Photodegradation of the neurotoxicant methylmercury (MeHg) in Swedish lakes

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Methylmercury (MeHg) is a neurotoxin that can accumulate in animals and its concentration gets higher in animals higher up the food chain in waters. It is considered as very potent and is also considered to be a big threat to the environment and to humans. The threat to humans comes mostly through eating fish, or other animals or products, that has been exposed to and has high concentration of MeHg. There have been a few incidents where MeHg poisoning has occurred, most famous are probably the incidents in Minimata bay in Japan in the 50's and in Iraq in the 70's. In both instances people were exposed to contaminated food which caused various symptoms such as; tremors, sensory disturbances walking difficulties and in worst cases death.

When exposed to sunlight the bonds that hold MeHg together can be broken so it takes another form of mercury (Hg) which is less toxic then MeHg. Other things that can influence the degradation of MeHg in waters is the concentration of dissolved organic carbon (DOC) in the water as well as the composition of dissolved organic matter (DOM). DOC is a classification for organic molecules that have various origins in waters and DOM is usually referred to as organic material that is smaller than 0.1-0.7 µm.

I exposed 3 different Swedish lakes to artificial sunlight in a solar simulator for various lengths of time to see the difference of the degradation of MeHg over time. I used different sets of light filters that filtered out certain parts of the spectrum. This was done to study the importance of different parts of the spectrum. The lakes had various DOC concentrations and color ranging from almost clear water to brownish looking water. Additional MeHg isotopes were added to the samples so the initial concentration would be known and to be able to calculate the final degradation after being run in the solar simulator. DOC concentrations were measured for all samples and other changes to the samples such as absorbance and fluorescence were also measured and compared to the initial samples.

The MeHg degradation increased over time and the degradation was more substantial when the UV part of the spectrum was not filtered out. DOC degradation also increased over time and was more substantial when the UV part of the spectrum was not filtered out, just like the MeHg degradation. This suggests that DOC concentrations are an important factor for MeHg degradation.

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