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Aescin incorporation and nano-domain formation in DOPG model membranes observed by small-angle neutron scattering as well as small-angle and wide-angle X-ray scattering

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The saponin aescin can be extracted from the horse chestnut tree and is known for its anti-inflammatory and anti-oedematous properties. Using small, unilamellar lipid vesicle (SUV) as model membrane, we study the mixing properties of aescin with the phospholipid 1,2-dioleoyl-sn-glycero-3-phospho-(1'-rac-glycerol) (DOPG) by using small-angle neutron scattering (SANS), small- and wide-angle X-ray scattering (WAXS, SAXS). Due to the very low phase transition temperature of DOPG at T_m=-18 ℃ only the fluid like phase of the lipid is accessible. For pure DOPG vesicles SANS, SAXS and WAXS measurements lead to the expected vesicle like form factor. In SANS measurements the interaction of aescin is almost not visible in the form factor whereas in SAXS measurements the interaction leads to a significant change in the form factors. With SANS and SAXS measurements combined the dimension of the lipid bilayer is resolvable. In contrast, the chain-chain correlation in the bilayer is observable with WAXS measurements. The interaction of aescin with DOPG can be differentiated into two regimes which are based on the aescin concentration. For concentrations up to 10 mol% aescin is incorporated into the bilayer statistically. For concentrations from 20-50 mol% a nano-domain formation of aescin can be assumed in the bilayer. The nano-domain formation is observable by a change in the SANS and SAXS form factors as well as the appearance of a second chain-chain distance in the WAXS signal.

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