Inter-Vesicle Second Virial Coefficient Regulated by Surface Charge Density and PEG-grafting Ratio: Optical Confinement Study

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Lipid vesicles are a useful drug-encapsulating carrier in the field of nano-biotechnology. Inter-vesicle interaction in nanoscale, which is a crucial factor to determine the stability of vesicles, however, has not been actively studied so far due to the obstacles of nanometer-sized (~100 nm) and thin walled vesicular structure as well as the lack of measurement techniques. In this poster session, we present the quantitative measurement of intermolecular interaction of charged lipid vesicles by "optical bottle", a technique to confine multi-particles into focused laser beam. This technique can probe osmotic second virial coefficient (B_2) in wide range of vesicle concentration up to several volume percent, which is ten folds denser regime than conventional scattering technique. As increasing the surface charge density (i.e. the charged lipid DOPG to neutral lipid DOPC ratio) in the range of $\gamma_{DOPG} = 0.2 – 1.0$, second virial coefficient increases from B2 $= 0.91 \times 10^7$ to 2.4×10^7 nm^3. This result has something to do with the theoretical estimation which shows that the electrical double layer interaction by the surface charge and released counterions from charged lipids vesicles plays a dominant role on regulating long range repulsive second virial coefficient. Also, as increasing the PEG-grafting ratio, B_2 changes dynamically depending on the PEG conformation regimes. This result is caused by the steric repulsion of PEG as well as the change of electrical double layer, which is represented by the decrease of average trapping energy.