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Density and Specific Gravity of Foods

Practical 28 - Analytical practical

Aim

To determine density and specific gravity of a food or liquid preparation at a stated temperature.

Principle

Density is mass per volume. Specific gravity compares the material density with water density under explicitly defined reference conditions. Entrained air, temperature and suspended solids can influence the measured result.

The test preparation, blank, calibration or titrant standardisation and independent controls are part of the measurement. State the actual concentration units, test conditions and adopted method before interpreting the result.

Materials and Requirements

- Qualified density bottle or pycnometer
- Calibrated balance and thermometer
- Suitable reference water and cleaning materials
- Qualified balance and volumetric equipment
- Controlled method and raw-data worksheet

Procedure

1. Identify the material, intended attribute, method version and acceptance criteria. Record preparation and instrument or reagent identities.
2. Prepare the prescribed blank and reference or standardised reagent. Verify the measurement with an independent check where applicable.
3. Record the reference and measurement temperatures and the selected volume convention.
4. Determine the clean empty bottle mass and the mass filled with reference water.
5. Fill with the homogeneous test preparation without air bubbles and determine its mass at the stated temperature.
6. Calculate the density or relative density and repeat with independent fills.
7. Record individual readings for independently prepared test portions. Keep all raw observations, including unsuccessful measurements and their investigation.
8. Calculate the result on the stated mass, volume or area basis, including dilution, blank and recovery corrections as justified.
9. Compare the evidence with the applicable criteria and write a conclusion limited to the tested preparation and conditions.

Observations and Record

Enter actual measurements or the supplied teaching data. Record the method, material identity, conditions and units.

Preparation / attribute	Method condition	Raw measurement	Calculated result
Empty bottle	Record	Record	Calculate
Water-filled bottle	Record	Record	Calculate

Preparation / attribute	Method condition	Raw measurement	Calculated result
Test-filled bottle	Record	Record	Calculate
Temperature and result	Record	Record	Calculate

Calculations

• Relative density = mass of test liquid occupying the defined volume / mass of water occupying that volume
• Density of test liquid = relative density x water density under the stated conditions

Worked Example

Illustrative empty bottle 20.000 g, water-filled mass 45.000 g and preparation-filled mass 46.250 g.
Relative density = (46.250 - 20.000)/(45.000 - 20.000) = 1.050.
If the applicable water density is 0.9982 g/mL, test density is about 1.0481 g/mL.

Result and Interpretation

• State temperature and reference conditions with the result.
• Report replicate variability and the evidence that the method can measure the intended attribute in this matrix.

Precautions

• Remove bubbles and dry the outside before weighing.
• Avoid warming the bottle by prolonged handling.
• Mix heterogeneous preparations through the adopted method.
• Use the adopted laboratory procedure, suitable controls and the designated waste arrangements.

Viva Questions and Answers

Does specific gravity have units?

It is a ratio and is dimensionless.

Why specify temperature?

Both liquid density and vessel volume depend on temperature.

What do bubbles do?

They can reduce the mass occupying the apparent filled volume.

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