Optical and Photochemical Data of Prairie Wetlands Collected in North Dakota and Minnesota from 2012-July to 2014-November

Abstract: Surface water samples were collected from seven prairie pothole wetlands between 2012-July and 2014-November. Optical and photochemical parameters of the samples were measured under controlled laboratory conditions. The data were collected to better understand the way in which seasonal changes and spatial differences in prairie wetland water chemistry influence photochemistry. Samples are identified by the month and year in which they were collected and the typical hydroperiod of the wetland surface water (temporary or semi-permanent). Rates of formation, steady-state concentrations, and apparent quantum yields (or appropriate proxies) were measured for triplet excited states of dissolved organic matter, singlet oxygen, hydroxyl radical, and carbonate radical under a broadband xenon-arc lamp with a 290-nm wavelength filter.

1. Title of Dataset: Optical and Photochemical Data of Prairie Wetlands Collected in North Dakota and Minnesota from 2012-July to 2014-November

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3. Data collected: 2012-07 through 2016-03

4. Location of Data Collection:
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5. Funding sources:

A. United States Geological Survey-National Institutes for Water Resources (G12AP20153)
B. Moos Fellowship from the College of Biological Sciences, University of Minnesota
C. Ancillary support from the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR)

Sharing and Data Access

1. Link to publication that uses this data:
   http://dx.doi.org/10.1016/j.chemosphere.2016.04.078

2. Suggested citation:
   McCabe, Andrew, J; Arnold, William, A. (2017). Optical and Photochemical Data of Prairie Wetlands Collected in North Dakota and Minnesota from 2012-July to 2014-November. Retrieved from the Data Repository for the University of Minnesota, https://doi.org/10.13020/D62C7G.

Data Overview

File:
Prairie_Wetland_Optical_and_Photochemical_Data.xlsx

Description:
This file contains optical and photochemical data measured in surface water samples from seven prairie wetlands collected between 2012-July to 2014-November.

Methodological Information

Description of methods used for data collection:
http://dx.doi.org/10.1016/j.chemosphere.2016.04.078

Data-specific information for: Prairie_Wetland_Optical_and_Photochemical_Data.xlsx

1. The estimated confidence interval for each variable is listed as a percentage above the respective data.

2. Variable List:
   A. Name: Sample ID
      Description: Sample identification labels are in the format: Wetland Name – Month of Sample Collection – Year of Sample Collection.
   B. Name: Hydroperiod
      Description: The hydroperiod classifies the length of time surface water is present at the site. Definitions generally follow the United States Fish and Wildlife National Wetland Inventory classifications.
   C. Name: DOC
      Description: DOC is the dissolve organic carbon concentration measured by catalytic combustion [units = mg C L^{-1}].

D. Name: E2/E3
   Description: E2/E3 [unitless] is the ratio of the light absorbance of the water sample at a wavelength of 250 nm to the absorbance at 365 nm measured by spectrophotometry.
E. Name: Spectral Slope
   Description: The spectral slope is the exponential fit coefficient resulting from the non-linear fit of the light absorbance spectrum to the function $y = a \times e^{b \times x}$ between wavelengths 300 – 500 nm, where x is the wavelength [units = nm], y is the absorbance [unitless], a is a fit coefficient [unitless], and b is the spectral slope (units = nm^{-1}).
F. Name: $SUVA_{254}$
   Description: $SUVA_{254}$ [units = L mg C^{-1} m^{-1}] is the specific ultraviolet (UV) absorbance at the wavelength 254 nm. It is computed as the ratio of the absorbance at 254 nm of the water sample [unitless] to the dissolved organic concentration [units = mg C L^{-1}]. $SUVA_{254}$ is reported in both decadic [log-10] and Naperian [log-e] units.
G. Name: R_a
   Description: R_a is the estimated rate of light absorption [units = E L^{-1} s^{-1}] by the water samples in the solar simulator used throughout this study. R_a was estimated by chemical actinometry.
H. Name: $k_{obs,TMP}$
   Description: $k_{obs,TMP}$ is the pseudo-first order rate constant for the photo-sensitized loss of 2,4,6-trimethylphenol (TMP) [units = s^{-1}]. In this sample set, $k_{obs,TMP}$ is used as a proxy for the steady-state concentration of triplet excited states of dissolved natural organic matter.
I. Name: f_{TMP}
   Description: f_{TMP} is the quantum yield coefficient for TMP loss computed as the ratio of $k_{obs,TMP}$ to R_a [units = L E^{-1}]. In this samples set, it is used as a proxy for the efficiency of formation of triplet excited states of dissolved natural organic matter.
J. Name: $R_{f,S}$
   Description: $R_{f,S}$ is the rate of formation of singlet oxygen as determined from the photo-sensitized loss of furfuryl alcohol in the water samples under simulated sunlight [units = M s^{-1}].
K. Name: $[^1O_2]_{ss}$
   Description: $[^1O_2]_{ss}$ is the steady-state concentration of singlet oxygen as determined from the photo-sensitized loss of furfuryl alcohol in the water samples under simulated sunlight [units = M].
L. Name: $\Phi_{app,S}$
   Description: $\Phi_{app,S}$ is the apparent quantum yield for the formation of singlet oxygen computed as the ratio of the rate of singlet oxygen formation to R_a [units = mol E^{-1}].
M. Name: $R_{f,\bullet OH}$
   Description: $R_{f,\bullet OH}$ is the rate of formation of hydroxyl radical as determined from the photo-sensitized formation of hydroxy-terephthalic acid from terephthalic acid in the water samples under simulated sunlight [units = M s^{-1}].

N. Name: $[^{\bullet}OH]_{ss}$
   Description: $[^{\bullet}OH]_{ss}$ is the steady-state concentration of hydroxyl radical as determined from the photo-sensitized formation of hydroxy-terephthalic acid from terephthalic acid in the water samples under simulated sunlight [units = M].
O. Name: $\Phi_{app,\bullet OH}$
   Description: $\Phi_{app,\bullet OH}$ is the apparent quantum yield for the formation of hydroxyl radical computed as the ratio of $R_{f,\bullet OH}$ to R_a [units = mol E^{-1}].
P. Name: $R_{f,CO3\bullet}$
Q. Description: $R_{f,CO3\bullet}$ is the rate of formation of carbonate radical as estimated from the rate of reactions of carbonate and bicarbonate with hydroxyl radical [units = M s^{-1}].
R. Name: $[CO_3^{\bullet -}]_{ss}$
S. Description: $[CO_3^{\bullet -}]_{ss}$ is the steady-state concentration of carbonate radical as estimated from $[^{\bullet}OH]_{ss}$ [units = M].
T. Name: $\Phi_{app,CO3\bullet}$
   Description: $\Phi_{app,CO3\bullet}$ is the apparent quantum yield for the formation of carbonate radical computed as the ratio of $R_{f,CO3\bullet}$ to R_a [units = mol E^{-1}].