Thermal and phase behavior of cationic dioctadecyldimethylammonium chloride / poly(allylamine hydrochloride) aqueous mixtures

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The interaction between cationic lipid bilayers and polymers was investigated by differential scanning calorimetry (DSC). Typically, DODAC/water dispersions display single transitions at \( T_m = 48.6 \, ^\circ\text{C} \) and \( T'_m = 43.3 \, ^\circ\text{C} \), and peak width \( \Delta T_{1/2} \approx 0.3 \, ^\circ\text{C} \) and \( \Delta T'_{1/2} \approx 5.3 \, ^\circ\text{C} \), respectively in the heating and cooling processes. This indicates that at low concentrations, DODAC dispersions assemble as unilamellar vesicles. Poly(allylamine hydrochloride), PAH (MM 15 kDa), is a water soluble cationic polyelectrolyte, whose properties depend on concentration, pH, aging time and additives. Since these compounds are both cationic, it is expected weak or no interactions between them in aqueous media. DODAC 1.0 mM vesicle was prepared in water or in 0.1-20 wt% PAH solution. Up to 0.1 wt% PAH there is no change in the optical appearance of the dispersion. Further addition of PAH yields phase separation with formation of a denser clear (bottom) phase, the volume of which increases to a maximum around 1 wt% PAH, in equilibrium with a top phase optically similar to DODAC dispersion. Above 1 wt% PAH, the top phase destabilizes and macroscopic aggregates are seen and two small endotherms appear. Thermal analysis shows that upon heating, the thermograms of neat DODAC dispersions present the melting transition at \( T_m \approx 48.6 \, ^\circ\text{C} \). These results point to weak DODAC-PAH affinity resulting segregation and formation of DODAC-PAH complexes with differing structures depending on composition, that is, vesicle-rich (on top) and PAH-rich (on bottom). Like the vesicles and the polymers themselves, these complexes can be applied in different fields of science industry.

Keywords: DODAC vesicles, Differential scanning calorimetry, cationic polymer
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