13. Detection of commonly used adulterants in milk

The most common adulterants found in milk are urea, insecticides, $NaHCO_3$, vegetable oil, sucrose, starch, etc.

Aim: To detect the presence of excess water added to the milk by using lactometer.

Requirements: Lactometer, measuring cylinders (500 ml capacity), thermometer and milk samples (minimum 3, preferably raw milk, of same animal source cow/ buffalo)

Theory: Animal husbandry plays a major supporting role in rural economy. Milk collection centers and cooperative societies, play an integral role in delivering the milk from the cowsheds to the customers.

Addition of water to milk can be a big problem. Hence water content of the milk is checked at many level, before it reaches the customer. Pure milk has a specific gravity of 1·032; addition of water to it reduces this value. FAO (Food and Agriculture Organization of the United Nations) suggested that the standard specific gravity of milk ranges between 1·026 to 1·032 g/ml.

Principle: Use of lactometer is a most widely used method for detection of specific gravity of milk. Lactometer is a hydrometer with limited scale (close to the range of the specific gravity of milk). Lactometer works on the principle of fluid displacement.

Lactometer is an instrument sensitive to temperature, hence, temperature of the milk sample must always be noted along with the reading of the lactometer. Temperature calibration must be either added or subtracted from the reading on the lactometer, to get the final specific gravity of the milk sample.

Figure :

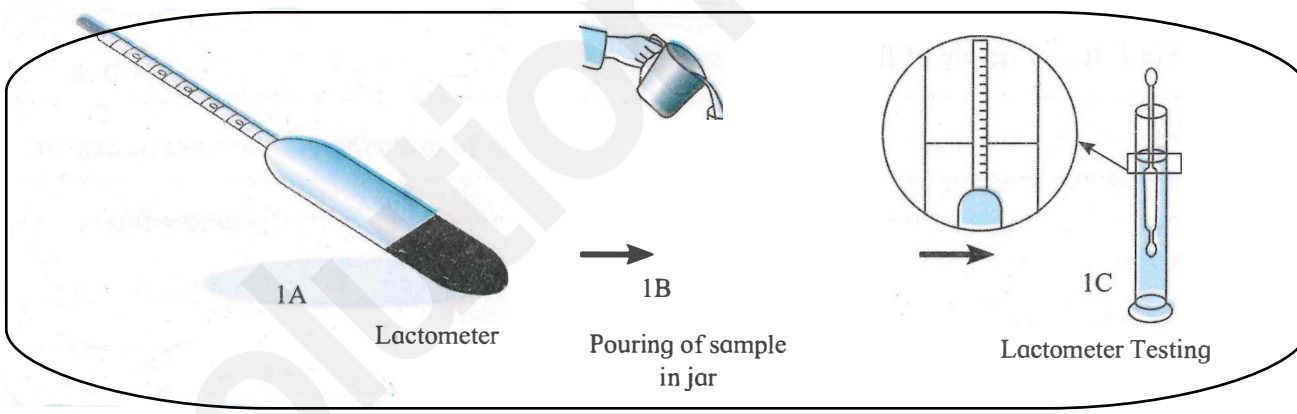

Fig. Experimental set up

Procedure:

- Prepare three measuring cylinders (500 ml capacity) and label them 1,2,and 3.
- Pour milk samples gently, in each measuring cylinder.
- Let the lactometer sink gently in the milk sample.
- Read and record the last lactometer degree reading (^{0}L) just above the surface of milk.
- Note down the temperature of each milk sample by using thermometer.
- If the temperature of milk is different from that of calibration temperature of the lactometer (20^0C), then calculate temperature correction.

- For every 10^{0}C above the calibration temperature, add 0.2 ^{0}L to the actual lactometer reading.
- For every 10^{0}C below the calibration temperature, subtract 0.2 ^{0}L from the actual lactometer reading.

Observation table and Calculation:

Sample	Milk temperature	Lactometer reading	Correction	Final reading
E. g. 1	17 ^{0}C	30.6 ^{0}L	- 0.6 ^{0}L	30.0 ^{0}L
E. g. 2	23 ^{0}C	30.6 ^{0}L	+ 0.6 ^{0}L	29.4 ^{0}L
Sample 1	21 ^{0}C	31.6 ^{0}L	+0.4 ^{0}L	31.2 ^{0}L
Sample 2	17 ^{0}C	29.1 ^{0}L	-0.6 ^{0}L	29.7 ^{0}L
Sample 3	23 ^{0}C	28.7 ^{0}L	+0.6 ^{0}L	28.1 ^{0}L

- For calculation of the specific gravity of the milk samples, we take the final reading from the above table and write 1.0 before it. (lactometer reading represents only the second and third decimal place).

Sample	Final reading	Specific gravity of milk sample
E. g. 1	30.0 ^{0}L	1.030
E. g. 2	29.4 ^{0}L	1.029
Sample 1	31.2 ^{0}L	1.031
Sample 2	29.7 ^{0}L	1.030
Sample 3	28.1 ^{0}L	1.028

Result:

- Specific gravity of milk sample 1 is
- Specific gravity of milk sample 2 is
- Specific gravity of milk sample 3 is

Questions

1. What is the principle of fluid displacement?

Archimedes principle states that : "the upward buoyant force that is exerted on a body immersed in a fluid, whether partially or fully submerged, is equal to the weight of the fluid that the body displaces and acts in upward direction at the center of mass of the displaced fluid".

2. How can the specific gravity of milk be adjusted to acceptable limits after it has been adulterated with water?

The specific gravity of milk measured at 15 ^{0}C or 20 ^{0}C is normally 1.028-1.033 kg / litre. The specific gravity depends on the protein and fat content. The specific gravity of fat is 0.93, solids-non fat 1.6 and water 1.0 kg/ litre.

3. Which chemicals when added to milk, result into its adulteration ?

Urea, insecticides, Baking soda, vegetable oil, sucrose , starch, etc.

4. What are the other methods for detecting excess water, added to the milk?

The presence of water can be detected by putting a drop of milk on a polished slanting surface, The drop of pure milk flows slowly leaving a white trail behind it, whereas milk adulterated with water will flow innediately without leaving a mark. Add a few drops of tincture of Iodine or Iodine solution.

Multiple Choice Questions

1. The specific gravity of pure milk is 1.032 g/ml.

a. 1.032 b. 2.432

c. 0.123 d. 0.982

2. The instrument used for detection of specific gravity in milk is lactometer

a. spirometer b. galvanometer

c. lactometer d. altometer

Remark and Signature of Teacher .....