Determination of Critical Micelle Concentration of Aerosol-OT in a Two-Solvent System by Fluorescence Spectroscopy

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Introduction

Fluorescence
- Three-step process:
  1) Excitation by absorbing radiation (λ_{ex})
  2) Vibrational relaxation and internal conversion to lowest vibrational level of the excited state
  3) Emission of a photon of lower energy (λ_{em})

Fluorescence Spectroscopy
- Polychromatic light is wavelength-selected by a monochromator and used to excite the fluorophore
- Fluorescence emission is collected at 90° relative to the excitation and directed towards an emission monochromator and a detector

Coumarin-120 (C-120) Fluorescent Probe
- Hydrophobic molecule
- Intensity depends on environmental conditions including pH, solvent polarity, and viscosity
- Useful in cell tracking applications

Reverse Micelles
- Surfactants are composed of a hydrophilic head and hydrophobic tail(s)
- Aggregate into ordered structures, such as micelles, due to entropic processes
- Critical Micelle Concentration (CMC) - lowest concentration of surfactant required for aggregation
- Reverse micelles are composed of hydrophilic heads with hydrophobic tails extending outwards
- Applications include targeted drug delivery, and protein isolation and refolding
- Hydrophobic fluorophores may be encapsulated in the core and used to determine the CMC by measuring fluorescence intensity

Aerosol-OT (AOT)
- Most widely studied surfactant molecule
- Capable of forming microemulsions
- Excellent in encapsulating hydrophobic molecules

Determination of CMC
- AOT sample solutions (0.20 – 2.50 mM) were prepared in hexane
- Each sample contained 0.15 nM C-120 in THF
- Concentration of C-120 previously optimized for limit of detection

Experimental

Conclusions & Future Work
- Concentration of C-120 should be reoptimized to improve resolution of spectra
- Deposition method using THF was successful in encapsulating the fluorophore, should be optimized to lower standard deviation
- Another fluorophore, soluble in a nonpolar environment, such as dansyl chloride, can be used to determine CMC

References
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