

Interactive comment on “Formation of secondary organic aerosols from the ozonolysis of dihydrofurans” by Yolanda Díaz de Mera et al.

Anonymous Referee #3

Received and published: 21 November 2016

The authors describe experimental findings from the ozonolysis reaction of 2,3- and 2,5-dihydrofuran at atmospheric pressure and room temperature. Experiments were carried out in a Teflon bag with special attention to SOA formation. Particle formation was followed by total number measurements using a TSI CPC 3775 as well by measuring the particle size distribution by means of a TSI FMPS 3091. Gas-phase species, such as ozone, the dihydrofurans and water vapor, were not monitored in the course of the reaction. For runs in presence of SO₂, the SO₂ time series were only monitored “For some experiments” but no information on that is presented in the manuscript.

The authors concluded as a result of their experiments that i) the detected particle formation was not connected to sulfuric acid, ii) the reaction of Criegee intermediates (CI) with SO₂ proceeds without SO₃ formation and SO₂ serves as a “catalyst” for acid formation starting from CI. These are very interesting statements. But unfortunately,

C1

the experiments do not distinctly support the conclusions. A significant fraction of other products than sulfuric acid from CI+SO₂ would be very important for the understanding of CI's role in atmospheric oxidation.

Here my critical points:

- The authors used very high reactant concentrations, far away from atmospheric conditions. Why they are doing so? High initial concentrations connected with high intermediate concentrations can open reaction channels not relevant for the atmosphere. Particle measurements are sensitive enough allowing to work close to atmospheric reactant conditions.
- Cyclohexane was used as OH scavenger for more than 95% of the OH radicals. But what about the residual OH radicals? They are definitely reacting with SO₂ in competition with all other OH reactions in the system forming finally sulfuric acid.
- What does it mean “completely dry conditions”? A measurement of the water vapor concentration in the Teflon bag is needed. It's very challenging to produce and handle an extremely dry reaction gas with a water vapor concentration as low as needed that hydrolysis of SO₃ doesn't work!
- Sulfuric acid measurements are needed in order to rule out a significant contribution of sulfuric acid for nucleation and particle growth. I would encourage the authors to collaborate with groups familiar with the H₂SO₄ CIMS technique.
- The authors should show the SO₂ time series or at least an example. What's the uncertainty of the SO₂ detection? I guess, from a constant SO₂ time series of 10(12) molecules cm⁻³ or more it is impossible concluding that 10(9) or 10(10) molecules cm⁻³ have been converted. And that's enough to produce the needed sulfuric acid for nucleation and early growth.

All together, I guess this manuscript needs a major revision based on additional experiments. It could become an important paper in the field of CI reactions. From my

C2

perspective, at the moment the experimental basis is not good enough.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-891, 2016.