

The Journey from Milk to Curd

Have you seen the process of curd formation at home? You might have also tried doing it yourself! Have you ever wondered, why we always need to add that small amount of curd to milk so that milk turns into curd? Can the same process be done using lemon juice? You might also have seen spoiling of milk. How can one differentiate between spoiled milk and curd? How can milk be transported to long distances without getting spoiled?

In this learning unit, you will study curd formation from milk under different conditions and try to understand the associated changes taking place in it. At the end of the unit, you should be able to come up with the best combination of conditions that might favour curd formation, and also convert milk into curd in very little time.

Materials

For one setup: 200 mL Fresh milk, 20 mL curd (prepared at home), sodium bicarbonate, Lemon juice, dilute acid (HCl or vinegar), baker's yeast, beakers, glass rod, glass slides, thermometer, gas burner or electric hot plate, refrigeration facility.

Before you begin with the main task, your teacher will conduct two small games for the class.

Task 1: Two Games

1. **Racing the Knowns:** Place a drop each of milk and curd on a glass slide, slightly tilt the slide. Find the ways in they can be differentiated.
2. **Smudge It:** Place a drop of each liquid on glass. Smudge each drop with your forefinger and answer the following questions:
 - How does it spread - uniformly/evenly or disperses into clumps?
 - Does the mass spread to the outer region of the smudged area or does it concentrate at the centre?

Preparing further for the task

- a) In the games you played, how did you differentiate between milk and curd?

- b) Have you seen the process of making curd at home? What are the steps involved?

Task 2: Will it form curd?

Now, design an experiment to determine how temperature, chemicals, and stirring might affect the process of curd formation. Note the details in Table 1, and the time when these were set up. If you wish to check the presence of any other substance or the effects of any other processes on curd formation, you may do so.

Table 1 Experimental setup

Beaker No.	Volume of Milk	Temperature of milk	Volume of curd added	Extra Additions	Incubation temperature

- Keep the tubes/beakers in a warm place and observe the tubes for any physical changes, every hour for up to six hours.
- As soon as you observe any change in the milk samples, like thickening or clump formation, record the time, i.e., how many hours after adding curd did you see the change? These observations can be recorded in Table 2.
- Observe these samples further for changes in consistency. Use a litmus paper to monitor the changes in acidity or basicity.
- Also, record any additional changes like change in smell, colour, or texture.

Table 2 Observation table

Sr. No.	Condition	After how many hours do you see any change?	What kind of changes do you see?

Let's discuss

1. What changes did you observe in the beakers for the conditions you tested?

2. Which condition that you tested showed the fastest curd formation, and in how many hours?

3. Did you observe any change in the milk to which no curd was added? Do you think it will remain the same? Why?

4. Which conditions favoured curd formation?

5. Why do you think a small amount of curd is to be added? Can curd formation occur even without adding that small amount of curd?

6. In which season, do you think, will curd formation happen the fastest?

7. Other than curd, which substances did you add to milk? Did it speed up or slow down the process of curd formation? Why?

8. Observe the beakers to which lemon juice or dilute acids were added. Did you see curd being formed in them? Describe what you see.

9. Did you observe the beakers in which a few granules of yeast were added? What can you infer from the experiment?

10. Did your group or any other group check if the process of stirring affects the curd formation? If yes, how did it affect?

11. In this experiment, we turned milk into curd. Can you turn curd into milk? Why or why not?

References

Montiville, T.J., Matthews, K.R., & Kniel, K.E. Lactic acid bacteria and their fermentation products. In *Food Microbiology: an Introduction* (pp. 269-281). ASM Press.