Nanoscale physics

Exponential deconvolution program for analysis of electron transfer kinetics of RC and wheat leaves chlorophyll fluorescence

T.V. Serdenko[1], Y.M. Barabash[1], S.M. Kochubey[2]

[1] Department of Physics of Biological System, Institute of Physics, Natl. Acad. of Sci. of Ukraine. Prospect Nauki, 46, Kiev-03039, Ukraine.
E-mail: tais.serdenko@gmail.com

[2] Institute of Plant Physiology and Genetics, Natl. Acad. of Sci. of Ukraine. Vasylkivska Street, 31/17, Kiev-03022, Ukraine.

The shape of induction curve of chlorophyll fluorescence in leaves of plants is caused by the several processes: energy exchange in the light-harvesting antenna, photochemical transformation and an electron outflow from reaction centers. In the present work, an analysis of the shape of this curve is performed for leaves of 4 varieties of wheat. The original method is applied for analyzing of a component structure of the induction curves by deconvolution of them on the exponents. Step-by-step procedure is used for selection of number of exponents, their amplitudes and decrements to obtain the best approximation of the experimental curve by the sum of these exponents.

Revealing of only three components in the analyzed induction curves is in a good accordance with finding out only three types of pigment-protein complexes in thylakoid membranes of chloroplasts. Thus, an analysis of induction curve of chlorophyll fluorescence can be used as an effective instrument for investigation of the state of photosynthetic membranes.

Using this program, the kinetic of structural changes in the reaction center (RC) in the process of photoexcitation is identified. It is shown that for returning into initial steady state of RC in the process of relaxation after achievement the dark state absorption value RC need to be kept in the dark for 700 s. It was found that after photoexcitation RC its structure has the nonequilibrium character within the first 40 seconds after turning off the light.