SUPPLEMENTARY MATERIAL

Wavelength trends of photoproduction of reactive transient species by chromophoric dissolved organic matter (CDOM), under steady-state polychromatic irradiation

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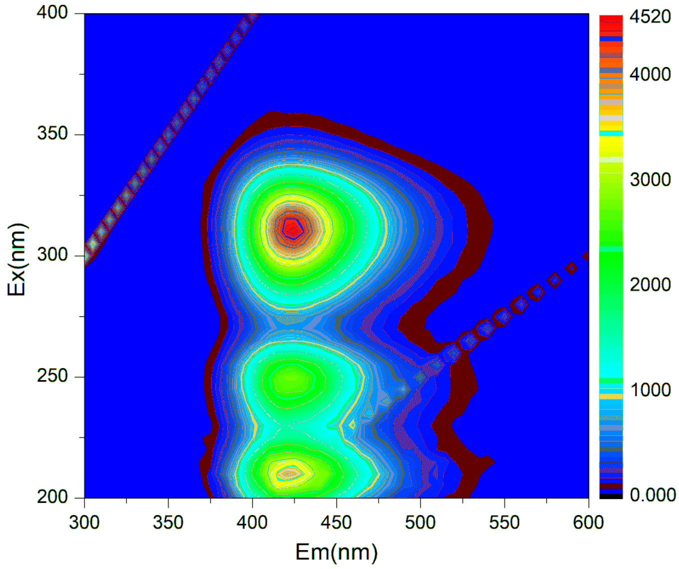

Figure S1. Excitation-emission matrix (EEM) fluorescence spectrum of 0.01 mM 2-hydroxyterephthalic acid. The spectrum was taken with a Hitachi F-7000 Fluorescence Spectrophotometer. The wavelength ranges of excitation and emission were 200-400 nm and 300-600 nm, respectively. The scanning speed was set at 1200 nm/min.

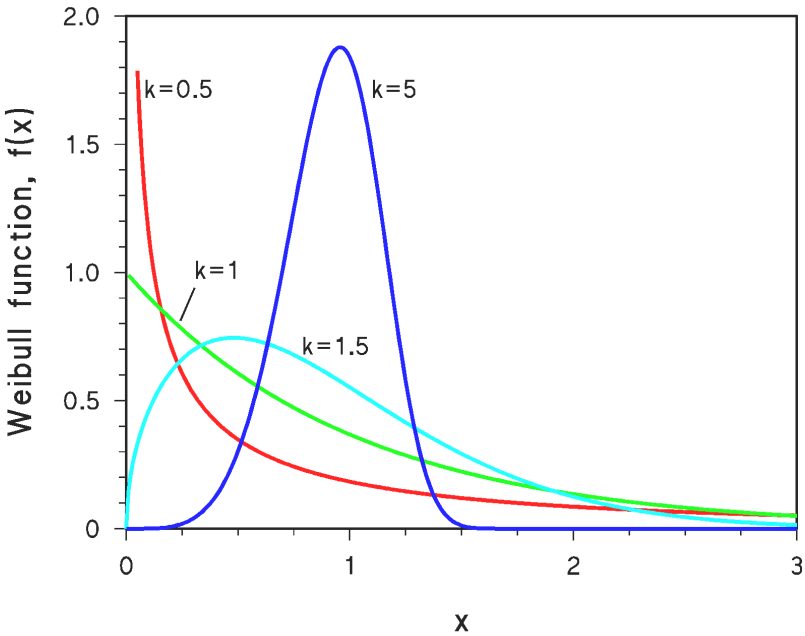

Figure S2. Trends of the simplified Weibull probability density function ($y = k\,x^{k-1}\,e^{-x^k}$), for different values of the *k* parameter.

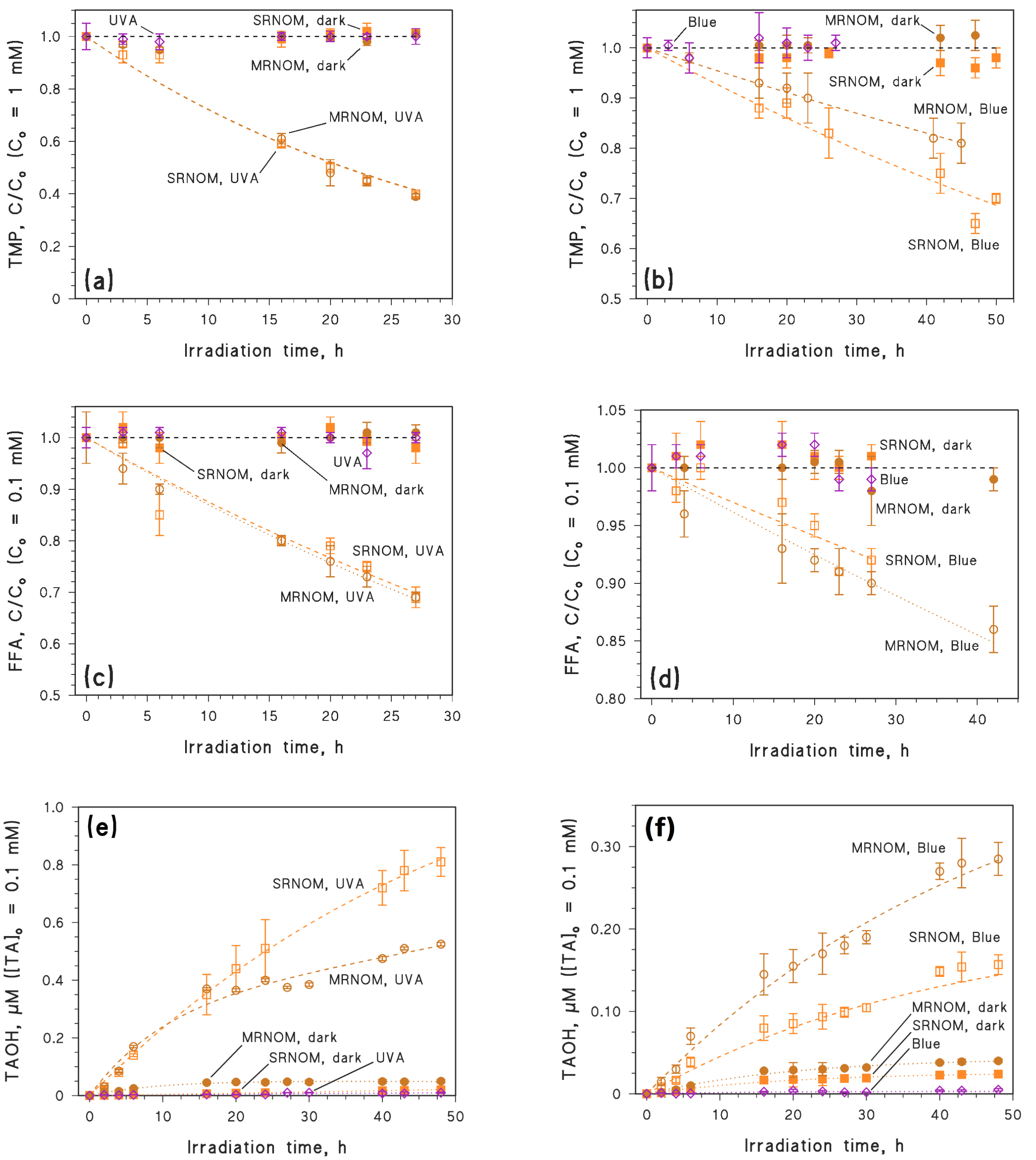

Figure S3. Time trends of the probe molecules, upon irradiation of the probes with SRNOM and MRNOM, of the probes alone, and of probes + SRNOM or MRNOM in the dark. **(a)** TMP, UVA irradiation; **(b)** TMP, irradiation under blue light; **(c)** FFA, UVA irradiation; **(d)** FFA, irradiation under blue light; **(e)** TAOH (from 0.1 mM TA), UVA irradiation; **(f)** TAOH (from 0.1 mM TA), irradiation under blue light. Note the zoomed Y-axis in panels b, c, d.

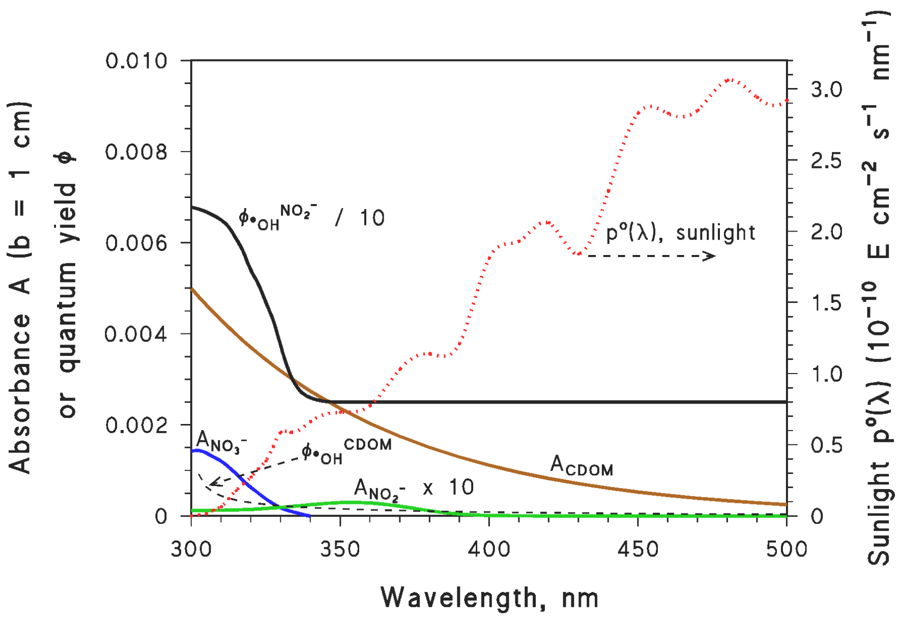

Figure S4. Wavelength trends of the absorbance values (optical path length *b* = 1 cm) of 0.18 mM nitrate, 1.3 μM nitrite and CDOM (DOC = 1 mg_C L^{-1}). $^{\bullet}OH$ formation quantum yields from irradiated nitrite and CDOM. Incident spectral photon flux density of sunlight (equivalent to mid-latitude 15 July, at 9 am or 3 pm solar time).

Text S1. Computation of solar radiation and water-column photochemistry in the case of Lake Jyväsjärvi (Finland)

Lake Jyväsjärvi is located in the centre of the town of Jyväskylä in Finland. In Lake Jyväsjärvi, the concentration of nitrate + nitrite is ~136 μg L^{-1} (= 9.7 μM; Vähätalo, unpublished data). The DOC value of water in the lake is 8-9 mg_C L^{-1}. Here it was reasonably assumed that $[NO_2^-] = \frac{1}{100}[NO_3^-]$ = 0.097 μM. **Figure S5** reports the logarithmic units of the absorption spectra of CDOM in Lake Jyväsjärvi, as well as the absorption coefficients of nitrate and nitrite.

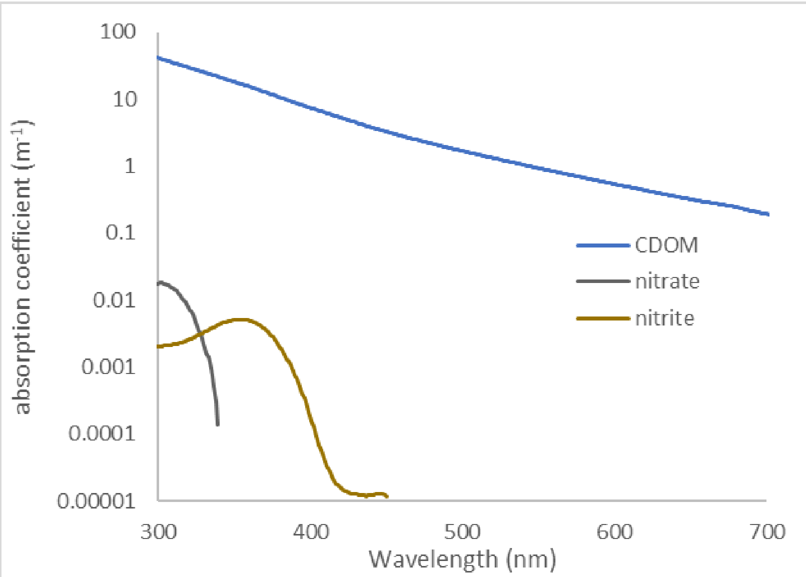

Figure S5. Logarithmic absorption coefficients ($Log_{10}[a(\lambda)]$) of CDOM in Lake Jyväsjärvi (Vähätalo, unpublished data), and of nitrate and nitrite.

The quantum yields used for calculations of $^{\bullet}OH$ photoproduction are 0.01 (wavelength-independent) for nitrate, decreasing from 0.068 to 0.025 with increasing wavelength (see **Figure S4**) for nitrite, and wavelength-dependent (**Eq. 33** and **Figure 4** of the main manuscript) for CDOM.

Solar radiation ($p°(\lambda)$) incident on the surface of Lake Jyväsjärvi was assumed as per 23 July 2019 at solar noon. The attenuation of solar radiation (290-500 nm) within the water column was calculated at 0.001 m steps down to 0.5 m, and at 0.01 m intervals from 0.5 m to 1.0 m depth. The solar radiation represents scalar photon flux density at each depth ($p_z°(\lambda)$).

The rate of $^{\bullet}OH$ photoproduction was calculated by integrating the relevant equations from 290 to 500 nm (from 301 nm in the case of CDOM), as follows:

$$R_{^{\bullet}OH}^{NO_3^-} = \int_{\lambda} [p_z^o(\lambda)\ a_{NO_3^-}(\lambda)\ \Phi_{NO_3^-}(\lambda)]\,d\lambda \quad \text{(S1)}$$

$$R_{^{\bullet}OH}^{NO_2^-} = \int_{\lambda} [p_z^o(\lambda)\ a_{NO_2^-}(\lambda)\ \Phi_{NO_2^-}(\lambda)]\,d\lambda \quad \text{(S2)}$$

$$R_{^{\bullet}OH}^{CDOM} = \int_{\lambda} [p_z^o(\lambda)\ a_{CDOM}(\lambda)\ \Phi_{CDOM}(\lambda)]\,d\lambda \quad \text{(S3)}$$

The calculation results are shown as **Figure 6** of the main manuscript.