

Interactive comment on “A novel source of atmospheric H₂: abiotic degradation of organic material” by H. Lee et al.

H. Lee et al.

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We appreciate the reviewer’s careful and constructive suggestions to improve the quality of this manuscript. We have carefully considered all of the suggestions in the revised version of the manuscript. Below are our line by line responses to the specific comments.

Page 8642, line 18, Abstract: add “degradation” after “Our results suggest that abiotic release of H₂ during organic matter...”

- Added.

Page 8643, line 20/21: regarding methane formation from plant litter a reference should be made to Keppler et al. (Methane emissions from terrestrial plants under aerobic

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conditions. Nature 439, 187-191, 2006) as this study was the very first that showed methane formation from plant matter both under thermal treatment and solar radiation. Furthermore, the two studies by Derendorp et al. (2011 and 2012) dealing with chloromethane formation from plant litter did not investigate the effect of photodegradation. Both studies focused on formation of chloromethane from plant litter during thermal treatment. This reaction was first described by Hamilton et al. (Chloride methylation by plant pectin: An efficient environmentally significant process. Science 301, 206-209, 2003.) These references would better fit into the next sentence (release of trace gases in the absence of solar radiation).

- We appreciate this suggestion and revised the text to reflect this.

Page 8644, 12-16: The authors speculate that H₂ might be produced during abiotic degradation of plant litter possibly as a byproduct of partial oxidation of methyl groups. This suggestion is quite interesting and might get support by a recent study describing the isotopic composition of H₂ from wood burning (Rockmann, T. et al. Isotopic composition of H₂ from wood burning: Dependency on combustion efficiency, moisture content, and delta D of local precipitation. Journal of Geophysical Research-Atmospheres 115, doi:10.1029/2009jd013188, 2010.). In this study it is shown that the isotopic composition of the bulk biomass is slightly depleted relative to the water, and both methoxyl groups and H₂ from wood burning are strongly depleted. The similar degree of fractionation of Methoxyl groups and H₂ relative to bulk biomass might be a coincidence, however, this observation could also hint that methoxyl groups provide a fraction of the produced H₂.

- We appreciate this suggestion. We added these references and included some description of these processes in the text. This will be an interesting addition for the readers.

Results: It would have been nice to also see the effect of varying UV-radiation intensities on the release rates of H₂ from organic matter.

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- We agree that an exploration of the effect of varying UV intensity would be an important future step for understanding H₂ release through photodegradation. We hope that our work will encourage others to pursue this line of research.

Page 8660, Figure 1, Y-axis: Replace “concentrations” by “mixing ratio”

- Replaced.

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