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Carbon monoxide apparent quantum yields and photoproduction in the estuary Tyne

Stubbins et al.

Photochemical production of carbon monoxide is a process that is important not only as a gas flux to the atmosphere, but also to the reworking of organic matter. The factors constraining the rate(s) of this photochemical process are not well quantified. Thus, with the changes I have outlined below this study will prove to be valuable contribution to the marine photochemical community.

There are a few issues that I would like to see resolved with this paper. My first issue is the discussion of how the AQY is correlated to the a_{412} . Since the AQY is calculated using the a_{CDOM} , by definition this correlation should hold for all samples. Second, the introduction of particle photochemistry in the last third of the paper seems like an afterthought.

My specific comments related to the above points are as follows:

- Please reorder your methods section to follow the logical progression of data collection and analysis. i.e. irradiation, absorption, CO photoproduction, AQY determinations.
- End of Section 2.2 Please elaborate on how your AQY spectra were calculated.
- Section 3.1 "Measured apparent quantum yields" One does not measure an AQY. One measures the photochemical production of CO and calculates the AQY. Please edit this section title to reflect what was actually done/observed.
- Figure 3: An AQY is a function of wavelength.
 Please edit the figure caption to reflect the wavelength of AQY being reported in Fig 3.
 Also, AQY is a unit-less. Please correct this throughout the manuscript.
- The "particulate a_{412} " is introduced for the first time in Section 3.4 Please elaborate either in this section, or the methods, how these values were obtained.
- Including particulate absorption data into your photochemical rate equation (eqn 3) also introduces a scattering term. Please indicate what assumptions were made about scattering.
- Is the "particulate a_{412} " on page 7432 the same as the coloured particulate matter? Please clarify.

Other comments:

- Section 3.2: discussion of estuarine variability of CDOM and AQY There has been some interesting FT-ICR-MS work on the chemical changes induced by photochemical fading (i.e. Kujawinski et al 2004, Gonsior et al, ES&T 2009 or Dittmar et al, Mar. Chem. 2007). The decrease in DBE will undoubtedly lower the CDOM absorption and contribute to a lower AQY. Please add elaborate your discussion of the factors contribution to the lower AQY to include a study such as one of the above in your discussion.

- Please update your Ziolkowski (2000) citation to Ziolkowski and Miller (2007) throughout the manuscript.
- It appears in the AQY vs salinity plots (Figure 4) that Tamar River is characteristically different than the other AQYs presented. Please comment on what may contribute to this difference (i.e. river runoff difference due to storms, different watersheds, etc).

With the above edits, this paper will be a strong contribution to the photochemical literature.