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‘Physical properties and self-organization of DNA-cationic surfactant complexes: influence of DNA type and surfactant structure’

Abstract

In the framework of PhD thesis, eight DNA-cationic surfactant complexes were prepared, based on four types of DNA (three linear, one plasmid) and three cationic surfactants (cetyltrimethylammonium chloride, CTMA; benzyldimethyl-hexaammonium chloride, BAC; hexadecylpyridinium chloride, HDP). The selected types of DNA differ in the distribution of the DNA chain length (linear) or the spatial arrangement of the chains (plasmid). In turn, surfactants are characterized by the same carbon chain length (16 carbon atoms) and differ in their functional groups. The complexes were studied in two forms: as bulk samples (powder) and thin layers.

The methods of infrared spectroscopy, X-ray diffraction and dielectric spectroscopy were used to study bulk samples. The research confirmed the formation of complexes (infrared spectroscopy), allowed to determine the unit cell parameters for selected complexes (X-ray diffraction), and allowed to determine their electrical properties and to identify the relaxation process occurring in the synthesized complexes (dielectric spectroscopy).

Thin layer of the complexes were created by using the Langmuir-Blodgett deposition technique. The behavior of the monolayers at the liquid-gas interface was described and the method of lifting the layer onto a solid substrate was optimized. The obtained thin layers were imaged by atomic force microscopy and the image was analyzed by using the FFT method. It has been shown that, depending on the lifting conditions, DNA type, structure of surfactant and kind of substrate, the different surface structures of monolayer can be obtained.