

3rd International Conference on

Medical Physics & Biomedical Engineering

November 07-08, 2016 Barcelona, Spain

DNA as a catalyst in redox, photo-induced processes and nano-scale energy transfer

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The aim of the present work is spectroscopic and thermodynamic study of DNA catalytic properties in the following processes: redox; performing of photo-dynamic effects; nanoscale resonance radiationless electron excitation energy transfer.

Using spectrophotometry and thermodynamic approaches we have shown that 1) at interaction with DNA, silver nano particles with the size 1-2 nm (AgNPs) are adsorbed on it and only partial corrosion of nanoparticles at the level of Ag⁺ ions is observed; 2) ascorbic acid reduces silver ions in ternary complex DNA-Ag⁺-AgNPs. Thus, AgNPs activate the process of quick reduction of Ag⁺ ions to silver atoms; 3) at photo-irradiation desorption of silver atoms from the surface of AgNPs takes place. The atoms are first adsorbed on the surface of DNA and then penetrate inside the double helix making prolate stretched structure; 4) kinetic study of photo-desorption makes it possible to determine desorption rate constant and adsorption heat $Q_a \geq 80$ kJ/mol Ag⁰ for AgNPs bound with DNA; 5) AgNPs represent liquid drops which moisture the DNA surface at interaction. At photo-irradiation of AgNPs-DNA complex DNA dependant conformational transition takes place due to fast and intensive heating.

The nano-scale method of laser induced fluorescence resonance energy transfer (FRET) to donor-acceptor intercalator pair for quantitative and qualitative study of stability quality DNA double helix in solution in real time is offered. The approach is based on the example of acridine orange molecule (donor) and ethidium bromide (acceptor) intercalated in DNA.

Biography

T G Giorgadze is a Scientist in Department of Biological Systems of Physics, Andronikashvili Institute of Physics. She completed her Graduation from Ivane Javakishvili Tbilisi State University. She is an author of seven scientific publications. She recently defended her PhD thesis entitled "Nano-technological processes in DNA complexes with silver nanoparticles and silver ions studied by spectroscopic and thermodynamic methods".

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