
PW 01: Milk Transformation

Aims: This practical aims to study the main technological transformations of milk through the production of yogurt, fresh cheese, leben, and cream, while monitoring the physicochemical and microbiological changes occurring during processing.

Materials and Reagents

- Whole milk.
- Natural plain yogurt (as starter culture).
- Lemon juice or white vinegar (5%).
- Thermometer.
- Hot plate or water bath.
- Incubator.
- pH meter.
- NaOH 0.1 N, phenolphthalein indicator.
- Beakers, pipettes, burette and gauze.
- Nutrient agar for total aerobic flora.
- MRS agar for lactic acid bacteria.
- Sterile saline solution (0.9% NaCl).
- Gram staining reagents

Part I: Analysis on raw milk (Before processing)

A. Physicochemical measurements

1. Take 50 mL of milk at room temperature (~20 °C).
2. Measure the initial pH using a pH meter.
3. Determine the titratable acidity:
 - Pipette 10 mL of milk into a beaker.
 - Add 2 drops of phenolphthalein indicator.
 - Titrate with 0.1 N NaOH until a pale pink color persists for 30 seconds.
 - Calculate: °D (Dornic degrees) = (mL NaOH) × 10

B. Microbiological analysis of raw milk

1. Prepare serial dilutions:
 - Pipette 1 mL of milk into 9 mL of sterile saline ($\rightarrow$ dilution 10^{-1}).
 - Mix gently and, if needed, prepare 10^{-2} and 10^{-3} dilutions.
2. Inoculation on Nutrient Agar :
 - Plate 0.1 mL of dilution on GN agar.
 - Spread with a sterile L-shaped rod.
 - Incubate at 37 °C for 24–48 hours.

C. Microscopic observation

1. Prepare a thin smear from the milk sample or from a colony obtained on agar.
2. Air-dry and heat-fix gently over a flame.
3. Perform Gram staining and observe under the microscope (1000 $\times$, oil immersion).

Part II : Processing Steps

A. Yogurt

1. Heat milk to 85 °C for 15 minutes.
2. Cool to 45 °C.
3. Add 2–3% of natural yogurt as starter and mix well.
4. Incubate at 42–45 °C for 4–6 hours.
5. Cool and store at 4 °C.
6. Measure pH and titratable acidity after fermentation.
7. Inoculate a sample of the final product on MRS agar to verify the presence and activity of lactic acid bacteria (LAB) responsible for fermentation.

B. Fresh Cheese (Acid coagulation)

1. Warm milk to 40 °C.
2. Add lemon juice or vinegar drop by drop while stirring until clear coagulation occurs (pH $\approx$ 4.6).
3. Let stand for 10 min, then filter through gauze.
4. Separate curd and whey.
5. Measure pH and acidity of the whey.