

Structural changes of DMPC bilayers induced by gemini surfactants

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Dimyristoylphosphatidylcholine (DMPC) is a phospholipid commonly occurring in biological membranes. Fully hydrated DMPC undergoes well-characterised thermotropic phase transitions. Gemini surfactants (also known as dimeric surfactants) are amphiphilic compounds composed of two conventional (monomeric) surfactants moieties connected by the so-called spacer group. They have several characteristics that distinguish them from their monomeric counterparts. The most important include increased surface activity or even 1000 times smaller value of the CMC (critical micelle concentration) [1-3].

Gemini surfactants interacting with phospholipids can strongly affect their structural behavior, even at very low concentration. Therefore the physicochemical properties of that group of mixed systems can be easily modified. They can be relevant in the pharmacy, cosmetics industry, bionanotechnology, in the development of NMR research of membrane proteins but they also can be used for the delivery of DNA into the cell [4].

The aim of this study was to analyze the impact of alkoxyderivatives of bisimidazolium quaternary salts at various concentrations on the structure and phase stability of DMPC in aqueous solutions. All studied gemini compounds possess side chains with the same length but differ in spacer group and type of side chains (linear or cyclic).

The presented data has been collected at Beam Line 911-4 at MAX-lab in Lund, (Sweden). The scattering data were recorded in the temperature range 6-30 °C using the synchrotron radiation ($\lambda=0.091$ nm) and the Mar 165 CCD detector. The scattering vector range was $0.05 < s < 4 \text{ nm}^{-1}$. All sets of data have been processed (normalized to the intensity of the incident beam, corrected for detector response and scattering was subtracted from the buffer) using computer programs BLI7-11 [5] and PRIMUS [6].

The addition of the studied surfactants has caused a gradual perturbation of the lamellar phase typical for DMPC and eventually, for the highest surfactant concentration, the formation of the unilamellar vesicles – bicellar phase (the observed scattering patterns of DMPC/surfactant systems are very similar to the SAXS patterns reported for the bicellar DMPC/DHPC systems). Also the temperature range of the main phase transition of DMPC was shifted towards lower temperatures with increasing surfactant concentration.

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