Introduction

- Liposome and polymeric micelle are used to deliver hydrophilic and hydrophobic drugs, respectively.
- Liposome can efficiently deliver hydrophilic drugs encapsulated in their core, but hydrophobic drugs inserted into the liposomal bilayer tend to leak out prematurely.
- Polymeric micelles are good nano-carrier for the encapsulation and controlled delivery of hydrophobic drugs, but cannot accommodate hydrophilic drugs.

Objective

To develop a novel drug delivery system combining both liposome and polymeric micelle for the co-delivery of hydrophilic and hydrophobic drugs and characterize the physicochemical properties of liposomes loaded with polymeric micelle, namely Lipocells.

Methods

- Di-block copolymer of poly(ethylene oxide) (PEO) and poly(ε-caprolactone) (PCL) of varying degrees of polymerization were prepared.
- A third block of poly(ε-caproate-lactic-co-caprolactone) (PCL) was attached to the PCL block and used for Cy5 conjugation.
- Micelle was prepared from the Cy5 attached tri-blocks.
- Liposome with different molar ratios of DSPC, DPPC, and cholesterol were prepared.
- Micelles were loaded inside liposome by film hydration and several cycles of freeze-thaw.
- Micelle loaded liposome (lipocell) separated from unloaded micelle by either by membrane dialysis or size exclusion chromatography (SEC), after 2 hours incubation with SDS.

Future Directions

- Specific aim of the research is to develop an optimum lipocell formulation by varying different factors e.g. molecular weights of the copolymers, their hydrophilic-lipophilic balance (HLB), transition temperatures of the phospholipids, and loading conditions.
- In-vitro release studies will be performed to compare with those formulations of only liposome and polymeric micelle nanoparticles.

Results

Figure 1: 1H NMR analysis of the tri-block copolymer M-PEG45-PCL15-PCC3
Figure 2: M-PEG45-PCL15-PCC3 tri-block copolymeric micelle size
Figure 3: Disruption of M-PEG45-PCL15-PCC3 tri-block copolymeric micelle in the presence of SDS
Figure 4: Liposome size and PDI unaffected by SDS
Figure 5: Quantification of micelle loading by fluorescence measurement in different samples

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