Impact of the sapogenin gypsogenin on the structure and phase behavior of DMPC vesicles

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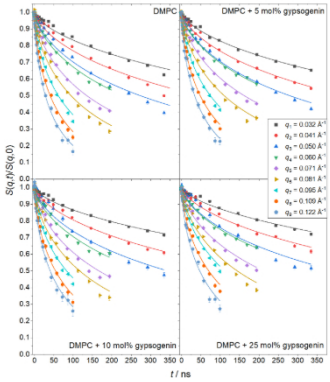
Small unilamellar vesicles (SUVs) composed of phospholipids such as 1,2-dimyristoyl- *sn* -glycero-3-phosphocholine (DMPC) are widely used as model membrane systems. DMPC bilayers undergo a well-defined phase transition from the gel to the fluid phase at approximately T_m ~24 °C.[1,2] While the interaction of saponins with DMPC membranes has been extensively studied, considerably less is known about the effects of their aglycone counterparts, the sapogenins. Gypsogenin, a pentacyclic triterpenoid found in soapwort (*Saponaria officinalis*) and gypsum herb (*Gypsophila oldhamiana*), has attracted interest due to its reported anticancer activity.[3,4]
In this study, gypsogenin was incorporated into unilamellar DMPC vesicles to investigate its biophysical impact. Structural changes were analyzed using small-angle neutron scattering (SANS), providing insights into vesicle size, morphology, and bilayer thickness. Complementary neutron spin-echo (NSE) spectroscopy revealed a concentration-dependent increase in membrane stiffness above T_m , evidenced by enhanced bending rigidity and suppressed collective membrane undulations. Notably, this stiffening effect increases with higher gypsogenin content and is comparable to the well-known impact of cholesterol incorporation into lipid bilayers.[5]
Thermotropic properties were examined by UV–vis spectroscopy through turbidity measurements, indicating shifts in the main phase transition temperature as well as alterations in transition cooperativity. These results demonstrate that gypsogenin significantly affects the phase behavior of DMPC membranes. Overall, this study shows that gypsogenin modulates both the structural and thermal properties of phospholipid vesicles, contributing to a deeper understanding of membrane interactions.

Keywords:
phospholipid vesicles, model membranes, sapogenin, SANS, NSE



Intermediate NSE scattering functions S(q,t)/S(q,0) for vesicle dispersions composed of DMPC with gypsogenin at concentrations of 0, 5, 10, and 25 mol%, measured at 40 °C. Vesicles were extruded through a membrane with a pore diameter of 50 nm.

References:

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