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DMPC-glycyrrhizin model membranes in the absence and presence of cholesterol: From small unilamellar vesicles to flat disc structures

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The saponin glycyrrhizin is the main sweet-tasting part of the liquorice root and is often used as a sweetener and emulsifier. It is known to interact strongly with cholesterol and has anti-viral activity. Using small, unilamellar lipid vesicle (SUV) as model membrane, we study the mixing properties of glycyrrhizin with the phospholipid 1,2-dimyristoyl-*sn*-glycero-phosphocholine (DMPC) by using small-angle neutron scattering (SANS). Due to the phase transition temperature of DMPC at $T_m \approx 24$ °C, the fluid-like state (above T_m : 40 °C) and the solid-like state (below T_m : 10 °C) of the DMPC bilayers were studied. SANS measurements show that DMPC vesicles with and without cholesterol (10 mol%) generate a vesicle like form factor. The interaction of glycyrrhizin with the DMPC bilayer can be differentiated into three regimes which are based on the concentration of glycyrrhizin. Below 7 mol%, glycyrrhizin is incorporated into the bilayer (with and without cholesterol), respectively for both states of the bilayer. From 10 to 30 mol% aggregation occurs and above 30 mol% the form factor indicated the presence of smaller structures, for a solid-like state of the bilayer. In the presence of cholesterol, aggregation is observed not before 15 mol% glycyrrhizin and no nano discs are formed. For the membrane in the fluid-like state aggregation occurs up to 40 mol% glycyrrhizin. Beyond this value no aggregation can be observed. Small structures can only be found from 60 mol% onwards.

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