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Photodegradation of Mono- and Dimethylmercury in Natural Water

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Photodegradation is a major sink of the bioaccumulating neurotoxin monomethylmercury (MMHg) in surface waters. Important factors controlling the rate of MMHg photodegradation, such as the concentration and composition of the dissolved organic matter (DOM) and salinity, have been previously studied. However, to what extent these parameters influence the degradation rates of MMHg in complex matrices, such as natural waters, is still not fully understood. Furthermore, it remains to be tested if these factors also play a role in the photodegradation of dimethylmercury (DMHg). Here, we tested the effects of DOM concentration (0-26 mg C L^{-1}) and source, salinity (0-35 g L^{-1}), the combined effect of salinity and DOM, as well as the role of reactive oxygen species on the photodegradation rates of MMHg and DMHg. The experiments were conducted in quartz flasks using a xenon lamp as the radiation source and isotopically labeled MMHg and DMHg tracers. The photodegradation rate of MMHg was highest at intermediate DOM concentrations (2.6 mg L^{-1}). For DMHg, however, we observed lower photodegradation rates as the concentration of DOM, and related light attenuation, increased. For both MMHg and DMHg, we observed increasing photodegradation rates with decreasing salinity (here, decreasing NaCl concentration in ultrapure water). However, when testing the combined effects of NaCl and DOM, DOM was found to affect photodegradation rates of MMHg and DMHg to a larger extent than the salinity. Observed DMHg photodegradation rates for the different waters tested were similar to, or even faster, than the rate of MMHg decomposition, indicating that DMHg might be a source of MMHg in surface waters. Our study provides mechanistic insight into the processes controlling the photodegradation of methylated Hg in natural waters.