Conformational and Phase Transitions in DNA—Photosensitive Surfactant Solutions: Experiment and Modeling

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ABSTRACT:

DNA binding to trans- *and* cis-*isomers of azobenzene containing cationic surfactant in 5 mM NaCl solution was investigated by the methods of dynamic light scattering (DLS), low-gradient viscometry (LGV), atomic force microscopy (AFM), circular dichroism (CD), gel electrophoresis (GE), flow birefringence (FB), UV–Vis spectrophotometry. Light-responsive conformational transitions of DNA in complex with photosensitive surfactant, changes in DNA optical anisotropy and persistent length, phase transition of DNA into nanoparticles induced by high surfactant concentration, as well as transformation of surfactant conformation under its binding to macromolecule were studied. Computer simulations of micelles formation for* cis- *and* trans-*isomers of azobenzene containing surfactant, as well as DNA-surfactant interaction, were carried out. Phase diagram for DNA-surfactant solutions was designed. The possibility to reverse the DNA packaging induced by surfactant binding with the dilution and light irradiation was shown. © 2014 Wiley Periodicals, Inc. Biopolymers 103: 109–122, 2015.*

Keywords: DNA-surfactant complexes; light-induced DNA de-compaction; phase diagram; DNA volume and persistent length

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INTRODUCTION

Manipulation with high molecular DNA and investigation of its conformational possibilities after the addition of different compounds into the solution not only provide new knowledge about the structure and molecular basics of functions of the main biopolymer, but also allow to find a new approach for the construction of nanosystems having peculiar properties. Indeed, due to the unique charge density, chain rigidity, and double stranded structure of nucleic acid with hydrophobic bases inside the helix and hydrophilic sugar-phosphate carcass with high negative charge outside

Additional Supporting Information may be found in the online version of this article.

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