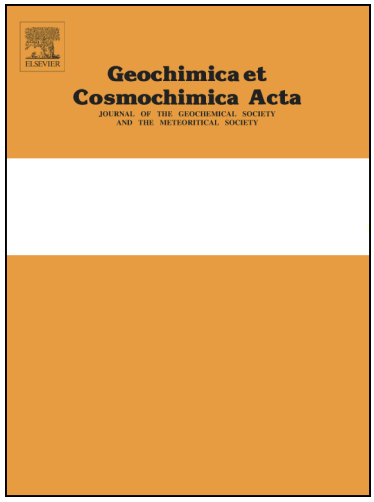

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PII: S0016-7037(17)30197-7
DOI: http://dx.doi.org/10.1016/j.gca.2017.03.036
Reference: GCA 10218

To appear in: *Geochimica et Cosmochimica Acta*

Received Date: 1 September 2016
Revised Date: 10 March 2017
Accepted Date: 11 March 2017

Please cite this article as: Waggoner, D.C., Wozniak, A.S., Cory, R.M., Hatcher, P.G., The role of reactive oxygen species in the degradation of lignin derived dissolved organic matter, *Geochimica et Cosmochimica Acta* (2017), doi: http://dx.doi.org/10.1016/j.gca.2017.03.036

The role of reactive oxygen species in the degradation of lignin derived dissolved organic matter

Derek C. Waggoner [a], Andrew S. Wozniak [a], Rose M. Cory [b], and Patrick G. Hatcher [a]*

[a] Department of Chemistry and Biochemistry, Old Dominion University, Norfolk, VA 23529
[b] Department of Earth and Environmental Sciences, University of Michigan, Ann Arbor, MI 48109

Abstract

Evidence suggests that reactive oxygen species (ROS) are important in transforming the chemical composition of the large pool of terrestrially-derived dissolved organic matter (DOM) exported from land to water annually. However, due to the challenges inherent in isolating the effects of individual ROS on DOM composition, the role of ROS in the photochemical alteration of DOM remains poorly characterized. In this work, terrestrial DOM was independently exposed to singlet oxygen ($^1O_2$), and superoxide ($O_2^{-\bullet}$ under controlled laboratory conditions. Using ultra-high resolution mass spectrometry to track molecular level alterations of DOM by ROS, these findings suggest exposure to $^1O_2$ (generated using Rose Bengal and visible light) removed formulas with an O/C > 0.3, and primarily resulted in DOM comprised of formulas with higher oxygen content, while $O_2^{-\bullet}$ exposure (from KO_2 in DMSO) removed formulas with O/C < 0.3 and produced aliphatic formulas (H/C > 1.5). Comparison of DOM altered by ROS in this study to riverine and coastal DOM showed that (20-80%) overlap in formulas, providing evidence for the role of ROS in shaping the composition of DOM exported from rivers to oceans.

1. Introduction