SMALL ANGLE SCATTERING OF SYNCHROTRON RADIATION STUDIES OF BIOMEMBRANES

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Cell membranes consists of lipids, proteins and carbohydrates. Phospholipids are the main group of cell membranes lipids. The occurrence of a hydrophilic and a hydrophobic part in the phospholipide molecule determined their ability to self-organization in such solvents as water. Fully hydrated phospholipids exhibit tendency to aggregation and formation of different structural phases. Typical for phospholipids lamellar phases (lamellar gel phase, rippled phase, liquid crystalline phase) are formed by stacks of bilayers and water. The cubic phases are formed by spherical micelles organized in cubic lattice or bicontinuous 3D-network of finite phospholipids rods. The hexagonal phase is composed of hexagonally packed long rods formed by molecules of phospholipids [1].

In mixtures of phospholipids with short-chain phsopholipids or surfactants the discoidal (bicellar) phase can be formed [2].

The most intense study concentrates not just on the structure and interactions in the lipid/water systems but also on more complex systems including additional components such as surfactants, polyelectrolytes, peptides or liquid crystals [3].

Small angle X-ray and neutron scattering techniques are one of the most effective methods for structural analysis of lipids and their mixtures. These methods permit determination of such structural parameters as the radius of gyration, intramolecular distance distribution function (p(r)), phospholipid double layer thickness or diameters of the tubes in the hexagonal phase. The SAXS method also permit getting the information on the orientation and symmetry of the scattering molecules.

The lecture gives analysis of performance of selected and the most popular applications of the small angle scattering of synchrotron radiation in structural biology of biomembranes. The presentation will be illustrated on the several examples: discoidal (bicellar) phases formed by phospholipids [4] and mixtures of phospholipids and cationic surfactants [5], cubic phases observed for mixtures of phospholipids and zwitterionic surfactants [6] and structures formed in phosphilipid/gemini surfactant systems.

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