UNIVERSITY OF GUELPH, SCHOOL OF ENGINEERING
ENGG*4300 FOOD PROCESSING ENGINEERING DESIGN, F'2007

Calendar description
Formulation of mathematical models to describe food processing operations and the response of foods to such operations. Process evaluation, development and computer-aided design of operations such as thermal processes and food freezing. The influence of water activity and structure on the enzymatic, cellular, organic and structural systems of foods. The properties of powders and particulate foods and mechanical operations with solid foods.

Prerequisite(s): ENGG*3260, ENGG*3830

Objectives
1. To develop mathematical models of various food processes, and simulate them on a computer using a simulation language.
2. To design and develop processes for food manufacturing.
3. To develop and optimize process conditions for unit operations with and without mathematical models.
4. To select reasonable indicators of microbial, nutritional and organoleptic quality for a given product and process, and to identify process uncertainty for better process.

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Text
Advanced Food Engineering Notes by G.S. Mittal

Topics
1. Modeling and Simulation
   - ISIM
   - Metlab-Simulink
2. Modeling based on Mass and Energy Balances
   - 2.1 Mass Balance Procedure
   - 2.2 Energy Balance Procedure
   - 2.3 Process modeling and simulation
     - 2.3.1 Pasteurization of a beverage in a can
     - 2.3.2 Temperature profiles of particulate solids in liquid during pasteurization
3. Modelling Food Processes Involving Transport Processes
   - 3.1 One Dimensional Mass Transfer in an Infinite Slab
   - 3.2 One Dimensional Mass Transfer in an Infinite Cylinder
   - 3.3 Two Term Model
   - 3.4 One Dimensional Mass transfer with Concentration dependent Moisture Diffusivity–Infinite Slab

3.5 One Dimensional Heat and Mass transfer with Concentration dependent Diffusivity–Infinite Cylinder
3.6 Modeling Mass transfer by Diffusion and Convection in an Infinite Slab
3.7 Modeling Mass transfer by Diffusion and Convection n an Infinite Cylinder
3.10 Frozen food transport in insulated containers - modeling and simulation

4. Cooking and Frying Processes
4.1 Introduction
4.2 Frying
4.3 Dielectric and microwave drying
4.4 Osmotic drying
4.5 Roasting
4.6 Cooking of a Spherical Product--modeling and simulation
4.7 Modeling the deep-fat frying of spherical food products
4.8 Crust formation dynamics and quality kinetics during meatballs frying

5. Food Quality Modeling
5.1 Thermal Softening of Potatoes and Carrots
5.2 Selection criteria of meat emulsion fillers based on cooking kinetics and filler properties
5.3 Kinetic Modelling of Quality Changes of Fruits and Vegetable in Storage

6. Process Optimization
6.1 Product development process and process flow charts
6.2 Process flow charts
6.3 Linear Programing
6.4 Dynamic Programing

7. Process Modeling and Design
7.1 Blanching
7.2 Heat and Mass Transfer in Spherical Biological Products
7.3 Simulation of Heat Transfer in an Apple during Air Cooling
7.4 Modelling of a Scraped Surface Heat Exchanger (SSHE)
7.5 Dynamic Simulation of a Nonlinear Model of a Double-Effect Evaporator
7.6 Two Dimensional Heat Transfer Through A Can During Thermal Processing

8. Food Thermal Processing
9. Food Freezing

Evaluation

Assignments (25%) and Projects (25%)	50%
Examination I	25%
Examination II (Final)	25%

Reference material

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