Influence of AG^+ ions on DNA spectral properties

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DNA is vitally important macromolecule and often used in various fields of biochemistry, biology and medicine.

In many experiments the DNA fluo- and phosphorescence emission is observed and investigated.

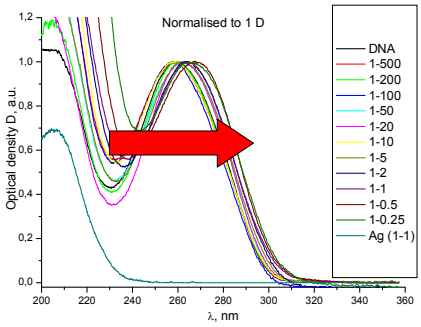
It is well known the property of Ag+ ions "gathering" on the DNA, from separate ions in solution to some small nano-clusters in or near DNA, and then to clusters and nanoparticles. This is often used in controlled nanoparticles grows on DNA used as on template.

In this work we examine the effect of presence of Ag+ ions on the DNA spectral properties.

Aqua solutions of DNA, and DNA-Ag samples of different DNA:Ag ratios were investigated at room and nitrogen (77K) temperatures.

The UV-vis absorbtion as well as fluorescence and phosphorescence spectra of DNA in presence of different quantity of Ag were compared to pure DNA spectra.

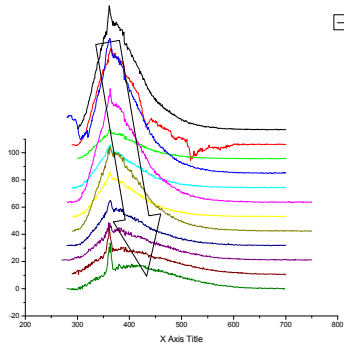
1. Absorbtion



It is clearly seen that the bigger quantity of Ag+ ions leads to shift maximum of DNA absorbtion ratio to long-wave region by 7-8 nm from 259 nm of 1/500 DNA-AG ratio, to 267 nm on the 4/1 ratio of DNA/Ag.

(DNA absorbtion is not depend on quantity of Ag)

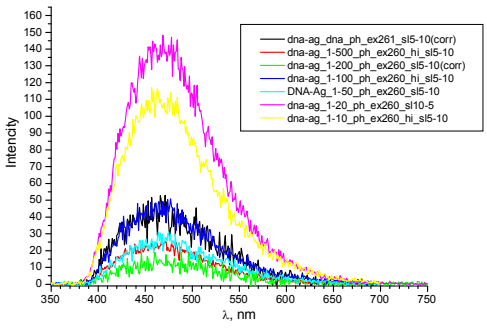
2. Fluorescence

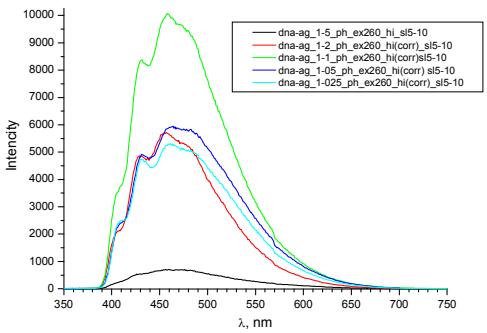


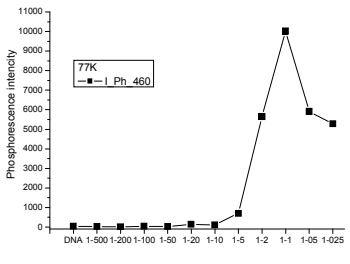
With increase the number of Ag atoms, the fluorescence is decreased, wider and maxima are shifted to long-wave side.

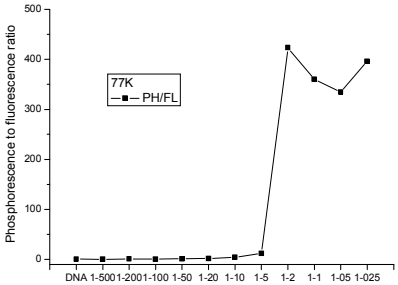
Wide part may be connected with some part of phosphorescence, which is significantly increased, and the shirt-lifetime part of it is appears or make visible.

3. Phosphoresecnce









With increase the number of Ag atoms, the phosphorescence intensity is rapidly increased at full range of ratios.

At low concentrations of Ag+ ions the intensity rises not so quickly, but starting from the ratio 1/5 the intensity is rapidly increase, and also well known adenine structure is appear.

This can be connected to the fact that after some critical concentration (as can be seen from experiment, it is near 1/5), the Ag+ ions can penetrate inside DNA and electronic excitation, which is running through DNA, is deactivated trough phosphotescence emission. As known from our previous experiments in our lab, and also from literature data, the Adenine triplet level is lowest from DNA bases, so triplet excitations collected on adenine part of macromolecule and deactivated from it.

The main results:

1. It is shown that presence of silver ions in the DNA aqua solutions do not effect on the absorption band shape of DNA but leads to the longwave shift of absorption maximum in the range of DNA base pairs to the number of silver ions 0 - 4/1 ratio.
2. The fluorescence spectra do not change essentially in this range too. Only the fluorescence intensity decreasing is observed.
3. The dramatic changing of phosphorescence spectra (appearing of adenine-like structure and sharp increasing of phosphorescence intensity) is observed starting from the ratio of the number silver ions to the number of DNA base pairs 1: 5

References:

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