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# Critical Micellar Concentration of a Surfactant

Experiment 2 - Practical Notes

Name: _____ Roll no.: _____ Date: _____

## Aim

To estimate the CMC from a change in a measured property across surfactant concentrations.

## Principle

Below the CMC, increasing concentration mainly changes the population of individual surfactant molecules. Above it, micelles form and the concentration dependence of conductivity or surface tension changes. CMC depends on temperature, electrolyte content and the chosen surfactant.

## Requirements

- Assigned ionic surfactant for conductivity, or a validated surface-tension method.
- Accurately prepared concentration series, purified water, calibrated meter/tensiometer and temperature control.

## Procedure

### 1. Plan range

Prepare concentrations spanning the expected transition, with closely spaced points near it. Record concentration units, purity and any added electrolyte.

### 2. Blank and calibrate

Check the chosen instrument with its prescribed standard and water blank. Maintain one temperature throughout.

### 3. Measure

Measure each solution after the same equilibration procedure. Rinse the cell correctly between solutions and take repeat readings.

### 4. Plot

For conductivity, plot conductivity against molar concentration. For surface tension, plot surface tension against $\log_{10}$ concentration.

### 5. Fit branches

Fit the approximately linear pre- and post-transition regions without forcing all points into one line. Find their intersection.

### 6. Report

Convert the intersection to the original concentration units. Give the method, temperature, range and uncertainty/replicate spread; a weak or broad transition requires qualification.

## Observations and Record

| Concentration (mol/L) | Property and units | Repeat / mean |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

## Worked Example

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

- If a surface-tension intersection is at $\log_{10}$ C = -2.10, CMC = 10^(-2.10) = 0.00794 mol/L = 7.94 mmol/L.
- This constructed example is not a universal CMC for every surfactant or water composition.

## 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 use logarithmic concentration for a surface-tension plot?

It often separates the pre-transition trend clearly over a wide concentration range.

### 2. Does added salt leave CMC unchanged?

No. Electrolytes can substantially affect ionic surfactants.

### 3. Can conductivity measure every non-ionic surfactant well?

Not necessarily; choose a suitable validated property method.

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