

Temperature Dependent formation of glyoxal and methyl glyoxal from the oxidation of isoprene under zero and high NO_x conditions

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Isoprene emitted from the biosphere is the largest single atmospheric source of volatile organic compounds (VOC), contributing 410 Tg annually (about 40% of the global VOC source).¹ Especially in biogenic dominated regions, even small percentage yields of isoprene oxidation products can have significant effects on atmospheric gas and aerosol phase composition. Two alpha-dicarbonyls, glyoxal and methyl glyoxal, have been shown to have multi-generational yields from isoprene oxidation. The magnitude of these yields have been the subject of several recent studies,^{2,3,4} that show glyoxal and methyl glyoxal are formed as first generation products, as well as second and third generation products. The first generation yields significantly add to the global source for glyoxal and methyl glyoxal. In this study we present first results regarding the temperature dependence of first generation yields of glyoxal and methyl glyoxal under zero and high NO_x conditions. Experiments combine the atmospheric simulation chamber at the National Center for Atmospheric Research with the CU Light Emitting Diode Cavity Enhanced Differential Optical Absorption Spectroscopy (CU LED-CE-DOAS) for the detection of glyoxal and methyl glyoxal; as well as Proton Transfer Mass Spectrometry for the detection of other isoprene oxidation products. The implications of our results are discussed in context of the inability of current models to explain satellite observations in the mid-latitude biogenic ‘hotspot’ regions^{5,6}.

References

- (1) Guenther, A.; Karl, T.; Harley, P.; Wiedinmyer, C.; Palmer, P. I.; Geron, C. *Atmos. Chem. Phys.*, **2006**, 6, 3181-3210, doi:10.5194/acp-6-3181-2006.
- (2) Volkamer, R.; Barnes, I.; Platt, U.; Molina, L. T.; and Molina, M. J. in: *Environmental Simulation Chambers: Application to Atmospheric Chemical Processes*, edited by: Barnes, I. and Rudinski, J., 62, Springer, Dordrecht, Netherlands, **2006**.
- (3) Paulot, F.; Crouse, J. D.; Kjaergaard, H. G.; Kroll, J. H.; Seinfeld, J. H.; Wennberg, P. O. *Atmos. Chem. Phys.*, **2009**, 9, 1479-1501, doi:10.5194/acp-9-1479-2009.
- (4) Galloway, M. M.; Huisman, A. J.; Yee, L. D.; Chan, A. W. H.; Loza, C. L.; Seinfeld, J. H.; Keutsch, F. N. *Atmos. Chem. Phys.*, **2011**, 11, 10779-10790, doi:10.5194/acp-11-10779-2011.
- (5) Myriokefalitakis, S.; Vrekoussis, M.; Tsigaridis, K.; Wittrock, F.; Richter, A.; Brühl, C.; Volkamer, R.; Burrows, J. P.; Kanakidou, M. *Atmos. Chem. Phys.*, 2008, 8, 4965–4981, doi:10.5194/acp-8-4965-2008.
- (6) Stavrou, T.; Müller, J.-F.; De Smedt, I.; Van Roozendaal, M.; Kanakidou, M.; Vrekoussis, M.; Wittrock, F.; Richter, A.; Burrows, J. P. *Atmos. Chem. Phys.*, **2009**, 9, 8431-8446, doi:10.5194/acp-9-8431-2009.