Interactions between zwitterionic sufractants and DMPC

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Betaines are zwitterionic organic compounds, which means that in their structure, we can distinguish positively charged and negatively charged functional groups. Sulfobetaines are analogues of betaines in which the anion is a sulfonic group. Therefore the surfactants based on sulfobetaine derivatives are amphoteric molecules composed of hydrophilic and hydrophobic moieties, so they tend to form associates in the aqueousenvironment. Understanding the interactions between sulfobetaines, and phospholipids, which are one of the major components of biological membranes, is an important issue for biophysics, gene therapy or nanotechnology. Such mixed systems can be used as drug delivery systems, nucleic acids, or as a component of the shell quantum dots [1-3].

The aim of this study was to determine the effect of two novel zwitterionic surfactants with the sulfobetaine sturucture on the stability of model systems of biological membranes based on phosphatidylocholine derivative. The studies were performed on 1,2-dimyristoyl-sn-glycero-3-fosfatydylocholine (DMPC) and 4-(N-octylmorpholine)-1-butansulfonate (OMBS) and 4-(N-decylmorpholine)-1-butansulfonate (DMBS).

The small angle X-ray scattering data were collected at the Beam Line I911-4 at the MAXII storage ring of the MAX-Lab (Lund, Sweden) using the synchrotron radiation (λ=0.091 nm) and the Mar-CCD 165 mm detector. The transmission SAXS measurements were performed at temperatures ranging from 6 – 30°C. The scattering pattern for the buffer solution (background scattering) was collected before and after data collection for all phospholipid samples. The scattering vector range was $0.1<s<4$ nm^{-1} (where $s=4\pi\sin\theta/\lambda$). All data obtained were normalized to the intensity of the incident beam, corrected for detector response and the buffer scattering was subtracted using computer programs BLI7-11 [4] and PRIMUS [5].

The results showed that the addition of sulfobetaines causes destabilization of lamellar structures characteristic for fully hydrated derivatives of phosphatidylcholine and gradually induces the formation of mixed liposomes. The presence of surfactants also affects the main phase transition temperature (the phase transition from gel to liquid crystalline phase).

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References

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