Laboratory studies on the formation of secondary organic aerosol (SOA) from the isoprene oxidation

Janine Schindelka[1], Yoshiteru Iinuma[1], Olaf Böge[1], Anke Mutzel[1] and Hartmut Herrmann[1]

1 **Leibniz-Institute for Tropospheric Research, Leipzig, Germany**

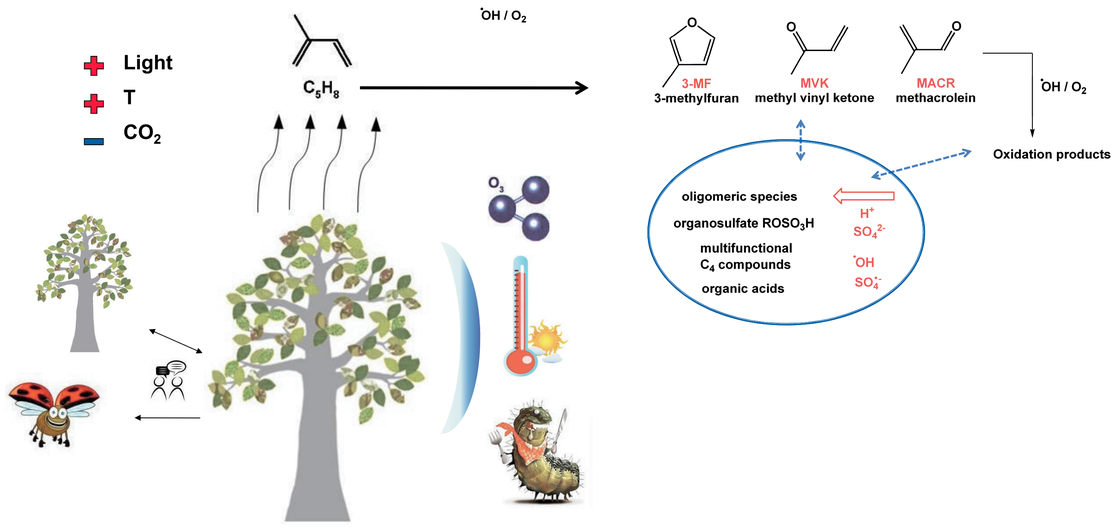
PEGASOS Pan-European Gas-AeroSOls-climate interaction Study

TROPOS Leibniz Institute for Tropospheric Research

Member of the Leibniz Association

INTRODUCTION

The contribution of isoprene to SOA



- Isoprene contributes 50% to the total BVOC emission (global emission rate of 660 TgC/y)[1]
- Isoprene is highly reactive
- Degraded by hydroxyl and nitrate radicals as well as ozone[2,3]
- Formation of oxidized, semi-volatile organic compounds (SVOCs)
- SVOCs can condense on particles or partition into the aqueous phase of cloud and fog droplets
- SVOCs are further processed[3]

- Adds mass to the atmospheric organic particle matter
- change the chemical and physical properties of the tropospheric aerosol
- Effect on ability to act as CCN and the radiation budget of the atmosphere[4]

SETUP AND FIRST RESULTS

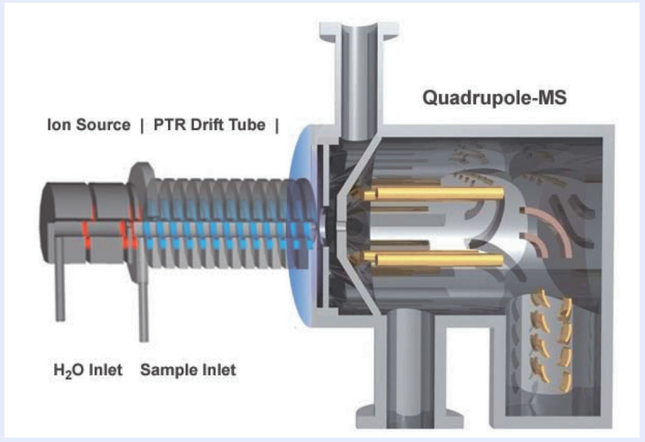
Experiments at LEAK (Leipziger Aerosol Kammer)

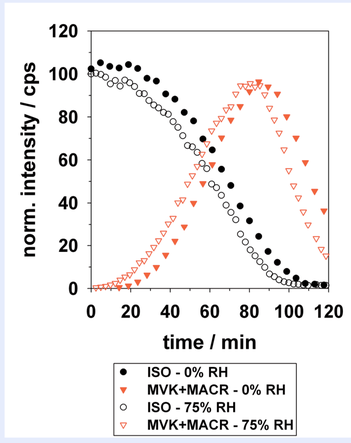
- Isoprene + OH radicals
- Varying rel. humidity (0, 75%)
- Varying seed acidity (pH 7, 3, 0)
- OH source:
  - At 0% RH -> H_2O_2 + hv
  - At 75% RH -> O_3 + hv + H_2O

Material: FEP foil
Volume: 19 m^3
8 UV lamps (254 nm)

Fig. 2: Scheme of the Leipziger Aerosol Kammer (LEAK).

Gas phase





PTR-MS (Proton-Transfer-Reaction Mass Spectrometer)

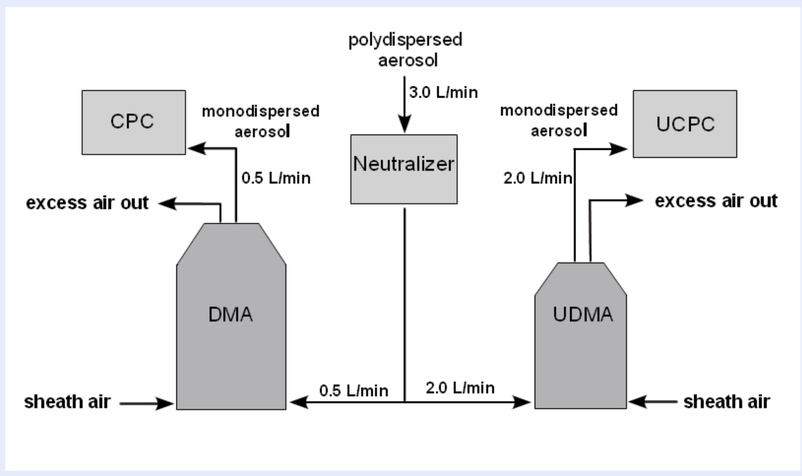
Time-resolved measurement of the gas phase mixing ratios of isoprene and its oxidation products in their protonated form

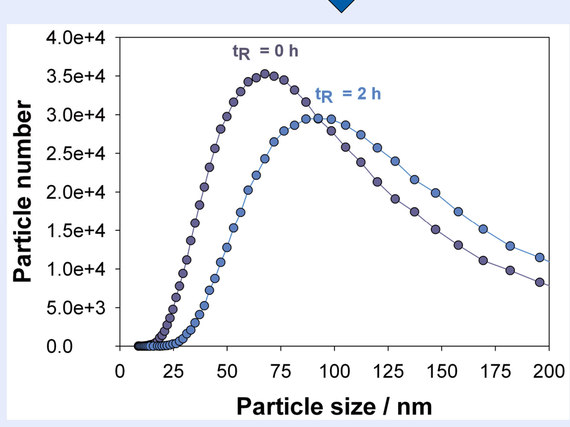
$H_3O^+ + X \rightarrow XH^+ + H_2O$

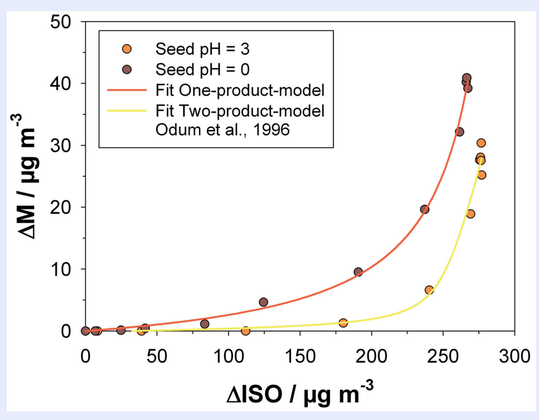
Particle phase

TDMPS (tandem differential mobility particle size)

Time-resolved measurement of the number-size-distribution of particles
Diameters: 3 - 900 nm



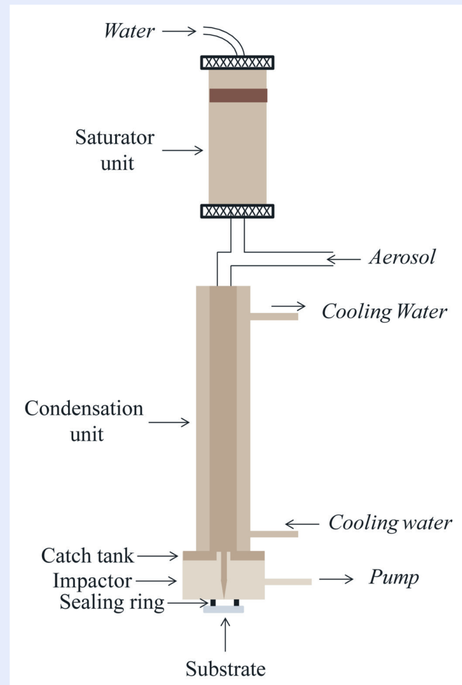




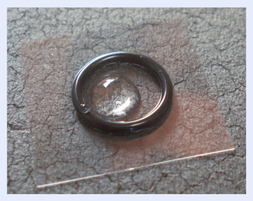
- **SOA is mainly formed from second-generation products**
- **Increasing seed acidity promotes partitioning of oxidation products**

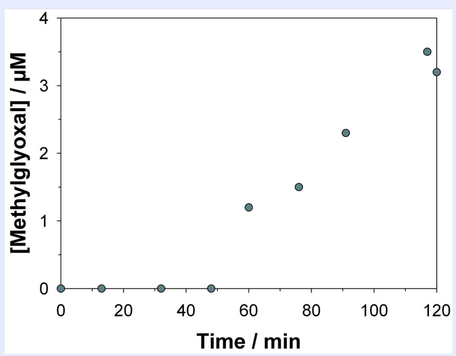
C-GIS (condensation-growth and impaction system)

Time-resolved sampling of particles as droplets due to condensation-growth.[5]
Sampling Time: 15 min



HPLC-MS
GC-MS





Time dependent course of particle phase concentrations of the oxidation products

Comparison of filter and C-GIS measurements

Compound	Filter [µg/m³]	C-GIS [µg/m³]	Recovery [%]	Mean value
Terpenylic acid	0.23	0.09	39	39 ± 2
	0.13	0.05	38	
	0.20	0.08	40	
Pinic acid	0.24	0.06	25	21 ± 4
	0.09	0.09	22	
	0.41	0.07	17	

REFERENCES

[1] Günther et al., *Atmos. Chem. Phys.* (2006), **6**, 3181-3210.
[2] Günther et al., *J. Geophys. Res.* (1995), **100**, 8873-8892.
[3] Carlton et al., *Atmos. Chem. Phys.* (2009), **9**, 4987-5005.
[4] Kanakidou et al., *Atmos. Chem. Phys.* (2005), **5**, 1053-1123.
[5] Sierau et al., *J. Aerosol Sci.* (2003), **34**, 225-242.

ACKNOWLEDGEMENT

This study is funded by the project PEAGSOS (Pan-European Gas-Aerosols-Climate Interaction Study).