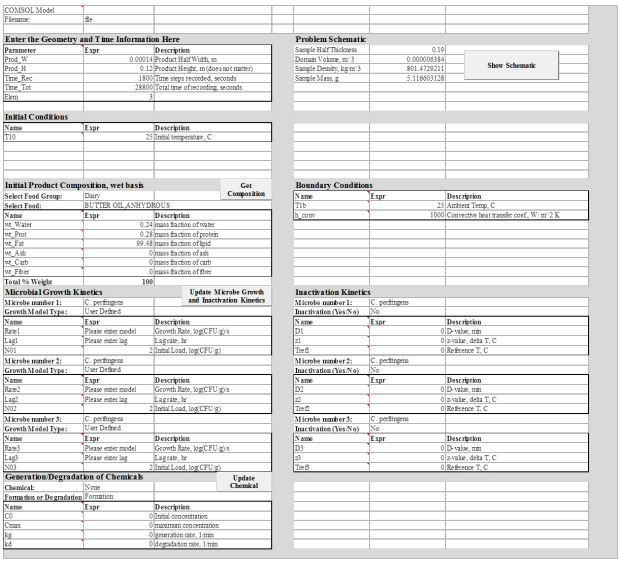

Figure 2: Excel User Interface