Laboratory Work 4

Title

Determination of the density, acidity, and fat content of milk.

Objective of the Work

- To determine the density of milk using a lactometer or pycnometer.
- To assess the acidity of milk by titration with a standard alkali.
- To determine the fat content of milk using the Gerber or Soxhlet method.
- To understand how these physicochemical properties relate to milk quality.

Theoretical Background

1. Milk Composition

Milk is a complex colloidal system containing water, fats, proteins, lactose, minerals, and vitamins. Quality assessment often includes density, acidity, and fat content.

2. Density of Milk

- Density is the mass per unit volume (g/cm^3 or kg/m^3).
- A lactometer or pycnometer can be used to measure milk density.
- Density is affected by fat content, solids-not-fat (SNF), temperature, and adulteration.

3. Acidity of Milk

- Acidity reflects the amount of lactic acid in milk, an indicator of freshness.
- Expressed as % lactic acid.
- Determined by titration with standard sodium hydroxide (NaOH) solution using phenolphthalein as an indicator.

4. Fat Content of Milk

- Fat content is a key nutritional parameter.
- Determined using the Gerber method (sulfuric acid and centrifugal separation) or Soxhlet extraction.

Equipment and Materials

- Milk sample
- Lactometer or pycnometer
- Thermometer
- Analytical balance
- Burette, pipette, conical flask, and phenolphthalein
- Standard NaOH solution
- Gerber bottles and centrifuge (for fat determination)

- Sulfuric acid, amyl alcohol (for Gerber method)
- Protective gloves and goggles

Experimental Procedure

A. Density Determination

1. Bring the milk sample to the standard temperature (20 °C).
2. Fill the lactometer cylinder with milk.
3. Gently lower the lactometer into the milk.
4. Record the reading at the milk surface.
5. Correct for temperature if necessary.

B. Acidity Determination

1. Pipette 10 mL of milk into a conical flask.
2. Add 2–3 drops of phenolphthalein indicator.
3. Titrate with 0.1 N NaOH until a persistent pink color appears.
4. Calculate the acidity:

Acidity (%) = (V × N × 0.009) / m × 100

Where V = volume of NaOH (mL), N = normality, m = mass of milk (g).

C. Fat Content Determination (Gerber Method)

1. Pour 10 mL of milk into a Gerber bottle.
2. Add 10 mL of concentrated sulfuric acid carefully.
3. Add 1 mL of amyl alcohol.
4. Seal the bottle and mix gently.
5. Centrifuge for 5 minutes.
6. Read the fat column in the calibrated neck of the bottle.
7. Record the fat content (%).

Calculations

- **Acidity:** Acidity (%) = (V × N × 0.009) / m × 100
- **Density:** Read from lactometer or calculate from pycnometer measurement.
- **Fat content:** Direct reading from Gerber bottle (%).

Results Presentation

Parameter	Value
Sample type	
Density (g/cm³)	
Acidity (% lactic acid)	
Fat content (%)	

Discussion

Compare measured values with standard milk quality parameters. Discuss any deviations due to fat content, freshness, or adulteration.

Conclusion

In this laboratory work, the density, acidity, and fat content of milk were determined. These parameters provide essential information for assessing milk quality and safety.