FORMATION OF J-AGGREGATES BY THRIMETHINECYANINE DYE 7514 ON FIBRILAR INSULIN

M.Y. Losytskyy¹, K.D. Volkova¹, V.B. Kovalska¹, N.O. Derevyanko², Y.L. Slominskii², O.I. Tolmachev², S.M. Yarmoluk¹

¹Combinatorial Chemistry, Institute of Molecular Biology and Genetics of NAS of Ukraine, ²Institute of Organic Chemistry of NAS of Ukraine, Kyiv, Ukraine

Aggregation of protein molecules into amyloid fibrils is associated with several neurodegenerative diseases, e.g. Alzheimer’s and Parkinson’s ones. Recently series of cyanine dyes strongly increasing the fluorescence intensity in fibrilar protein presence was reported. These dyes are considered to bind to the channels of the fibril beta-structure. Here we report about the trimethine cyanine dye J-aggregates self-organized in the presence of insulin fibrils. Study of such aggregation is interesting both for understanding processes that occur in ligand-fibril system and for the search of fibril-binding compounds, e.g. probes.

Spectral-luminescent properties of trimethine cyanine dye 7514 in the presence of fibrils of model protein insulin were studied. At high protein to dye concentrations ratios the dye molecules bind to the fibrillar insulin as monomers that is accompanied with the increase in dye fluorescence intensity. At the same time, upon decreasing the protein fibrils concentration the dye was shown to form H- and J-aggregates. Since the observed H- and J-bands are not manifested in the free dye fluorescence spectra, we suggest the aggregates to be formed on the insulin fibril. The most interesting is that the J-aggregate fluorescence (at 636 nm) could be excited also at the wavelength of the H-aggregate excitation maximum (515 nm). We suppose that the excitation energy transfer exists between the H- and J-aggregates formed on the insulin fibrils. Based on this assumption, the model of the 7514 molecules packing in the H- and J-aggregates bound to the fibril beta-sheet was proposed.

[Structure of the dye 7514]