Size Stability of Asymmetric Liposomes Produced from Phospholipids

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Abstract: In this study asymmetric liposomes were produced using phospholipids by the inverted emulsion technique at room conditions and their size stability was studied using a zetasizer.

1 Introduction

Within the last two decades, it has been demonstrated that encapsulation of drugs into liposomes can lead to the enhancement of therapeutic efficacy of drugs, reduction of their toxicity and extension of their therapeutic effect. Liposomes are vesicular colloidal particles made of self assembled amphiphilic molecules. Amphiphiles are molecules that contain two groups with different solubility in water. The hydrophilic group, often referred to as the polar head, is "water loving". Therefore, these molecules self assemble and form ordered structure in aqueous solutions. Single chain amphipiles, such as soaps and detergents, form micelles [Maria et al. 1997]. These are small spherical structures in which surface polar heads shield the non polar interior against water. Many natural amphipilics, such as lecithin (diacyl phosphotidylcholine), have two non polar tails and hence bulky non polar part cannot be packed into miscelles. These molecules normally self assemble into lipid bilayers in which two polar surfaces shield the non polar interior. Bilayered lamellae have their edges exposed to water, therefore, at lower concentrations they self close into spherical structures to eliminate this unfavorable exposure, and lipid vesicles or liposomes are formed [Bingham et al. 1994].

2 Objectives

The overall objective of this study was to prepare liposomes from phospholipids by the inverted emulsion technique and investigated the size stability over four days.

3 Materials and methods

Based on literature review phospholipids such as 1, 2-Dimyristoyl-s*n*-Glycero-3-Phosphocholine (DMPC) and 1, 2-Dioleoyl-3-Trimethylammonium-Propane (chloride calt) (DOTAP) were selected as bilayers for liposome formulation. Solution A was prepared using 1% of phospholipid (DMPC) to 40 mL dodecane and sonicated for 0.5 hour in a centrifuge tube to form the outside leaflet of the liposome. Solution B was prepared by adding 250 µL of Tris buffer to the same composition as solution A and sonicated for 1 hour to form the inside leaflet. Solution B (1 mL) was taken in the Hamilton cylinder for extrusion purpose. The lipid solution was extruded repeatedly through a 400 nm polycarbonate membrane for 21 times (recommended by the manufacture) to produce liposome. The extruded emulsion was collected and stored in a 2-ml plastic tube. One empty centrifuge tube was taken and filled fresh TRIS-Buffer. Solution A was added into it. On top of that 0.5 mL of extruded emulsion was added. It was put into the centrifuge with balanced mass on 2 sides and let it run for 1 hr and made sure keeping the interface still while moving the tube. Liposomes were produced on the bottom of tube and they were extracted.

4 Analysis and Discussions

The liposomes were produced at room temperature. The shape and the size distribution of the liposomes were characterized using the phase contrast fluorescence microscope and zetasizer respectively. The liposomes produced were spherical in shape of various sizes as shown in Fig 1. The diameter of the largest liposome shown in Fig 1 was about 400 nm. The size variation is quantified in Fig 2. The mean size after one day was 343.9 nm. The mean size of liposome after four days was 249.8 nm.

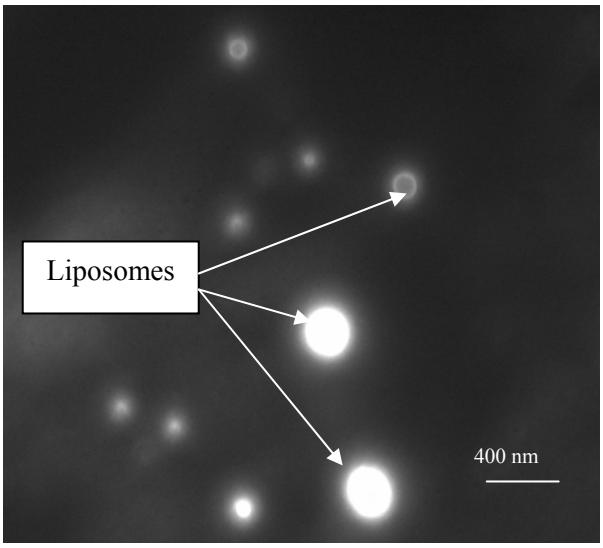

Fig 1: Liposomes produced using the inverted prepared emulsion technique –after 1 hour (Contrast Fluorescence Microscope)

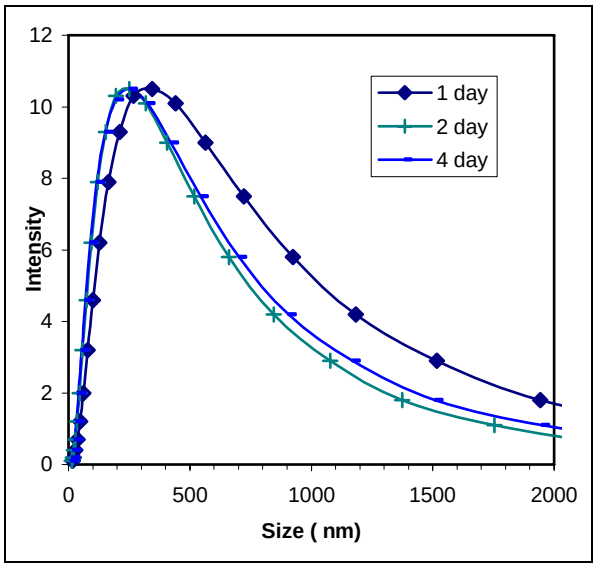

Fig 2: Stability of asymmetric liposomes using DOTAP and DMPC

5 Conclusions

Inverted emulsion method coupled with the extrusion technique (400 nm membrane) was used to produce liposomes. This approach produced spherical liposomes of widely varying sizes. The liposomes were stable for four days.

6 Acknowledgements

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7 References

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