INTERACTIONS OF CATIONIC GEMINI SURFACTANTS WITH DMPC

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In water solutions phospholipids exhibit tendency to aggregation and formation of different structural phases (lamellar, cubic, hexagonal *etc.*) [1]. In mixtures of phospholipids with short-chain phospholipids or surfactants the bicellar phase can be formed [2].

The study has been performed on the model systems of biological membranes obtained on the basis of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) and cationic gemini surfactants – derivatives of 1,1'-(1,4-butane)bis 3-alkyloxymethylimidazolium chlorides (with octyl, decyl and cyclododecyl chains).

A series of the SAXS measurements were performed at DESY, EMBL Beam Line X33, (Hamburg, Germany) [3] using the synchrotron radiation ($\lambda = 0.15$ nm) and the Mar 345 image plate detector. The measurements were performed at temperatures ranging from 6 to 30°C and for the scattering vector $0.05 < s < 5.0$ nm^{-1} ($s = 4\pi\sin\theta/\lambda$). Additional SAXS data set was collected in MaxLab, Beam Line 7-11 (Lund, Sweden) [4]. The data were collected at temperatures from 6 to 30°C for the scattering vector $0.05 < s < 3.6$ nm^{-1} using the synchrotron radiation ($\lambda = 0.1066$ nm) and the MAR 165 CCD detector.

All data sets were normalized to the incident beam intensity, corrected for detector response and the scattering of the buffer was subtracted using the computer program PRIMUS [5].

The SAXS results implied a gradual disappearance of the lamellar phase typical of DMPC and a probable formation of the bicellar phase. Also the temperature range of the main phase transition in DMPC was shifted towards lower temperatures.

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References

[1] R. Koynova, M. Caffrey, "Phases and phase transitions of the phosphatidylcholines," *BBA-Rev Biomembranes* **1376** (1998) 91-145.

[2] J. Katsaras, T.A. Harroun, J. Pencer, M.P. Nieh, "«Bicellar» lipid mixtures as used in biochemical and biophysical studies," *Naturwiss.* **92** (2005) 355–366.

[3] M.W. Roessle, R. Klaering, U. Ristau, B. Robrahn, D. Jahn, T. Gehrmann, P. Konarev, A. Round, S. Fiedler, C. Hermes, D.I. Svergun, "Upgrade of the small-angle X-ray scattering beamline X33 at the European Molecular Biology Laboratory, Hamburg," *J. Appl. Crystallogr.* **40** (2007) 190–194.

[4] M. Knaapila, C. Svensson, J. Barauskas, M. Zackrisson, S.S. Nielsen, K.N. Toft, B. Vestergaard, L. Arleth, U. Olsson, J.S. Pedersen, Y. Cerenius, "A new small-angle X-ray scattering set-up on the crystallography beamline I711 at MAX-lab," *J. Synchrotr. Radiat.* **16** (2009) 498–504.

[5] P.V. Konarev, V.V. Volkov, A.V. Sokolova, M.H.J. Koch, D.I. Svergun, "PRIMUS: a Windows PC-based system for small-angle scattering data analysis," *J. Appl. Crystallogr.* **36** (2003) 1277–1282.