

Multiple Effects of Cadmium on the Photosynthetic Apparatus of *Avicennia germinans* L. as Probed by OJIP Chlorophyll Fluorescence Measurements

Daniel Gonzalez-Mendoza^a, Francisco Espadas y Gil^b, Jorge M. Santamaría^b, and Omar Zapata-Perez^{a,*}

^a Departamento de Recursos del Mar, Cinvestav Unidad Merida, Merida, Yucatan, Mexico.

Fax: 52 99 99 81 23 34. E-mail: ozapata@mda.cinvestav.mx

^b Unidad de Biotecnología, CICY, Merida, Yucatan, Mexico

* Author for correspondence and reprint requests

Z. Naturforsch. **62c**, 265–272 (2007); received September 5/October 31, 2006

The toxic effects of cadmium on the photosynthetic apparatus of *Avicennia germinans* were evaluated by means of the chlorophyll fluorescence transient O–J–I–P. The chlorophyll fluorescence transients were recorded *in vivo* with high time resolution and analyzed according to the OJIP-test that can quantify the performance of photosystem II. Cadmium-treated plants showed a decrease in yield for primary photochemistry, TR^0/ABS . The performance index of photosystem II (PSII), PI_{ABS} , decreased due to cadmium treatment. This performance index is the combination of the indexes of three independent parameters: (1) total number of active reaction centers per absorption (RC/ABS), (2) yield of primary photochemistry (TR^0/ABS), and (3) efficiency with which a trapped exciton can move an electron into the electron transport chain (ET^0/TR^0). Additionally, the F_0/F_v registered the highest sensitivity to the metal, thus indicating that the water-splitting apparatus of the oxidizing side of PSII is the primary site of action of cadmium. In summary, cadmium affects several targets of photosystem II. More specifically the main targets of cadmium, according to the OJIP-test, can be listed as a decrease in the number of active reaction centers and damage to the activity of the water-splitting complex.

Key words: *Avicennia germinans*, Chlorophyll Fluorescence, Heavy Metals, Photosystem II