Microscale Determination of CAC for PEO-PBD-PEO Triblock Surfactants

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Background
Surfactants are amphiphilic in nature and have a hydrophobic and hydrophilic region, thus forming aggregates in solution where the hydrophilic head is in solution and hydrophobic tail in the center.

Figure 1. PEO-PBD-PEO triblock has hydrophilic tails and a hydrophobic center. In solution it will self-assemble into an aggregate formation. The displayed picture is in the form of a micelle, but aggregates may not be spherical.

Methods of Characterization
The point of aggregation is found by:
1. Preparing dilutions with solutions of surfactant and pyrene
2. Obtaining fluorescence intensity
3. Plotting fluorescence intensity and logarithmic concentration
4. The CAC corresponds to the intersection of the two lines

Figure 2. Proteins found in blood are known to adsorb on medical device surfaces, which leads to clotting.

Figure 3. Proposed system of coating tri-block polymer onto a surface that will repel proteins. This is of interest in the medical device industry to prevent clotting.

Figure 4. Pyrene fluoresces in hydrophobic regions. For a known dilution scheme of surfactant in solution, fluorescence intensity is graphed vs. the log of surfactant concentration and two distinct linear regions are present. The intersection of these regions is the CAC.

Cited literature CAC values were reproduced for surfactants F68 and Triton X-100 to verify the fluorescence method.

Industrial Application
Blood coagulation upon contact with surfaces is a large problem in the medical device industry.

Figure 5. Known dilution scheme of surfactant in solution, fluorescence intensity is graphed vs. the log of surfactant concentration and two distinct linear regions are present. The intersection of these regions is the CAC.

Figure 6. Pyrene and surfactant solutions were incubated in dilutions for 24 h prior to fluorescent readings. Experimental values were consistent with literature.

Figure 7. CTs adhere to the surface and are stabilized with gamma-irradiation. The PEO chains are cleaved off to reveal the surface morphology.

Novel PEO-PBD-PEO Triblocks

Figure 8. The surface morphologies of 6 different cleavable tri-blocks at concentration of 1 and 10 [mg/mL]. Knowing the CAC of CT surfactants will give insight into why the surfaces have differing morphologies at different concentrations.

Future Work
1. Determine the CAC for the remaining CTs
2. Discuss how the CAC of CTS relates to the different surfactant surface morphologies

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References