

Lab 5: Microbial Fermentation Instructions – (15 points)

The questions for this lab are posted separately (Lab 5: Submission Form).

Objectives:

- To apply and extend the knowledge gained in previous labs.
- To learn by experience the desirable role of microbes in food production.
- To develop an understanding of pH and the role of acids in preserving food.
- To make hypotheses and state whether the experimental data support the hypotheses.

Activity Time: approximately 5 hours or maybe a little longer (however, it is not labor intensive)

Part One:

What You Need:

- 1 pint of milk (whole milk or 2% work better than non-fat milk)
- Candy thermometer (optional)
- Plastic dropper (from lab supply package)
- 1 container of commercially-prepared yogurt with “active cultures”
 - *contains *Streptococcus thermophilus* and *Lactobacillus bulgaricus*:
- pH strips (from lab supply package)
- 1 pot that will hold the milk
- A second container to hold the milk once it has cooled (if the pot is large)
- Spoon
- Heating pad

What to do:

1. Measure out several tablespoons of the commercial yogurt with active cultures and allow to warm up to room temperature while you perform the following steps.
2. Pour the milk into a pot/pan that is large enough to hold all of the milk.
3. Slowly heat the milk to scald the milk.

4. Once the milk has been scalded, remove from the heat, cover, and allow the milk to cool for about 45 minutes to one hour. The milk should still be hot to the touch, but not intolerably hot. If you have a candy thermometer you are aiming for 110°F.
5. *While the milk is cooling answer Question #1 and Question #2 on the submission form.*
6. Use a plastic eyedropper to get a small amount (~ 2 drops) of your milk to test the pH.
7. Put 1 drop on a pH paper strip. Observe the color change (if any) and approximate the pH according to the chart with the pH strips. *Record the pH on the submission form.*
8. Add two tablespoons of yogurt with active cultures to the scalded milk and stir well.
9. Test the pH right after adding the commercial yogurt. *Record the pH on the submission form.*
10. Place the pot with the yogurt mixture onto a heating pad set on “high”. If the pot that you used is really too big, then transfer the milk/yogurt mixture to a smaller container and then place on the heating pad. I actually folded the heating pad over to ensure that the container stayed warm. Since heating pads have automatic shut-offs, you will need to turn the heating pad back on (usually around an hour).
11. After one hour check the pH again. *Record the pH on the submission form.*
12. After two hours check the pH again. *Record the pH on the submission form.*
13. After three hours check the pH again. *Record the pH on the submission form.*
14. After four hours check the pH again. *Record the pH on the submission form.*
15. If the milk has not solidified continue to incubate the mixture up to six hours. *Record the pH on the submission form.*
16. Let the container sit overnight at room temperature.
17. In the morning check the pH again. . *Record the pH on the submission form.*
18. *Answer the questions regarding the yogurt found on the submission form.*

Part Two

What You Need – Part Two

- Quick-rise baker’s yeast
- Table-sugar (sucrose)
- Pop (soda) bottles or water bottles with narrow neck
- Balloons (7 – 10 inch or smaller) – blown up and then deflated
- Masking or duct tape
- Ruler

What To Do:

1. Note: the bottles can be set up separately if you do not have enough on hand
2. To bottle "A" add 1 tablespoon sugar and $\frac{1}{2}$ cup of water
3. To bottle "B" add 2 tablespoons sugar and $\frac{1}{2}$ cup water
4. To bottle "C" add 3 tablespoons sugar and $\frac{1}{2}$ cup water
5. To bottle "D" add 4 tablespoons sugar and $\frac{1}{2}$ cup water
6. To bottle "E" add $\frac{1}{2}$ cup of water
- 7. Answer question #6 before proceeding with the experiment**
8. To bottle "A" add 1 level teaspoon yeast
9. Tape a balloon over the top of Bottle "A" and **record the time on the submission form.**
10. To bottle "B" add 1 level teaspoon yeast
11. Tape a balloon over the top of Bottle "B" and **record the time on the submission form.**
12. To bottle "C" add 1 level teaspoon yeast
13. Tape a balloon over the top of Bottle "C" and **record the time on the submission form.**
14. To bottle "D" add 1 level teaspoon yeast
15. Tape a balloon over the top of Bottle "D" and **record the time on the submission form.**
16. To bottle number "E" add 1 level teaspoon yeast
17. Tape a balloon over the top of Bottle "E" and **record the time on the submission form.**
18. Examine the bottles at 30 minutes, 1 hour, 1.5 hours, and 2 hours.
 - a.** If the balloon has started to inflate measure the diameter of the balloon and **record the diameter on the submission form.**
 - b.** If there is no change in the size of the balloon, **indicate that on the submission form as "No Change".**
19. The experiment can be stopped after two hours or you may continue longer if you would like.