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**A simple method to determine the apparent quantum yield matrix of CDOM photobleaching in natural waters**

**Abstract:** The photobleaching of chromophoric dissolved organic matter (CDOM) is considered an important loss process for CDOM absorption in sunlit natural waters, where it can regulate the biota's exposure to sunlight, surface solar heating, and dissolved organic matter dynamics. Despite its importance, this sink remains poorly quantified, primarily because of the difficulty of determining photobleaching apparent quantum yields (AQYs) that capture the dual spectral dependency of this process and are applicable to polychromatic sunlight. Here, we present a simple method to determine a CDOM photobleaching AQY matrix (AQY-M) for natural water samples that does not require any a priori assumptions about the spectral dependency of photo-16 bleaching. It combines controlled irradiation experiments, a partial least-square regression, and an optimization procedure to produce AQY-Ms that are spectrally coherent and optimized for modeling accurate photobleaching rates in natural waters. Water temperature and the solar exposure history of CDOM had a major influence on the magnitude and spectral characteristics of the AQY-M. These factors should be considered when determining the AQY-M of samples and provide constraints when modeling photobleaching rates in natural waters. We expect that this effective method will provide future studies with a robust means to characterize and understand the variability of AQY-M in natural waters.