CHE462SExam 1990

Thermal processing

1. a. A canned product is placed in a steam retort, and the temperature in the coldest spot of the can is monitored. The following temperature profile was obtained:

time (min.)	Temperature
0	77° C
5	87
10	97
15	103
20	109
25	115

The product was then held at 115°C, and quenched rapidly by immersion of the cans in cold water.

Given that the D_{121}= 2.8 minutes and z=15 calculate the time required at 115° C for a 12D reduction in C.Botulinum. Assume that the temperature rise between measurements is linear.

Edible oils

2. a. Give the process flowsheet, showing the reagents added, and reaction conditions, for the physical refining of canola oil.

b. Iodine value (IV) is defined as grams of iodine that can react with 100 grams fat. Assuming that the average molecular weight of a triglyceride is 900, and the molecular weight of I_2 is 254, calculate the weight of hydrogen used by a plant producing 240,000kg of margarine feedstock (IV=70) from canola oil (IV=120). Ignore the small change in molecular weight due to the hydrogenation process. What would be its volume?

DO **EITHER** QUESTION THREE **OR** QUESTION FOUR

Baking

3. a. Describe, with the use of chemical equations, the processes that cause leavening of bakery products.

b. Describe the three different dough preparation techniques we saw at Christie Brown and Co. What is the reason for using these different techniques?

Chocolate

4. a. What is chocolate?

b. What is the function of the conching step in the production of chocolate?

c. What is cocoa butter? Give the process flow diagram for its manufacture. Briefly describe each processing step.

Nutrition:

5. a. Calculate the calorie content of a meal consisiting of a 113 g hamburger patty on a 150 g bun, with 100g french fries, and 225mL milk. - The following compositions are given:

	Protein %	Carbohydrate %	Fat %
hamburger	25	2	28
bun	10	60	5
fries	5	50	25
milk	2	3	3.6

b. Comment on the nutrient balance in this meal. What nutrients may be used to balance it better? What foods could provide the required nutrients?

c. List the fat-soluble vitamins, and their physiological function.

Refrigeration

6. 5000 lb/h of a dairy product is pumped at 80°F to a refrigerated working space, which is maintained at 20°F. The product is chilled to 20°, solidified and packaged. Its thermal properties match those of butter. Calculate the heat-load on the refrigeration system given the following information:

- The room dimensions are 50 x 50 feet, with 15 foot ceiling.
- The room shares two walls with the plant, which is maintained at 70°F, the one outside wall is facing south, and its effective oustside temperature is the same as that of the roof: 120°F. The product passes to a freezer at -20°F through the remaining wall.

The walls are insulated by 8“ expanded polystyrene, the roof has 8” fibreglass insulation, while the floor is 6” corkboard on grade, which can be assumed to be at 50°F.

- assume normal traffic density
- lighting is provided by 27 light fixtures consuming 100W each
- the installed motor capacity of the equipment is 30 HP
- three people work in the room during each shift

1HP = 2600BTU/h= 750W

Presentations:

7. **CHEMICAL ENGINEERING STUDENTS:** ANSWER TWO (2) of the FOLLOWING SIX (6). You may not select your own presentation topic.

a. Describe the process of making champagne.
b. Describe the process of making bagels.
c. What are preservatives? How are they made?
d. What are the functions of nitrite? What are its advantages and disadvantages?
e. How is instant decaffeinated coffee made?
f. Describe the process of making cheese.

ENGINEERING SCIENCE STUDENTS:

Mass, heat and momentum transfer are central to most chemical processes. Compare these operations in chemical and food processing applications.

DO **EITHER** QUESTION 8 **OR** QUESTION 9

Brewing

8. a. Describe the lauter tun and its operation.
b. Give the flow diagram of the brewing process starting from, and including, the brewing kettle. Indicate the processing conditions. Describe the chemical reactions occuring at each of the stages.

9. a. What are the functions of the grooves, or rifling in a single-screw extruder?
b. Describe three techniques of obtaining compression in the barrel of an extruder?
c. Name three functions of a food extruder. Give the operating characterics and typical products of three types of food extruders.

DO **EITHER** QUESTION 10 **OR** QUESTION 11

10. The following difference tests can be used to distinguish between food samples:

triangle test
duo-trio test
paired comparison test
ranking

Briefly describe these tests. Describe how you would determine how much a series of six products differ from each other?

11. a. Describe the source, causative organism, time of onset and mechanism of action for two types of food-borne disease.
b. List three food products, not containing ethyl alcohol, that are produced usingat least one microbial reaction. Briefly describe one process, naming the microbes involved.

1133SExam 1990
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