You are a team of new project engineers at FOODSCorp. Your engineering team receives this email regarding a new job your company, FOODSCorp, has been contracted to do.

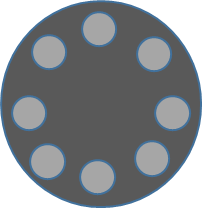
-----Original Message-----  
From: Jennifer Gonzalez [[mailto: jgonzalez@lyoncorp.com](mailto:mailto:%20jgonzalez@lyoncorp.com) ]   
Sent: Tuesday, March 10, 2017 7:00 AM  
To: Purdue Engineering Team  
Subject: Sterilization Line Malfunction  
  
Hey FOODSCorp team,

We know we have done work with you before and are confident we will get great results again. Last night one of our heaters before the filler went out for our canning sterilization line. The manufacturer of the filler is unfortunately in Germany and this is a specialty part, so we don’t expect to get the new heating element for a couple of months. In addition, we reached out to general machining, however, they too cannot generate the new heating element. The line is work about 10k an hour and runs four different products, so anything we can do to get it running again the company is willing to try.

Our hope is within the next two weeks to get the line back up and running by adjusting processing parameters, however, we do not have the capabilities in house to model the process using MATLAB software. The heating element was originally able to heat the food material prior to canning to 200 oF however, the replacement part we found can only achieve a filling temperature of 180 oF currently. After the food is canned, it is heated to commercial sterilization and then it is cooled with water. Our micro team has asked per company policy that we achieve a 12-15 log reduction in microbial load prior to production. Our quality team has asked that we maximize our Vitamin B1 and Vitamin C intact in all products.

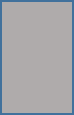
I’ve attached a document overviewing the properties of the food materials as well as a blueprint overviewing our production process. Please deliver us an appropriate computational model via MATLAB software that is capable of outputting visuals of the sterilization process for all four food products showing temperature at various points along the radius as a function of time in addition to plots describing micro load and nutrition degradation. This program should also be able to describe optimal conditions for nutrient retention. In addition, if you could inform us of potential additional energy and time costs from our normal process that would be helpful. The production runs primarily in the midwestern United States.   
  
Thanks!  
Jenn  
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
CAUTION: This email originates from outside of FOODSCorp.  Please consider carefully whether you should click on any link, open any attachment, or provide any information.

BluePrint – Canning Production Line



Filling Full Steam Immersion Cooling Water

Retort Immersion



Material Fill Temp: 200 oF

Outside Room Temp: 85 oF

Target exit Temp: 100 oF (average temperature in the can)

Cooling Water Temp: Randomly fluctuates between 50-60 oF

Residence Time: User selects

Maximum Steam Temperature: 250 oF

Maximum Rotation Speed: 10 RPM

Properties of the food materials and microbes

Production Line Time Breakdown

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Food Material** | **Moisture Content (%)** | **Can Size (Can #)** | **Water Activity (aw)** | **Percentage of Production (%)** |
| Tomato Soup | 81-84 | 2 | .96 | 42 |
| Cream Corn Puree | 70-72 | 10 | .93 | 25 |
| Pumpkin Pie Filling | 45-50 | 3 | .98 | 23 |
| Nacho Cheese | 80-85 | 1 tall | .96 | 10 |

\*Assume a conduction process inside the can.

Kinetic properties of food components

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Z-value (oF)** | **Ea (kcal/mole)** | **D250-value** |
| Thiamine | 47-49 | 21-27 | 246.9 min |
| Ascorbic Acid | 48-52 | 22-24 | 1.12 days |
| Cobalamin | 46-49 | 20-24 | 1.94 days |

Kinetic properties of microorganisms

|  |  |  |  |
| --- | --- | --- | --- |
| **Microorganism** | **Z-value (oF)** | **Ea (kcal/mole)** | **D250-value** |
| C. Botulinum | 12-19 | 64-82 | .1-.2 min |
| C. Perfringens | 15-19 | 72-79 | .02-.04 min |
| B. Cereus | 14-18 | 65-71 | .005-.008 min |

Properties of food materials

|  |  |  |  |
| --- | --- | --- | --- |
| **Food Material** | **Emmissivity** | **pH** | **Light Transmittance (%)** |
| Tomato Soup | .87 | 4.7 | 5.0 |
| Cream Corn Puree | .89 | 6.1 | 4.0 |
| Pumpkin Pie Filling | .75 | 5.1 | .01 |
| Nacho Cheese | .80 | 5.8 | .05 |

Please deliver the following to FOODSCorp as the engineering team that is solving this problem. There will be three stages of deliverables for this assignment.

**Deliverable 1 – Prepping the model template (due at end of lab on 9/13)**

Working with your group, outline the proposed solution in the provided template report (individually) giving the following. **This will be done in lab time on 9/13.**

**Deliverable 2 – Building the model template, commented coding files (due at beginning of class (9/27)**

A building the model template report (individual) along with the commented m.files that answers all of the following (bring to class on 9/20). Bring a printout of your m.files to class. Each member of the group should code and comment their own model, with each group member modeling the process for one of the four different foods produced.

**Deliverable 3 – Evaluating your model notes (due at end of lab on 9/27)**

Each group will meet with 2-3 other groups to discuss differences in how they approached the problem; in both a mathematical and computational sense. An evaluating the model notes template will be provided. **This activity will be completed in class on 9/20 during the first hour of lab time.**

**Deliverable 4 – Reflecting on your model (due at the beginning of class on 10/02)**

An individual reflection report template (due before class on 10/02), which overviews the difference observed from the second in class activity and allows for reflection as to how your model could be improved or useful in future iterations.