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Effect of Millimeter Range Electromagnetic Waves on The Interaction of DNA-specific Ligands with Bovine Serum Albumin

Ara P. Antonyan[1*], Marieta S. Mikaelyan[1], Anzhelika H. Karapetyan[1], Mariam A. Shahinyan[1], Marine A. Parsadanyan[1], Vitali P. Kalantaryan[2], Poghos O. Vardevanyan[1]

[1] Faculty of Biology, Institute of Biology, Yerevan State University, Yerevan, Armenia 0025

[2] Institute of Physics, Yerevan State University, Yerevan, Armenia 0025

ABSTRACT

Nowadays the anthropogenic factor has been added to millimeter range electromagnetic waves (MM EMW) of the environment, which acquires an ecological value and possesses biological effect on living organisms. Though, this factor significantly affects biological systems, being, especially on the molecular level – biomacromolecules, since MM EMW influences their structure in the mediated way. From this point of view, we have revealed that MM EMW affect the interaction of DNA-specific ligands – methylene blue (MB) and Hoechst 33258 (H33258) with blood serum albumin. This effect is mediated by water, which has resonant absorption at several frequencies, including 51.8 GHz. MM EMW effect with the mentioned frequency results in the certain changes of the protein tertiary structure, particularly in increasing the wrapping degree. Due to this for the irradiated complexes the hydrophobic interaction of H33258 compound with the protein increases, which is reflected by more pronounced change of the differential spectra of the formed complexes. Moreover, in these spectra there emerge two peaks – positive and negative. The positive peak corresponds to hydrophobic interaction of this ligand with the protein and the negative peak – formation of hydrogen bonds. In spite of the complexes of H33258-albumin, the differential spectra of MB complexes with the protein are composed of one, negative peak. The irradiation results in the change of spectral properties of MB-albumin complexes, due to which the deviation of the differential spectra of the irradiated complexes toward short wavelengths becomes neglecting, since the polarity change of the binding centers on the protein is less as compared to non-irradiated protein. The obtained data resulted from the fact that small molecules of MB, most apparently, are localized in binding II region of albumin, which is in III A subdomain.

Keywords: bovine serum albumin, DNA-specific ligand, millimeter waves, resonant frequency

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[*]Corresponding Author:

Ara Antonyan, Faculty of Biology, Institute of Biology, Yerevan State University, 1 Alex Manoogian str., Yerevan 0025 Armenia.
Email: apant@ysu.am