
Role of protective and repair mechanisms in the inhibition of photosynthesis in marine macroalgae

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The mechanism of photoinhibition was investigated in three representative macroalgal species growing on the coast of Patagonia: the chlorophyte *Ulva rigida* C. Agardh, the rhodophyte *Porphyra columbina* Montagne and the phaeophyte *Dictyota dichotoma* (Huds.) Lamour. Dark adapted specimens were exposed to 15 min unfiltered solar radiation to induce photoinhibition, and subsequently the recovery of the photosynthetic quantum yield was followed for up to 6 h. Photoinhibition is believed to be due to the damage and proteolysis of the D1 protein in the reaction center of Photosystem II. During recovery this protein is resynthesized. In order to prove this hypothesis, inhibitors of the chloroplast protein synthesis, streptomycin and chloramphenicol were applied. Both retarded the repair process indicating an inhibition of the D1 protein resynthesis during recovery after the damage they experienced during light exposure. Some algal groups use the xanthophyll cycle to ameliorate the inhibition by excessive light. Dithiothreitol, an inhibitor of violaxanthin de-epoxidase, was administered, to impair the xanthophyll cycle. It strongly affected both photoinhibition and recovery even in the red algal species, which do not have the xanthophyll cycle, indicating that this drug has significant side effects and should be used with caution for the study of the involvement of this protective cycle in algae. Pigmentation was followed in the three species using absorption spectroscopy of thallus extracts at 665 nm during continuous exposure to natural solar radiation or radiation deprived of the UV component during two days. The results indicated a pronounced variation in pigmentation over time due to bleaching and resynthesis. Solar radiation was monitored during the experiments in three channels (UV-B, UV-A and PAR) using an ELDONET instrument on site.