Yogurt Preparation Lab

Introduction
The production of yogurt from the fermentation of milk is an ancient practice that requires a combination of two or more starter cultures such as Streptococcus thermophilus and Lactobacillus bulgaricus. These Gram-positive thermophilic organisms ferment the sugar lactose to lactic acid via glycolysis. The lactic acid makes the yogurt tart, discourages the growth of pathogens, and prevents spoilage. Lactic acid also causes the major milk protein, casein, to form a solid curd, which results in a thick texture.

Lactose is a disaccharide composed of glucose and galactose. S. thermophilus does not possess the enzymes needed to metabolize galactose, and L. bulgaricus preferentially metabolizes glucose. This results in an accumulation of galactose, which adds sweetness to the yogurt. Other components of milk are converted to products such as acetaldehyde, diacetyl, and acetate that, together with the lactic acid and galactose, give yogurt its characteristic flavor and aroma. Some strains of S. thermophilus also produce glucose polymers, which result in a viscous consistency.

Type of Milk
You will be assigned one of several different types of milk. Whole fat cow milk will usually produce a mild tasting and firm yogurt. Nonfat cow milk will produce a more tart and less firm yogurt. Milk from grass fed cows has a different composition than that of grain fed cows. Goat milk contains less lactose and more calcium/potassium than cow milk; it is less allergenic and will produce a lighter yogurt with a stronger flavor. Plant-based milks (almond, soy, coconut, hemp, rice) lack lactose and have less protein than cow milk; they may require the addition of thickeners such as guar gum or gelatin to reach the desired consistency.

In this exercise you will make highly edible yogurt, observe the effect of a starter culture on milk, and compare the quality and flavor of yogurts made with different types of milk.

Materials Needed
- 2 Quarts of Milk (Whole, reduced fat or nonfat cow, goat, or plant-based milk)
- 5-10 grams of Yogourmet freeze-dried starter culture containing L. bulgaricus, S. thermophilus, and L. acidophilus
- Ice water bath and thermometer
- 3-Gallon Pot with lid, spatula, spoon, small bowl/measuring cup, and whisker
- Glass Mason Jar Containers and lids, plastic wrap
- Optional: Water jacket, Guar gum, gelatin, powdered milk, cream, or half and half

1. Pour 2 Quarts (1/2 Gallon) of milk into a 3-Gallon pot. **Optional:** For a thicker texture you can add 2 tablespoons of powdered milk before heating. Adding half and half results in a creamier product. Guar gum, gelatin or other thickeners can be added to planted based milks.

2. **Slowly heat the milk over medium fire** (not so hot that it burns on the bottom) to a temperature of 180-195°F (82-90°C) while stirring constantly. Turn off the heat, place the lid on the pot, and allow the milk to sit for 10 minutes. **Tip:** Whisking the milk occasionally will prevent the formation of a skin during heating and cooling. **Caution: Do not allow the milk to boil over!**

**Note:** This scalding step is done to kill the milk bacteria remaining after pasteurization and to ensure a more consistent product. The presence of milk bacteria can result in undesirable
flavors and textures. Scalding also helps “condition” or denature the milk protein casein, resulting in a smoother yogurt. A water jacket or steam bath can be used during this step to reduce the need for constant stirring.

3. Carefully transfer the pot with the heated milk to a pan with ice and cool water and allow the milk cool to 110-115°F (43-46°C).

4. Dissolve 5-10 grams (one-two envelope sections) of the Yogourmet freeze-dried starter culture into a small amount (e.g.: 1 cup) of the cooled milk in a bowl. Once the culture dissolves completely, add to the rest of the milk and mix in thoroughly.

5. Pour the milk into clean glass pint-sized Mason jars and cover the mouths of the jars with plastic wrap. Punch a couple of holes in the plastic wrap to minimize condensation and place the lid ring over the plastic so that it remains in place during the incubation period.

6. Incubate the covered glass jars for 6-12 hours at 110-115°F (43-46°C) and allow to set. **Disturbing the yogurt during early incubation will interfere with proper setting.**

   **Note:** Incubation temperature and time may vary beyond this range and will depend on the type of starter culture used and individual preferences. Yogurt may be incubated for as little as 4-5 hours if 10 g of the Yogourmet starter culture is added. In general longer incubation periods will result in a thicker, more tart yogurt with less lactose.

7. After the incubation period, place the lids on the jars and refrigerate for up to 2 weeks. **Option:** For thicker, Greek-style yogurt, after incubation, spoon the yogurt into a cheesecloth-lined colander set over a bowl and let it drain, covered in the refrigerator, for at least 1 hour or overnight. Discard or use the whey that drains out for another purpose.

8. During the next lab period record the appearance, texture, aroma, and taste of your yogurt. Compare your product to yogurts made by your classmates with other milks.

   **Note:** “**Good**” yogurt typically has a uniform texture and color. “**Bad**” yogurt may have signs of separating whey and water or bubbles forming near the bottom of the container.

   **Tip:** You can add fruit, honey, granola, or other toppings to make the yogurt more palatable.

9. **Optional Follow Up:** Measure the pH of the different yogurt products. Perform a Gram stain on the yogurt by diluting a small amount of the product with ddH₂O in a test tube and preparing a smear on a slide. Under the microscope, you should observe the presence of Gram-positive bacteria from the starter culture that was added to ferment the milk.

   **The presence of Gram-negative bacteria indicates that the yogurt is contaminated.**

References