Critical deflocculation temperature of dioctadecyldimethylammonium bromide (DODAB) vesicles revealed by differential scanning calorimetry

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Within the temperature range of 1-65 °C, DSC thermograms of (up to 10 mM) DODAB aqueous dispersions exhibit typically up to four endothermic and one exothermic transition in the heating mode, and two exothermic transitions in the cooling mode. Thus far, most of these transition peaks have not been uniquely or satisfactorily related to any specific thermal transition. Besides the well-known melting transition at $T_m \approx 45$ °C, there are secondary transitions around 5-9, 36, 46 and 52 °C in the heating mode, and around 14- 40 and 14.5 °C in the cooling mode. This work is mainly concerned with the transition around 52 °C, which will be shown as being related to the vesicle deflocculation, whose characteristic temperature is the critical deflocculation temperature ($T_d$), assigned to the peaks maximum. While the DSC melting peak is indicative of integral vesicle structures, the deflocculation peak is indicative of vesicle flocks even when they cannot be viewed with the naked eye. The presence of deflocculation peak is, therefore, and indicative of vesicle instability, or vesicle flocculation below $T_d$, while its absence indicates stabilized vesicles even below $T_d$. The lack of this peak in the cooling mode indicates that the rate of vesicle flocculation is much slow if compared to deflocculation. The data also indicate that the amounts of flocks in fresh samples increase with surfactant concentration and ageing time, but it decreases continuously with repeated heating cycles, indicating that non fresh DODAB dispersions can be “refreshed” after some heating cycles throughout $T_d$. The absence of deflocculation peak for 0.1 mM DODAB, indicates that up to this concentration the vesicles are stable. The awareness of $T_d$ for a given vesicle-forming surfactant is important not only for vesicle preparation protocols, but also for vesicle storage. Vesicle should be prepared and stored above $T_d$ to minimize flocks formation.

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