LXD Investigation of the Effects of MRPs and SIV Fusion Peptide on Phase Structure of N-methylated Dioleoylphosphatidylethanolanmine

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Lamellar X-ray diffraction (LXD) was used to determine the membrane structure of multilayer of N-monomethylated 1,2-dioleoyl-sn-glycero-3-phosphoethanolamine (MeDOPE), at the presence or absence of SIV fusion peptide and Maillard reaction products (MRPs). The measurement was carried out with synchrotron radiation at the beam line 13A1 SW6.

The sample humidity was increased gradually by decreasing the temperature difference between sample plate and water bath. The temperature of water bath was increased from 20 °C to 28 °C, at a rate of 1 °C per step. The highest and lowest humidity in this measurement was 93% and 63%, respectively. The samples were exposed to X-ray for certain time, in order to obtain a strong enough diffraction pattern but not over-loaded. The exposure time was varied from 5 s to 180 s.

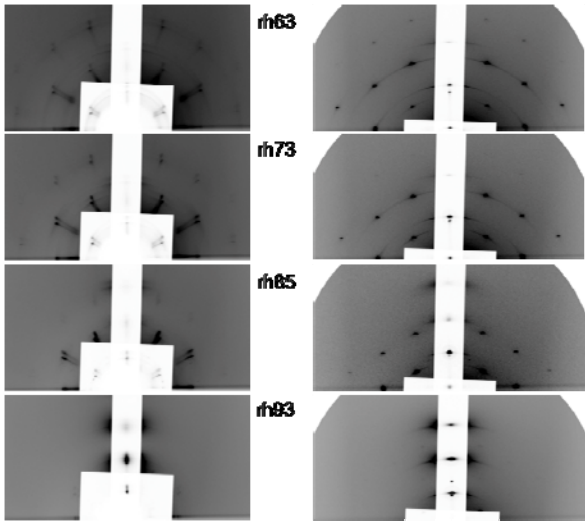

Fig. 1: The diffraction of MeDOME at the presence (a) and absence (b) of AG MRPs (5 mol%) at four humidities, 63%, 73%, 85%, 93%.

As shown in Fig. 1, at the humidities lower than 81%, MeDOPE was fully in H_{II} phase, although the distance between each peak was decreasing when the humidity was raising up, which indicates the happening of phase transition from invert hexagonal phase to lamellar phase. At the humidities higher than 81%, the lipid bilayer was gradually transited to L_α phase. The proportion of lipids in L_α phase increased step by step until L_α phase became dominant at 93% rh.

The addition of AG MRPs (5 mol%) generally weakened the lipid diffraction signal in H_{II} phase, which resulted in a longer exposure time to X-ray for the same amount of lipids, and a smaller peak to peak distance. Furthermore, at the highest humidity, 93%, the lipid bilayers haven't been fully transited to L_α phase since a weak diffraction of H_{II} phase was observed. The appearance of L_α phase was at 81% rh, the same as the pure MeDOPE. The weakening of diffraction indicates that AG disorders the H_{II} phase and makes it easier for lipid bilayers to transit from H_{II} phase to L_α phase.

The presence of SIV fusion peptide (1 mol%) generally enhanced the diffraction signal of H_{II} phase, which indicates a stablizing function of the peptide on invert hexagonal phase. This is constant with the previous studies [1].

The addition of AG MRPs to this lipid-peptide system dramatically decreased the intention of lipid diffraction in H_{II} phase. AG MRPs inhibits the effects of SIV peptide on lipid bilayer, in a concentration dependent manner.

Reference

[1] T. A. Harroun *et al.*, Biochimica et Biophysica Acta **1561**, 119 (2002).