STRUCTURAL ANALYSIS OF SELECTED GEMINI SURFACTANT (1-IMIDAZOLILO-3-DECYLOOXYMETHYL) PENTANE CHLORIDE LIPOPLEXES

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Cationic amphiphilic agents are one of the well established components for non-viral gene delivery vectors for gene therapy [1, 2]. Their natural ability to form self-assembled structures together with nucleic acids in water provides a protection of genetic material in vivo environment. Moreover, their positively charged hydrophilic parts demonstrate a great affinity to polyanionic nucleic acids, reducing strong repulsive interaction with cell membranes and causing significant condensation of attracted molecules. Those properties have a response in increased cell internalisation of nucleic acids and enhanced transfection [2].

A new class of amphiphilic cationic surfactants — gemini surfactants [3], is currently studied for gene delivery purposes [4, 5]. The gemini surfactant molecule is composed of two hydrophilic "head" groups attached to hydrophilic "tail" chains and connected via the molecular linker between them. The mixtures of cationic surfactants and lipids are recently under investigation [5, 6]. In our study mixtures of phosphatidylholine derivatives (e.g. 1,2-dipalmitoyl-sn-glycero-3-phosphocholine [DPPC], 1,2-dimyristoyl-sn-glycero-3-phosphocholine [DMPC]) and gemini surfactants with cationic imidazole "head" groups are tested.

The influence of different concentrations of 1,5-bis (1-imidazolilo-3-decylooxymethyl) pentane chloride (cationic gemini surfactant) on the thermotropic phase behaviour of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC) (PC derivative) bilayers was investigated using FTIR spectroscopy and differential scanning calorimetry DSC.

FTIR spectra were obtained by using BRUKER TENSOR 27 FT-IR spectrometer. DSC measurements were performed using DSC-204 Phoenix Netzsch system with a high sensitivity μ-sensor.

Thermotropic transitions between gel (L_β) $\rightarrow$ rippled gel (P_β) and rippled gel (P_β) $\rightarrow$ liquid crystalline (L_α) phases were observed. FTIR analysis of CH_{2l}, CH_3 symmetric and antisymmetric stretching, as well as CH_2 scissoring bands showed discontinuous conformational changes in DMPC hydrophobic chains. Hydration of DMPC hydrophilic heads was investigated by analysis of $C=O$ stretching band. DSC analysis showed a decrease in enthalpy (ΔH) of the main transition ($P_\beta \rightarrow L_\alpha$) in correlation with the increase in (1-imidazolilo-3-decylooxymethyl) pentane chloride concentration.

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