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# Design and Evaluation of a Shampoo Base

Practical 20 - Bench formulation practical

## Aim

To prepare and evaluate a shampoo base using a controlled laboratory formula.

## Principle

Shampoo performance depends on a compatible surfactant system, formulation rheology, cleaning and foaming properties and the intended scalp and hair-use context. Foam height is one test attribute and is not a direct measurement of all cleaning performance.

A formulation comparison is meaningful when the raw-material grades, batch size and evaluation conditions are recorded. Change one planned factor at a time or use a documented experimental design, and compare independently prepared batches rather than only repeated readings from one batch.

## Materials and Requirements

- Approved surfactant blend, viscosity modifier and aqueous base
- pH meter and defined foam and viscosity test methods
- Suitable mixing, temperature and measurement equipment
- Calibrated balance, suitable containers and identified evaluation equipment
- Controlled batch sheet and raw-data forms

## Procedure

1. Define the purpose, formula, batch size, material grades and comparison conditions. Calculate all quantities before weighing.
2. Check equipment readiness and record material identities and actual quantities. Reconcile theoretical and actual batch mass.
3. Calculate surfactant addition on an active-matter basis, accounting for the concentration of each supplied ingredient.
4. Mix using the defined order and shear conditions, controlling entrained air. Add viscosity modifiers through the adopted process.
5. Measure pH, viscosity and foam behaviour using specified dilution, water and test geometry. Compare replicate measurements under identical conditions.
6. Evaluate the stated quality attributes on representative portions using the same method for all comparison batches. Record individual readings and any excluded observations with reasons.
7. Calculate the specified response, variability and material balance. Compare with predefined teaching or product criteria and discuss sources of variation.
8. Label retained preparations and dispose of remaining material through the laboratory procedure. Keep the complete preparation and evaluation record together.

## Observations and Record

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

| Attribute or stage | Method / conditions | Individual readings | Calculation / comment |
|---|---|---|---|
| Surfactant active matter | Record the adopted method | Record | Evaluate |
| pH and viscosity | Record the adopted method | Record | Evaluate |

| Attribute or stage | Method / conditions | Individual readings | Calculation / comment |
|---|---|---|---|
| Foam height and persistence | Record the adopted method | Record | Evaluate |
| Appearance and homogeneity | Record the adopted method | Record | Evaluate |

## Calculations

• Component mass = total target batch mass x percentage / 100
• Batch recovery (%) = recovered mass / theoretical batch mass x 100

### Worked Example

Illustrative target: 5.0 g active surfactant is needed in a 100 g teaching batch. If the supplied surfactant solution is 25.0% active, required supplied material = 5.0/0.25 = 20.0 g.

The 15.0 g nonactive fraction is part of the total formula mass and must be included in the water and ingredient balance.

## Result and Interpretation

• Distinguish supplied surfactant mass from active content and interpret foam in the context of the chosen test. Record appearance, homogeneity, relevant physical measurements and the defined observation period.
• State the preparation conditions and the evidence supporting the result. A satisfactory physical observation alone does not establish long-term stability, clinical performance or suitability for administration.

## Precautions

• Prepare only the authorised teaching batch and identify it for laboratory evaluation.
• Follow ingredient-specific handling and disposal requirements.
• Record the need for a validated preservation system before any stored or distributed product is considered.
• Use the laboratory-approved formulation and equipment procedure. Teaching batches are identified for laboratory evaluation.

## Viva Questions and Answers

### Why calculate all quantities first?

It identifies inconsistencies in the formula and establishes the material balance.

### Why use a controlled method?

Mixing, temperature and ingredient order can change the resulting structure.

### Does a visually acceptable batch establish stability?

No; stability and microbiological quality need appropriate evidence.

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