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Biogeosciences Discussions

Interactive comment on "Photo-lability of deep ocean dissolved black carbon" *by* A. Stubbins et al.

Anonymous Referee #2

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Stubbins et al provide a concise study on photolability of dissolved black carbon (DBC) in seawater. The discussion paper is timely and the presentation of the study was well conceived; it was very easy to follow this paper and to understand the importance of DBC in global carbon cycling. A major outcome of this paper was the tight coupling between CDOM (the absorptive property of DOM) and DBC. In fact, Stubbins et al provide a convincing argument that DBC rather than lignin is a key chemical tracer of terrestrial CDOM. The aim of this paper was to investigate its photoreactivity, and I think here the authors have show a more direct link between chemistry and optical properties than in studies that focus on lignin, especially for seawater.

Overall, I recommend acceptance of this manuscript, it is a nice study. Some specific comments, which include a few minor minor revisions: p490, L1: remove "the" be-

tween "On" and "20" p491, L11: it would be useful to know the limit of detection and the volume analyzed for the DOC analysis. p493, L12: The comparison amongst these different samples is fine, but I wonder if it is entirely accurate with respect to irradiation regime. Were all samples optically thin? Are these DOC changes based on similar irradiance exposures (eg, approximating natural sunlight)? p493,L19: It is worth noting that these are C18 extracts and not whole DOC. It is a important subtlety that should be acknowledged. p494,L27: Why not write "a 95% loss in DBC" to keep consistent with DOC and CDOM? p495,L07: Replace "fall" with "decrease" p495,L11: This result is pretty incredible in terms of linking DOM photobleaching and photomineralization. The PAH photodegradation literature shows similar coupling. Further, Vähätalo et al. Biodegradation 10: 415–420, 1999, show mineralization rates of 14C-lableled coniferyl alcohol almost entirely due to photochemistry. It seems CDOM photodegradation is overwhelmingly linked to aromatic ring degradation. What is important here in comparing DBC and coniferyl alcohol is that Vähätalo work only measured 14C-CO2 as the mineralization product, which only could have come from the aromatic ring. Decarboxylation is often invoked as the CO2 producing mechanism for photodegradation of DOM, but clearly DBC compounds could be direct precursors of CO2. Again, this is in line with photodegradation studies of PAHs in the contaminant literature. It may be worthwhile for the authors to review this study and compare their results in terms of the fraction of DBC:DOC photodegradation in comparison to the confieryl alcohol mineralization. Both studies report about 20% mineralization over 2d irradiation (this ms) and 7 d irradiation (Vähätalo). I doubt this is coincidence. p496,L27: "In the current irradiations DBC tracked CDOM..."; please re-word, this is confusing. p497: These paragraphs seem more more like Discussion rather than Conclusions. I recommend moving them up to the Discussion section.

Interactive comment on Biogeosciences Discuss., 9, 485, 2012.