Key Stage 3

Micro-organisms: Useful Microbes

Teacher Guidance

Bacteria are single-celled organisms and although some of these cause illness and disease, others are helpful and useful. One of the main ways in which bacteria are beneficial is in the food industry. The natural by-products created during normal microbial growth are used to make many of the food products we eat everyday.

Fermentation causes a chemical change in foodstuffs. It is a process by which the bacteria break down the complex sugars into simple compounds like carbon dioxide and alcohol. Fermentation changes the product from one food to another.

The acetic acid fermentation carried out by microbes produces vinegar. Lactic acid fermentation produces yoghurt and cheese. Some fungi are also used to make the cheese turn blue. The yeast, *Saccharomyces cerevisiae*, is used to make bread and dough products through fermentation. Wine and beer are also produced in the same manner although alcohol is produced following fermentation when the microbes are grown without oxygen. The chocolate industry also relies on bacteria and fungi. These organisms produce acid through fermentation which eats away at the hard pod and makes it easier to get at the cacao beans.

When the bacteria *Streptococcus thermophilous* or *Lactobacillus bulgaricus* are added to milk they consume the sugars during fermentation, turning it into yoghurt. So much acid is produced in fermented milk products that few potentially harmful microbes can survive there.

Lactobacillus bacteria are generally referred to as useful or ‘friendly’ bacteria. They help us digest food and have been termed probiotic bacteria, literally meaning ‘for life’. It is these bacteria that we find in our yoghurts and probiotic drinks. Although, in those that are immunocompromised even friendly bacteria can cause infection.

SW1 Yoghurt Experiment Answer Sheets

(Also included in teacher sheet TS1)

Test 1 – Yoghurt

	Before Incubation	After Incubation
What was the consistency of the mixture?	Runny liquid	Thick and creamy
What did the mixture smell like?	Like milk	Like rotting food
What was the colour of the mixture?	White	Cream/ white

Test 2 – Sterile Yoghurt

	Before Incubation	After Incubation
What was the consistency of the mixture?	Runny liquid	Runny liquid (no change)
What did the mixture smell like?	Like milk	Like milk (no change)
What was the colour of the mixture?	White	White (no change)

How did the mixture change during fermentation?

During test one, the mixture changed to a thicker, creamier texture consistent with yoghurt. This was due to the lactic acid fermentation of the microbes present. No change was observed in the second test due to the lack of microbes in the sterile yoghurt.

Test 3

How long did it take to make the yoghurt when the yoghurt was incubated at:

20°*C*– approx. 3-5 days

40°*C* – overnight

SW1 Conclusions Answer Sheet

(Also included in teacher sheet TS1)

1. What caused the change from milk to yoghurt?
   The microbes added to the milk converted the sugars to lactic acid which caused the milk to thicken into a yoghurt.

2. What is this process called?
   Lactic acid fermentation.

3. Explain the difference in results in test 1 and test 2.
   Everything in test 2 was sterile; therefore, there were no microbes present to carry out lactic acid fermentation.
4. What is the type and name of microbes which can be used to make yoghurt? Bacteria of the genus *Lactobacillus* and *Streptococcus*.

5. Why did it take longer to make yoghurt at 20°C than at 40°C?
   Bacteria prefer to grow at body temperature i.e. approx. 37°C, at 20°C it takes the bacteria longer to multiply therefore they are slower to produce the lactic acid.

6. A sterile spoon is used to stir the mixture (step 5) before incubating, what do you think might happen if a dirty spoon was used?
   The resulting yoghurt may be contaminated with harmful microbes.

SW2 Microscopic Yoghurt Observation Sheet

Observations

What did you see in the yoghurt smear?

Bacteria of different shapes moving around. You may be able to identify rod shaped bacteria (*Lactobacillus*) and spherical shaped bacteria (*Streptococcus*).

What did you see in the sterile yoghurt smear?

You may not have seen any microbes. If you do, they will be dead and will not be moving.

What, in your opinion, caused the difference?

The act of sterilisation killed the bacteria