Lab Activity: How Can You Test for Bacteria in Food?

Introduction

Bacteria can be found virtually everywhere. They grow and reproduce in the air, the soil, and water, and in and on plants and animals, including us. Bacteria are microscopic, single-celled organisms that have no nucleus and a cell wall made of peptidoglycan. Organisms which lack a nucleus and membrane-bound organelles are called prokaryotic. Although, bacteria are said to be microscopic in size, they make up for it in sheer number. In fact, bacteria are the most numerous living things on Earth. There are three shapes of bacteria, *Bacillus* (rod-shaped), *Coccus* (spherical) and *Spirillum* (Spiral).

We usually think of bacteria as the harmful germs that make us sick, and while that is often true, there are lots of other things bacteria do that we couldn't live without. Bacteria are used to make a wide range of food products. The most important bacteria in food manufacturing are Lactobacillus species, also referred to as lactic bacteria.

Bromothymol blue is a chemical indicator that turns from blue to yellow or green if carbon dioxide is present. In plants, animals, and many bacteria, respiration requires oxygen and produces carbon dioxide. Thus, this indicator can tell if bacteria or other living things are present in a sample being tested. The samples you will be testing in this exercise are different dairy products.

Keywords

Before you begin define the following terms:

<table>
<thead>
<tr>
<th>Prokaryotic:</th>
<th>Indicator:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control:</td>
<td>Respiration:</td>
</tr>
</tbody>
</table>

Figure 1- Bromothymol blue indicator changing from blue to green or yellow indicating the presence of carbon dioxide.
Materials

- 6 test tubes
- 6 rubber stoppers
- test tube rack
- wax pencil
- 2 medicine droppers
- 6 wooden splints
- 200 mL bromothymol blue indicator
- safety goggles, apron, gloves
- dairy products: milk, yogurt, sour cream, cottage cheese, butter

Safety consideration

Bromothymol blue, which is used as the indicator, can stain clothing, and should not come into contact with skin or eyes. Safety goggles, a lab apron, and gloves should be worn during this lab.

Procedure

1. Label 6 test tubes – 1 through 6.
2. Fill each test tube, approximately half full, with Bromothymol blue indicator.
3. Use a clean medicine dropper add 1-2 drops of the following to each test tube. (Do not let the products touch the side of the test tubes).
   - Test tube 1 – Control (Water)
   - Test tube 2 – Milk
4. Using a wooden splint, add a small amount of the following to each test tube.
   - Test tube 3 – Yogurt
   - Test tube 4 – Sour cream
   - Test tube 5 – Cottage cheese
   - Test tube 6 - Butter

Figure 2 - Add liquid dairy products using a medicine dropper. Add thick dairy products using a medicine dropper.
5. Stopper each test tube. In table 1, record the initial colour of the test tube contents. Do not disturb the test tubes.
6. Record the colour of the test tube contents at the bottom, both at the end of the period and the following day.

Table 1 – Test for Bacteria in Food

<table>
<thead>
<tr>
<th>Test tube #</th>
<th>Dairy product</th>
<th>Colour at start</th>
<th>Colour at end of class</th>
<th>Colour after 1 day</th>
<th>CO₂ present?</th>
<th>Bacteria present?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water (control)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Yogurt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sour cream</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cottage cheese</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Butter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Questions

1. What was the purpose of using water in test tube 1?

2. In which test tubes was colour changed detected one day later?
3. What is your proof that bacteria are present in these test tubes?

4. Are bacteria helpful or harmful?

5. Literacy connection – RAW MILK or PASTEURIZED MILK?
   Read the following:

   Pasteurization is a process, invented by Louis Pasteur, which applies heat to destroy pathogens in foods. This process is used in the dairy industry to kill harmful bacteria by heating milk to a specific temperature for a set period of time. You most likely heard the term “pasteurized milk”. Raw milk is milk from cows, sheep, or goats that has not been pasteurized to kill harmful bacteria. This raw, unpasteurized milk can carry dangerous bacteria such as Salmonella, E. coli, and Listeria, which are responsible for causing numerous illnesses.

   People continue to believe that pasteurization harms milk and that raw milk is a safe healthier alternative. Supporters of raw milk claim that in addition to killing potentially harmful bacteria, pasteurization also kills the many beneficial microorganisms found in milk. Raw milk drinkers say these “good bacteria” can aid in digestion and overall health. These bacteria can assist our bodies to more efficiently break down the foods we eat, and get the most nutrients from them. Probably pasteurization’s worst offence is that it changes the structure of the milk. It makes insoluble the major part of the calcium contained in raw milk, and destroys 20 percent of the iodine present in raw milk.

   What do you think? Make a list of pros and cons of drinking raw or pasteurized milk. Conclude with a statement that outlines your choice.