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Surface Tension by Drop Count and Drop Weight Methods

Experiment 1 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To estimate liquid surface tension relative to a reference using both drop methods.

Principle

Drop detachment balances capillary forces and drop weight. Relative methods use the same clean tip and controlled drop formation. The simple ratios assume comparable drop correction; differences in tip wetting, flow and surface age can affect the result.

Requirements

- Clean stalagmometer/drop apparatus, test liquid, reference liquid and their densities at the test temperature.
- Temperature control, stopwatch, weighed collection vessels and balance.

Procedure

1. Condition

Clean and rinse the tip with the appropriate liquid, position it vertically and equilibrate both liquids to the same recorded temperature.

2. Count reference

Count drops between the two fixed volume marks for the reference. Repeat at least three times and report the mean.

3. Count test liquid

Repeat over the same marked volume and controlled flow conditions. Avoid bubbles and partial starting/ending drops.

4. Drop-weight reference

Collect a known number of complete reference drops in a covered weighed vessel. Obtain total net mass and mean mass per drop.

5. Drop-weight test

Repeat for the test liquid with the same tip and comparable formation conditions. Limit evaporation.

6. Calculate

Use the appropriate ratio below. Include density in the fixed-volume drop-count ratio, but do not multiply the measured drop-mass ratio by density again.

Observations and Record

Method	Reference / test records	Calculated value
Drop count	N_r = ____; N_x = ____; densities = ____	γ_x = ____ mN/m
Drop weight	Net mass / number of drops = ____	γ_x = ____ mN/m
Conditions	Temperature / tip / formation rate	_____

Worked Example

The numbers below are illustrative; enter your own observations in the record.

- Drop count: $\gamma_x = \gamma_r \times (\rho_x N_r) / (\rho_r N_x)$.
- Illustrative assigned γ_r = 72.0 mN/m, ρ_x/ρ_r = 0.90, N_r = 50 and N_x = 60: γ_x = 54.0 mN/m.
- Separate drop-weight illustration: $\gamma_x = \gamma_r \times$ mean m_x / mean m_r. With 0.040 g and 0.050 g, γ_x = 57.6 mN/m. These are separate datasets.

Result

Record the observed outcome and calculated value, with units. State whether the stated laboratory specification was met; do not copy the worked example as your result.

Precautions

- Use the instructor's assigned material and apparatus; record actual temperature and units with every measured property.
- Check instrument calibration and use repeat readings rather than a single convenient result.
- Compare a marketed teaching formulation only under the same method and conditions; its excipients can change the property.
- Use the reference surface tension appropriate to the actual temperature; surfactant solutions can depend on drop formation time.

Viva Questions and Answers

1. Why use the same tip?

Capillary geometry affects detachment.

2. Why does drop count use density?

Mass per fixed volume depends on liquid density.

3. Why avoid rapid drops?

Formation conditions and surface adsorption may change the measured value.

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