DMPC MULTI- AND UNILAMMELAR VESICLES UNDER PRESSURE

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The present work is devoted to the study of the effect of high hydrostatic pressure on the structure of phospholipid vesicle membranes in the vicinity of phase transitions induced by a combination of temperature and pressure.
The influence of high hydrostatic pressure on structure and phase behavior of lipid membranes has been has been a subject of interest over the past decades. The importance of studying these effects can be explained both by the possibility of expanding the understanding of the cellular processes of deep-sea extremophilic organisms and by applied goals, in particular, by the ability to control the phase state of the membrane without changing the temperature in order to study the effect of membranotropic agents. The results of studies of multilamellar phospholipid vesicles by neutron and X-ray small-angle scattering show a significant shift of the main phase transition (from «rigid» gel-phase $L_{\beta'}$ to «fluid» L_{α} phase) to higher temperatures regions [1,2].
Structural parameters of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) multilamellar (MLV) and unilamellar (ULV) vesicles in D_2O solution were investigated by SANS method on YuMO spectrometer equipped with specially designed high-pressure chamber [3]. High-pressure setup could produce pressure up to 4000 bar with an accuracy of 2.5 - 10% (depending on the pressure value). The temperature of the pressure cell containing the sample was controlled using the Lauda thermostat.
For each isothermal or isobaric scan, repeat distances (membrane thickness plus water interlayer thickness) of MLV were determined and membrane thicknesses and radii for ULV were estimated. Based on the dependences obtained, the shifts of the temperatures of phase transitions were determined. For DMPC ULV a presence of previously unobserved phase pretransition is assumed.

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