**Donald Frank**

**Lab #5 – Microbial Fermentation – Submission Portion of the Lab**

**Questions to Answer (before starting Part One of the lab):**

1. In the yogurt-making part of this lab you need to scald the milk. Why is this an important step? (Think about what happens to milk when it gets too old and why)

**Scalding the milk kills any bacteria that might affect the culturing of the starting bacteria needed to produce yogurt.**

1. Write a hypothesis or two of what you think will happen to the pH of the yogurt as time progresses. Some of the things you might want to think about:
   1. Is the pH going to go up or down

**The pH will go down because lactic acid will be produced during fermentation.**

* 1. What will be the starting pH and what will be the final pH?

**The starting pH will be slightly less than neutral (6 range) and the final pH will be slightly lower.**

* 1. Will the pH actually change?

**Yes, the pH will change**

* 1. If the pH does change how long will it take to stabilize?

**The pH will stabilize after the fermentation process is complete.**

**Questions to Answer (after completing Part One of the lab):**

1. Describe the final product at the end of the experiment, including taste, color, texture, and smell. Keep in mind that saying that it looks like yogurt is an insufficient answer.

|  |  |
| --- | --- |
| **Taste** | * **Bitter** * **Tangy** |
| **Color** | * **White** |
| **Texture** | * **Clumpy** |
| **Smell** | * **Pungent** |

**\*my daughter say it tastes and smells like shoes**

1. What happened to the pH over time?

**The pH decreased over time**

1. Did the experimental results confirm or refute your hypothesis? Explain.

**The experiment confirmed my hypothesis. The starting bacteria cultures (*Lactobacillus bulgaricus and Streptococcus thermophilus* ) converted the lactose (sugar) in the milk into lactic acid; therefore the acidity of the final product was lower.**

**Yogurt Experiment**

|  |  |
| --- | --- |
| **Type of milk Used ** | **\_whole milk** |
| **Starting pH of milk** | **6.1** |
| **pH after adding yogurt** | **6.0** |
| **pH after 1 hour** | **5.8** |
| **pH after 2 hours** | **5.5** |
| **pH after 3 hours** | **5.0** |
| **pH after 4 hours** | **4.9** **(solid)** |
| **pH after 5 hours** | **4.7 (solid)** |
| **pH after 6 hours** | **4.6 (solid)** |
| **Final pH (next day)** | **4.0** |

**Questions to Answer (before starting Part Two of the lab):**

1. Write a hypothesis or two of what you think will happen to the balloons on top of the bottles as time progresses. Some of the things you might want to think about:
   1. What is the yeast doing with the sugar?

**As the yeast feeds on the sugar; respiration will occur and create carbon dioxide to fill the balloons.**

* 1. Will the change in the amount of sugar result in a different size balloon?

**The change in the amount of sugar will affect the size of the balloons – the more sugar added the larger the balloon size.**

* 1. Which bottle do you think will blow up the balloon to the largest size?

**Bottle “D” will be the largest.**

* 1. Which bottle will grow the increase the least in size or not at all?

**Bottle “E”**

1. What is the purpose of bottle “E” in the yeast experiments?

**Bottle “E” is the control to show that there is no change in the water without yeast and sugar added.**

**Data Tables**

**Yeast Experiment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bottle** | **Starting time** | **Size at 30 minutes** | **Size at 60 minutes** | **Size at 90 minutes** | **Size at 2 hours** |
| **A** | **7:00pm** | **“No Change”** | **4.5 cm** | **5 cm** | **6.0 cm** |
| **B** | **7:00pm** | **“No Change”** | **5.0 cm** | **5.75 cm** | **6.5 cm** |
| **C** | **7:00pm** | **“No Change”** | **6.0 cm** | **6.5 cm** | **7.0 cm** |
| **D** | **7:00pm** | **“No Change”** | **6.5 cm** | **8.0 cm** | **10.0 cm** |
| **E** | **7:00pm** | **“No Change”** | **“No Change”** | **“No Change”** | **“No Change”** |

**Questions to Answer (after completing Part Two of the lab):**

1. Did the experimental results confirm or refute your hypothesis? Explain.

The experiment confirmed my hypothesis.

**The more sugar added the more carbon dioxide was produced as a result of respiration**

1. Were there any big surprises from the results of the yeast experiment?

**No**

1. Explain what was the yeast was doing to cause an increase in the size of any of the balloons. Be sure to refer back to the chapter on metabolism to help you answer this question.

**The yeast was feeding on the sugar in a catabolic process-- anaerobic respiration/fermentation. This created carbon dioxide that filled the balloons. That larger the rate of metabolism → increase in balloon diameter.**

1. List four other foods or beverages that are produced using the process of fermentation.
   * + **Beer**
     + **Kombucha**
     + **Kimchi**
     + **Sauer kraut**
2. If you tested the pH of these foods what do you think that you would find.

**The pH would be acidic – 3- 5 range**

1. Look up each of the foods on the internet and report the pH for the food. Also, paste the URL for each site that you use.

|  |  |  |
| --- | --- | --- |
| **Food** | **pH** | **URL** |
| **Beer** | **4** | <https://uniavisen.dk/en/whats-the-ph-of-beer-the-true-origins-of-the-ph-scale/> |
| **Kombucha** | **3** | [www.organic-kombucha.com/kombucha\_and\_ph.html](http://www.organic-kombucha.com/kombucha_and_ph.html) |
| **Kimchi** | **4.2** | <http://farmtotable.colostate.edu/prepare-ferment/kimchi.pdf> |
| **Sauer Kraut** | **3** | <https://blogs.scientificamerican.com/lab-rat/the-science-of-sauerkraut-bacterial-fermentation-yum/> |

**\* I think the measurements on the instructions were incorrect – yeast = 1 tbsp & sugar in increments of tsps. ?**