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Viscosity by Ostwald and Brookfield Viscometers

Experiment 3 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

Aim

To compare relative capillary viscosity and rotational apparent viscosity.

Principle

An Ostwald viscometer relates capillary flow time to viscosity for suitable Newtonian liquids. A Brookfield instrument measures resistance to spindle rotation; a non-Newtonian material can give different apparent viscosities at different speeds.

Requirements

- Ostwald viscometer, Brookfield instrument and appropriate reference standard.
- Test liquid, density data, bath, timing device and the prescribed spindle/container.

Procedure

1. Temperature

Equilibrate liquids and instruments at one recorded temperature. Check that the chosen material is suitable for each method.

2. Ostwald reference

Fill to the specified level without bubbles. Draw liquid above the upper timing mark with a safe aid and time flow between marks. Repeat.

3. Ostwald test

Measure test-liquid flow times and density under the same conditions. Reject disturbed flow or air bubbles.

4. Brookfield setup

Level and check the instrument. Fit the specified spindle and immerse to its mark in the prescribed container, avoiding trapped air.

5. Rotational readings

Choose a spindle/speed combination within the manufacturer's usable torque range. Record spindle, rpm, torque, temperature and elapsed time for each reading.

6. Interpret

Calculate capillary viscosity from the ratio and report rotational values with their conditions. Do not call a speed-dependent reading a universal constant.

Observations and Record

Method	Raw record	Report
Ostwald	Mean t_r / t_x; ρ_r / ρ_x	η_x = ____ mPa·s
Brookfield	Spindle / rpm / torque / time	Apparent η = ____ mPa·s
Comparison	Same temperature and preparation?	_____

Worked Example

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

- $\eta_x = \eta_r \times \rho_x t_x / (\rho_r t_r)$.
- For an assigned reference η_r = 1.00 mPa·s, ρ_r = 1.00 g/mL, t_r = 60 s, ρ_x = 1.10 g/mL and t_x = 180 s, η_x = 3.30 mPa·s.
- The reference values are illustrative; use its certified value at the actual bath temperature. 1 cP = 1 mPa·s.

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.

Viva Questions and Answers

1. Why control temperature closely?

Viscosity is temperature dependent.

2. What is apparent viscosity?

The value obtained under specified flow/shear conditions for a material whose behaviour may depend on them.

3. Why record torque?

An unsuitable torque range can make a reading unreliable.

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