

STUDIES OF TiO₂ INFLUENCE ON ACTIVITY OF PHOTOSYSTEM II USING FAST FLUORESCENCE SPECTROSCOPY AND ATOMIC FORCE MICROSCOPY

HABINA Iwona, ORZECZOWSKA Aleksandra, SZYMAŃSKA Renata, KORECKI Józef, BURDA Kvētoslava

AGH University of Science and Technology, Cracow, Poland, EU

Abstract

TiO₂ nanoparticles (NPs) are used extensively in many commercial products, including paints, varnishes, cosmetics, plastics, paper, and food as an anticaking, sterilizing, deodorizing or whitening agent. Their accumulation in the environment has increased, recently. Toxic effects of these NPs on animals have been already recognized. On the other hand photocatalytic properties of TiO₂ (especially its anatase form) decided about their use in dye-sensitized cells. In our studies we investigated hybrid systems composed of titanium dioxide and photosynthetic membranes enriched in photosystem II (BBYPSII). Photosystem II (PSII) is a protein-lipid-pigment complex located in the thylakoid membranes of plants, algae and cyanobacteria. It utilizes the sun's energy in the process of water oxidation. We found that anatase and rutile modified the PSII acceptor side activity in a different way. In particular, measurements of the Kautsky effect showed that the exchange and reoxidation rates of the secondary quinone acceptor (QB) increased in BBYPSII treated with the NPs concentrations from about 0.003 to about 1.3 g/ml (at least two minima were detected). However, at higher concentrations, up to about 33 g/ml, the time constant of the QB exchange increased in the case of anatase (at the higher applied concentration even by ~50 ms) while rutile caused an opposite effect. All observed changes were more pronounced in systems containing anatase. An arrangement of structures formed by PSII BBY with TiO₂ NPs were investigated in a liquid cell using atomic force microscopy.

Keywords: Photosystem II, Fluorescence spectroscopy, Atomic Force Microscopy, titanium dioxide nanoparticles

ACKNOWLEDGEMENTS

I.H. has been partly supported by the EU Human Capital Operation Program, Polish Project No. POKL.04.0101-00-434/08-00. It is carried on within the BIONAN project.

Author did not supply full text of the paper/poster.