

P-08

Difference in structure and conformational dynamics of DPPC and DPPC/DNA systems with selected gemini surfactants with different spacer

Wojciech Kida^{1*} and Maciej Kozak¹

¹Dept. of Macromolecular Physics, Adam Mickiewicz University, Umultowska 85, 61-614 Poznan, Poland

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*e-mail: wk57@wp.pl

Cationic gemini surfactants (consisting of 2 cationic head groups and 2 hydrophobic tails linked by a spacer group) have proven to be effective synthetic vectors for gene delivery (transfection) [1-2].

The aim of this work was to investigate the influence of surfactants with different chain length on structure and conformation of DPPC and DPPC/DNA systems.

Complexes of gemini surfactant/DPPC and gemini surfactant/DPPC/DNA have been investigated using differential scanning calorimetry (DSC), small angle scattering of synchrotron radiation (SAXS) and Fourier transformed infrared spectroscopy (FTIR). Compounds with DNA have been also investigated using complementary techniques: agarose gel electrophoresis and circular dichroism (CD).

The studied surfactants have strong influence on structural and thermodynamic properties of measured complexes like disappearance of pretransition, the changes of the main phase transition temperature as well as changes the organisation of lipid bilayers in the multilayer lamellar phase.

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References

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P-09

Complexes between DNA and selected gemini surfactants – circular dichroism and AFM studies

Żaneta Kołodziejaska¹, Zuzanna Pietralik¹, and M. Kozak^{1*}

¹Faculty of Physics, Adam Mickiewicz University, ul. Umultowska 85, 61-614 Poznań, Poland

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*e-mail: mkozak@amu.edu.pl

The efficacy of gene therapy depends on the transfection stage of genetic material into cells. The best transfection properties provide a lipid-like molecules similar to components of biological membranes. These particles should have high affinity to genetic material and efficiently combine with him. Such molecules can be cationic gemini surfactants which, due to their physicochemical properties (positive electric charge, low critical micelle concentration CMC) are promising delivery systems for genetic material in gene therapy.

The aim of this study was to investigate the process of complex formation between gemini cationic surfactants and DNA. Dicationic surfactants studied had a different length of the hydrophobic chains (different number of carbon atoms in the chain).

Based on the data obtained by circular dichroism and electrophoresis can be concluded that the gemini surfactants with long side chains effectively combined with DNA at low concentrations in the solution.

AFM images confirmed the formation of vesicular structures – complexes between DNA and surfactants.

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