Measurements of α–Dicarbonyl Compounds: A Detailed Instrument Intercomparison at the European Photoreactor (EUPHORE)

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The α-dicarbonyl compounds glyoxal (GLY, CH(O)CHO) and methylglyoxal (MGLY, $CH_3C(O)CHO$)) are ubiquitous intermediates formed in the photo-oxidation of a wide range of anthropogenic and biogenic volatile organic compounds (VOCs). Recent measurements demonstrate that large uncertainties exist in the amount of glyoxal formed from isoprene photooxidation, the dominant VOC emitted into the atmosphere. In addition, α-dicarbonyl compounds are known to be precursors of secondary organic aerosol (SOA), potentially forming a significant fraction of the missing global SOA in atmospheric models. However, the exact role of such compounds in aerosol growth is still not well established. One of the main reasons for such uncertainties is the difficulty in measuring them, as they are very reactive and difficult to handle experimentally.

In order to elucidate both the chemical and instrumental issues related to the quantitative measurement of these compounds, a short experimental chamber campaign was carried out in the EUPHORE photo-reactor in Valencia, Spain to compare a number of currently available techniques (both optical and spectrometric). The campaign comprised a set of experiments simulating typical urban and semi-rural conditions. Measurements were performed over a range of concentrations in order to investigate the impacts of the presence of potential interferants in the chamber gas mixtures sampled (e.g. aerosol, NO_x, short chain carbonyls and ozone). The gas and aerosol phase compositional evolution was monitored simultaneously. Different amounts of GLY and/or MGLY were added directly to the chamber or were generated *in-situ* from the oxidation of various VOC precursors. The following instrumental techniques were employed during the campaign: LED-CE-DOAS (cavity enhanced differential optical absorption spectroscopy), long-path DOAS, SPME (solid phase micro extraction) -GC/MS, FTIR spectroscopy, GC-ECD, BBCEAS (broadband cavity enhanced absorption spectroscopy), LIP (Laser induced phosphorescence), CIR-TOF-MS (chemical ionization time-of-flight mass spectrometry), ATOFMS (aerosol time-of-flight mass spectrometry), FTICR (Fourier transform ion cyclotron resonance mass spectrometry, and LC-MS^n (liquid chromatography-ion trap mass spectrometry).

Experiments were separated into two groups; ***open***, where data was shared between all participants during the execution of the experiments and ***blind***, where the participants share their data only with the referee. We will present an overview of the campaign in terms of participants, instruments, definition of experiments as well as selected results.