Assignment #1
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1. **Examine the ingredient list for Yves Jumbo Veggie Dogs. Vegetable protein and a vegetable gum are included to help give the product its structure. Identify these ingredients and discuss their functionality with respect to product structure. (8 marks)**

Vegetable Proteins:	*Vegetable Gums:*
Soy Protein	**Carrageenan**
Wheat Gluten	**Wheat Starch**

The company Yves produced a "Jumbo Veggie Dog" that is alleged to be 60% larger than their original veggie dogs. The company incorporates vegetable proteins, (soy protein, wheat gluten) and vegetable gums, (carrageenan, wheat starch). These ingredients help aid to the meat-like texture and are popular in meat substitutes.

Wheat gluten is made by kneading flour to create strands of gluten protein; it is then rinsed, washed out, and cooked to be used as a meat substitute (Julson, 2018). Wheat gluten is known for being packed with proteins, making it a sought-after meat alternative. A 50g serving of wheat gluten mixed with water can produce 2 ounces of seiten, which contains about 38 grams of protein (Billings-Smith, 2018). Wheat gluten is able to be manipulated, cooked and seasoned; soy protein retains water when used. This can also be seen as beneficial because this allows the substitute to maintain juiciness; aiding to a real meat-like texture.

In regard to vegetable gums; Yves Jumbo Veggie Dogs use what is known as Carrageenan and wheat starch. Carrageenan and Wheat Starch are both called "polysaccharides", which is a combination of more than two sugars that are extremely large (Parker, 2017). Carrageenan is a naturally occurring polysaccharide; it is added to foods to increase fiber content and helps functionally by thickening substances and stabilizing proteins. What starch is also a polysaccharide, but is made up of glucose units; the number of glucose units within a starch vary widely depending on the starch (Parker, 2017).

2. **The 2 ingredient lists presented below are derived from a product consisting of a creme filling sandwiched between 2 cocoa cookie wafers. The 2 formulations represent different versions of the same type of product. (Note that ingredients are listed in descending order by weight.)**

Regular product:
sugar, enriched wheat flour, palm oil, cocoa, high fructose corn syrup, baking soda, cornstarch, salt, soy lecithin (emulsifier), artificial flavour, chocolate

Reduced calorie product:
maltitol, enriched wheat flour, palm oil, polydextrose, cocoa, cornstarch, glycerin, milk protein concentrate, inulin, whey protein concentrate, soy lecithin (emulsifier), baking soda, salt, dextrose, artificial flavour, cellulose gum, chocolate, cream, acesulfame-K, sucralose

The lower calorie version has a modified formulation which attempts to mimic flavour characteristics and creamy mouthfeel associated with the regular formulation. Identify 2

ingredients responsible for imparting flavour and 2 ingredients responsible for imparting mouthfeel in the reduced calorie product. Discuss their roles in the reduced calorie formulation in comparison with ingredients performing the same function in the regular formulation. (12 marks)

Ingredients that mimic flavour characteristics;

Sucralose: Sucralose is what is known as a high-intensity sweetener. High-intensity sweeteners are used to provide a sweet flavour to foods without the caloric additives; in fact, these sugar substitutes have no additional calories. This is because either less sweetener is necessary or because the sweetener cannot be metabolized by the human body, therefore not contributing any calories (Parker, 2017). High-intensity sweeteners also usually don't have the same added properties that sugar does when it comes to mouthfeel or other desired properties.

Maltitol: Maltitol is also known as a high-intensity sweetener with a sweetness rating of 68/100, compared to pure sucrose at 100 (Parker, 2017). A high-intensity sweetener like this contributes dramatically to the flavour characteristics of the product. Sugar would be the main ingredient in the regular product to compare with maltitol, but sugar comes with a few setbacks. Sugar has additional caloric value and unlike sugar, maltitol is not fermentable by bacteria meaning it does not contribute to things like tooth decay. Sugar substitutes are made by reducing sugar, chemically, to an alcohol (Parker, 2017).

Ingredients that mimic mouthfeel;

Glycerin: Glycerin is used as a sweetener and may help preserve foods however, it can also be used as a thickening agent. The thickening properties that glycerin has can attribute to the change in mouthfeel characteristics within the product. Glycerin can be compared to fructose corn syrup, but with less sugar and half the calories; which is why it would be used in a reduced-calorie product.

Cellulose Gum: Cellulose is the most common polysaccharide, and a component of cell walls (Parker, 2017). Cellulose gum is not able to be metabolized by the human body meaning that there is no caloric intake associated with it. Cellulose gum helps add a thickness or creamy effect to food. Mouthfeel textures like this are usually created with other foods like creamers or fats, but those have added sugars and calories; the cellulose gum does not.

3. **Kefir is a milk product touted to have health benefits. Explain why kefir may be slightly alcoholic, carbonated, and have a sour flavour. What microorganisms are used to produce kefir? (5 marks)**

Kefir is a drink made from fermented dairy; similar to yogurt but not quite. The bacteria that act in milk during the fermentation process is called lactose; which produces lactic acid (Knowledge, 2010). The reaction between the lactic acid and the proteins in the milk is what causes that sourness. Keifer has yeasts that act in it; as well as various bacteria (Knowledge, 2010). The

yeast and bacteria react to make a gel "kefiran", which also aids to the texture of kefir. The yeast also turns the sugars in the milk into alcohol and carbon dioxide; this is why kefir has a 0.5 alcohol percentage and has a carbonated/sour flavour (Knowledge, 2010).

4. **According to regulations, maple syrup must have a sugar content of 66% by weight (66 degrees Brix). Calculate the mass of maple sap required to make 500 kg of syrup. How much water must be removed by evaporation to make 500 kg of syrup? Assume that the sugar content of the sap is 3%. (5 marks)**

Sugar Content: 66% *Syrup:* 500 kg *Sugar Content of Sap:* 3%

Sugar = (500 kg) x (0.66) = <u>330 kg of sugar in 500 kg of syrup</u>

The sugar content of the sap is 3% therefore the ratio of sap:sugar is 1:0.03

We now have to solve for the mass of the maple sap (x_{maplesap})

$$\frac{1}{0.03} = \frac{x}{330} \quad \frac{(mass\ of\ maplesap)}{(sugar)}$$

$$\frac{330}{0.03} = x$$

$$= 11000\ kg$$

We now know that the mass of the maple sap is **11000 kg**

$$500kg_{syrup} = 11000\ kg_{maplesap} - y_{water}$$

$$y_{water} = 11\ 000kg - 500\ kg$$

$$y_{water} = 10\ 500kg$$

Therefore, **10 500 kg** of water must be removed by evaporation to make 500 kg of syrup.

5. **A bowl of potato salad was left on the picnic table for 3 hours on a hot summer day. The microbial load was 300 CFU/g when the salad was put on the table. Would the salad be spoiled after the 3 hour period? (Base your assessment on 1,000,000,000 CFU/g as the threshold for spoilage.) Assume a generation time of 20 minutes under ideal growing conditions, with no deaths, immigration or emigration. (5 marks)**

Final load = initial load x $2^{\#generations}$

1,000,000,000 CFU/g = (300 CFU/g) x 2^x , where x is the # generations

$\frac{1,000,000,000}{300} = 2^x$

$3333333.33 = 2^x$

$log(3333333.33) = log(2^x)$

$log(3333333.33) = xlog(2)$

$$x = 21.66\ generations\ \approx 21.7\ generations$$

time required = (21.7 generations) x (20 minutes/generation) = 434 minutes

434 minutes = 7.2 hours

The bowl of potato salad will spoil after **7.2 hours at 21.7 generations**

Therefore, the potato salad will **not** spoil after being left out for 3 hours because it would take approximately 7 hours for the salad to spoil.

6. **Strawberries are quick frozen at a rate of 6500 kg/h. The fruit enters the freezer at a temperature of 15 °C and is frozen to a final temperature of -20 °C. Calculate the rate of heat removal per hour. (5 marks)**

Strawberries
Highest Freezing: -0.8 ℃
Specific heat above freezing: 3.852 kJ/(kg ℃)
Specific heat below freezing: 1.968 kJ/(kg ℃)
Latent heat (L): 300.20 kJ/hr

∴ the decrease in temperature can be shown as: 15 ℃ → *-0.8 ℃* → *-20 ℃*

Q1 = m x Cp x ΔT
= (6500 kg/hr)(3.852 kJ/kg ℃*)(15-(-0.8) ℃)*
= 395600.4 kJ/hr

Q2 = m x L
=6500 kg/hr)(300.20 kJ/kg)
= 1951300 kJ/hr

Q3 = m x Cp x ΔT
= (6500 kg/hr)(1.968 kJ/kg ℃*)(-0.8 – (-20 ℃)*

= 245606.4 kJ/hr

Total heat lost = Q_{total} = Q1 + Q2 + Q3
= (395600.4 kJ/hr) + (1951300 kJ/hr) + (*245606.4 kJ/hr)*
= *2592506.8 kJ/hr*

Therefore, the rate of heat removal for quick frozen strawberries is **2592506.8 kJ/hr.**

References

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