Effects of sunlight and hydroxyl radical on dissolved organic matter: Bacterial growth efficiency and production of carboxylic acids and other substrates

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ABSTRACT: This study examines the importance of several possible mechanisms causing sunlight-mediated changes in the amounts of bacterial utilization and biomass growth on dissolved organic matter (DOM) from allochthonous sources. Our results demonstrate that, while hydroxyl radical reactions with DOM can be an important process increasing its bioavailability, other photoreactions will cause most of the sunlight-induced increases unless hydroxyl production rates are high (>~ 7 µmol L'' d''). Low molecular weight carboxylic acids could not account for most of the observed sunlight and hydroxyl-induced increases in DOM bioavailability. Both sunlight and hydroxyl-mediated reactions significantly decreased the bacterial growth efficiency of DOM, indicating that photochemical reactions affect not only the fraction of the total DOM pool available to bacteria on ecologically relevant timescales but also the substrate quality and ultimately the environmental fate of this material. Extrapolation of these results to field conditions suggests that photochemical and biochemical mineralization could be an important sink of DOC and source of bioavailable carbon in the Plum Island estuary during the summer months.

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