Dimethyl sulfoniopropionate and dimethyl sulfide production in response to photoinhibition in *Emiliania huxleyi*

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ABSTRACT: The response in intracellular dimethyl sulfoniopropionate (DMSP) and dissolved DMSP and dimethyl sulfide (DMS) concentrations when *Emiliania huxleyi* was exposed to acute (1-h) increases in photon flux densities of photosynthetically active radiation (PAR) and ultraviolet (UV) radiation was examined in cells acclimated to low light (LL, 30 µmol photons m^{-2} s^{-1}) and high light (HL, 300 vmol photons m^{-2} s^{-1}). LL-acclimated cells displayed greater photoinhibition, assessed as a decrease in maximum photochemical efficiency ($F_v : F_m$). Photoinhibition was increased by exposure to UV wavelengths. LL-acclimated cells also exhibited more light dissipation through the xanthophyll cycle, evident as changes in de-epoxidation state. Greater photoinhibition in LL-acclimated cells corresponded with increased accumulation of DMSP of 21% ± 4% relative to initial concentrations, contrasting with a slight decrease of 5% ± 6% in HL-acclimated cells. Exposure to UV appeared to decrease the rates of intracellular accumulation of DMSP. Conversely, PAR + UV exposure stimulated the net production of dissolved DMSP and DMS in both HL-acclimated and LL-acclimated cultures, compared with high PAR alone. The results indicate a direct link between acute photo-oxidative stress and DMSP synthesis by *E. huxleyi*. The physiological basis for increased release of DMSP and DMS from cells due to high PAR + UV exposure is unclear. However, the timescales of changes in intracellular DMSP, dissolved DMSP, and DMS are consistent with variations in light intensity experienced by phytoplankton in a turbulent mixed layer and are similar to rates of change in photosynthetic parameters associated with photoacclimation.

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