Experimental Study of Liposomes Aggregation

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Introduction

Membrane fusion is an essential molecular event involved in many cellular processes, such as, exocytosis, endocytosis, intracellular vesicle transport, fertilization, viral infection, etc. Aggregation of phospholipid (phosphatidylserine) vesicles was studied with a variation of cation species and their concentrations in vesicle suspensions and vesicle sizes. Aggregation was determined by measuring the turbidity of vesicle suspension. The experimental results of aggregation of vesicles induced by monovalent cations were explained well in terms of the interaction energy of two interacting vesicles using the ordinary Derjaguin–Landau–Verwey–Overbeek (DLVO) theory for both small and large lipid vesicles. In order to explain the experimental results of these vesicle aggregation phenomena, it was necessary to modify the theory by including hydration interaction energies which are due to hydrated water at Membrane surfaces, and their magnitude and sign Depend upon nature (hydrophobicity) of the membrane surface.

Method

Clindamycin phosphate was purchased from Suzhou Pharmaceutical Factory (Suzhou). Monobasic potassium phosphate (98- 100.5%), phosphoric acid (85-88%), sodium hydroxide (>98%), Tween 80 (for synthesis), triton X-100 (99%) and high performance liquid chromatography HPLC- grade acetonitrile were purchased from Merck. Sephadex G-50 was purchased from Sigma-Aldrich. Egg phosphatidyl cholin (E80) was purchased from Lipoid. Cholestrol (99%) was purchased from Aldrich.

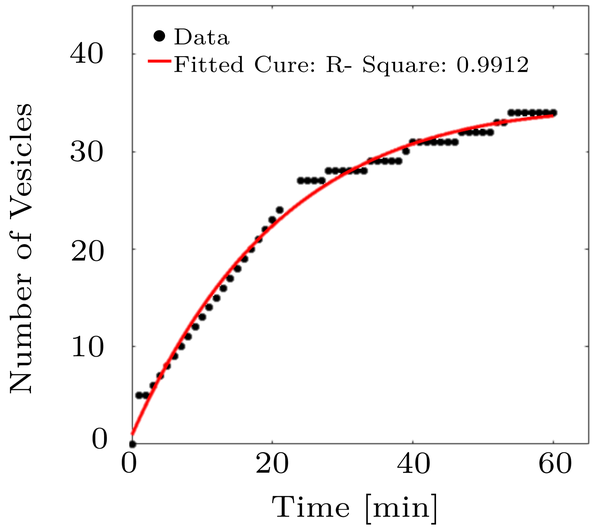

Figure 1
Changes in the number of liposome particles in aggregation over time, the number of particles next to each other increases over time and shows aggregation..

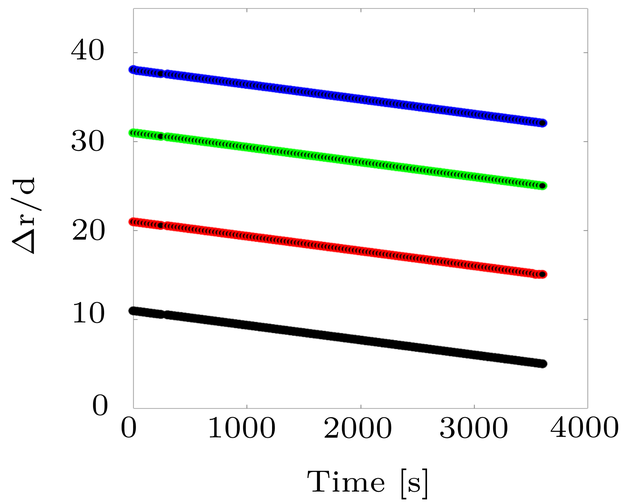

Figure 2
Mean distance changes between liposome particles with time for four different experiments. .

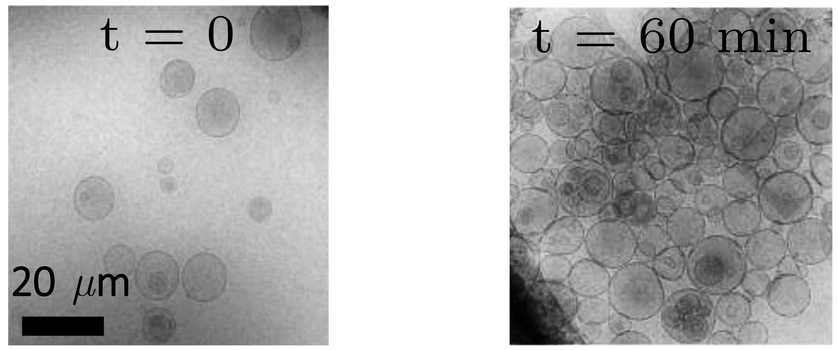

Figure 3
Microscopic images of the liposome at the beginning and 60 minutes after injection.

Results and Discussion

Based on the observations, the mean distance between the particles decreases linearly with the same slope over time in different repetitions of the experiment, and by observing the mean square displacement diagram of the liposome particle is in the sub diffusion regime. To better understand how changes in liposome particle accumulation in different environments, including ionic liquid environments, etc., are among our future plans.

References

[1] V. Forster, R. D. Signorell, M. Roveri, and J. C. Leroux, “Liposome-supported peritoneal dialysis for detoxification of drugs and endogenous metabolites”; *Science translational medicine* **6**, (2014).

[2] S. Ohki, H. Ohsima, “ Interaction and aggregation of lipid vesicles (DLVO theory versus modified DLVO theory)”; *Colloids and Surfaces B: Biointerfaces* **1**, (1999).

[3] C. S. O’Brien, “A mathematical model for colloidal aggregation ”, (2003).