Laboratory measurements of oxidation of fatty acids in marine organic aerosols

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Summary

- Organic aerosols
- Laboratory measurements
- Fatty acids oxidation
- Future directions

Organic aerosols

- Sources
  - Bubbles produced by breaking waves that scavenge surface-active organic matter and other materials

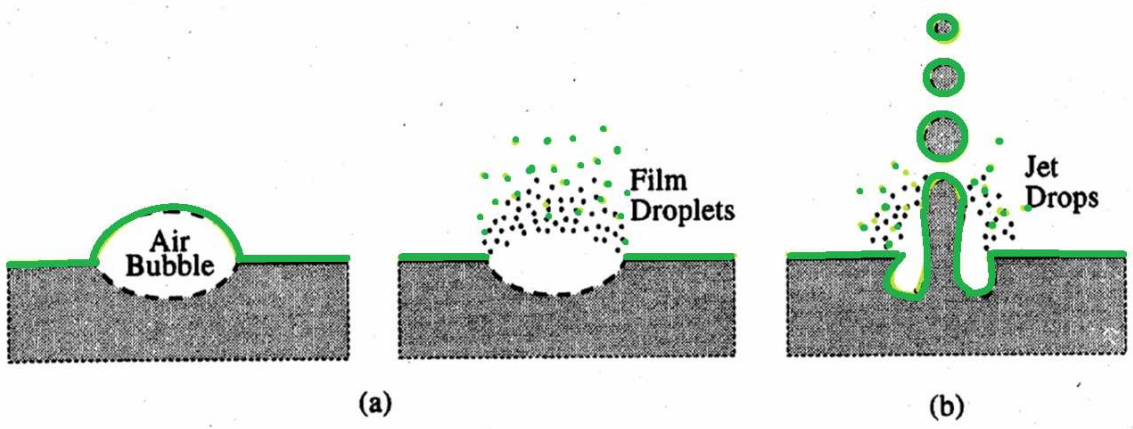
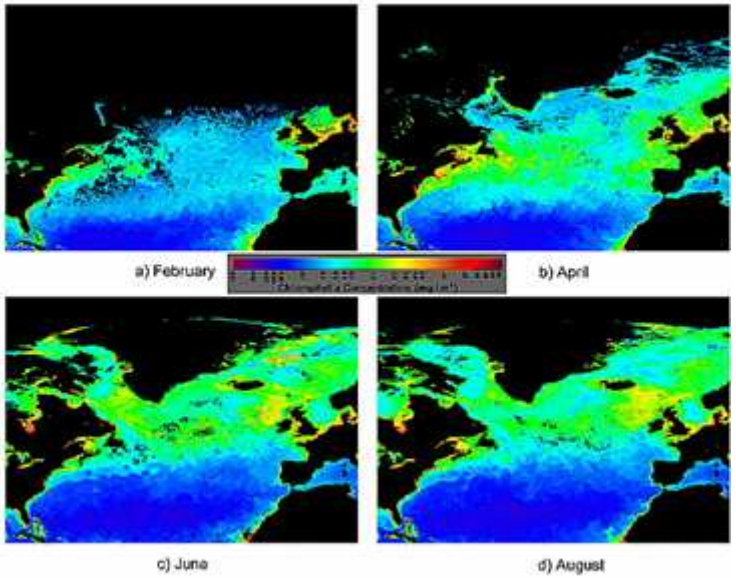


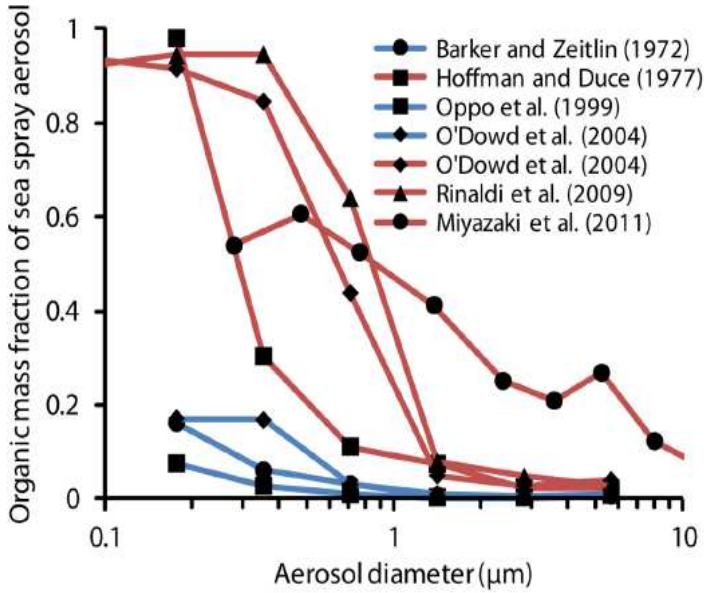
Figure 5.4 Production of sea-salt aerosols from (a) bursting air bubbles on the surface of the ocean and (b) mechanically breaking surface waves.

B. Gantt and N. Meskhidze Atmos. Chem. Phys., 13 3979-3996, 2013

Organic aerosols and marine biological activity



Monthly averages of chlorophyll - *a* concentration (from SeaWiFS) 2004



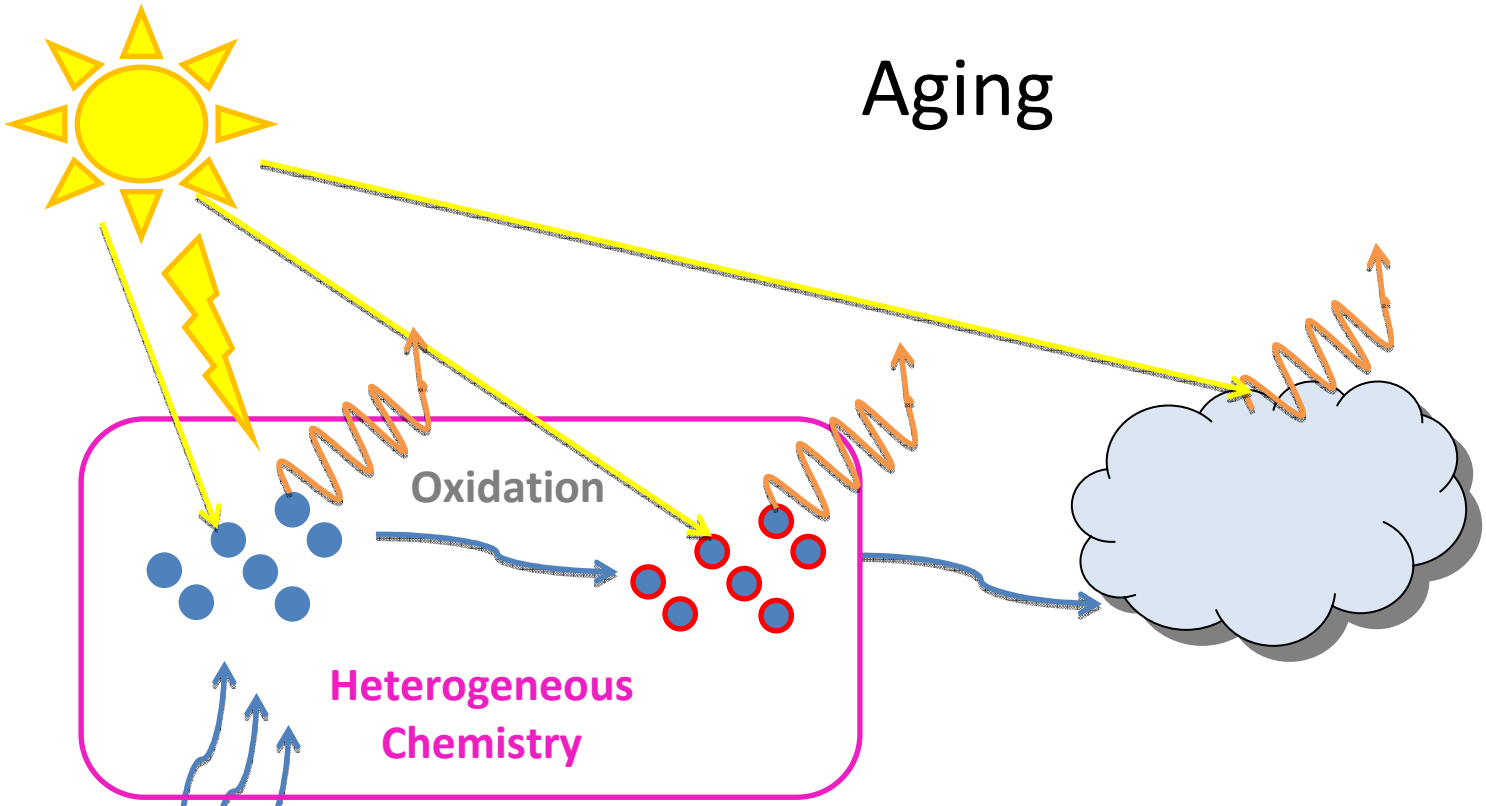
blue = low biological activity periods

red = high biological activity periods

Gantt and Meskhidze Atmos. Chem. Phys., 13 3979-3996, 2013
Yoon et al., JGR: Atmospheres, 112, Issue D4, D04206, 2007

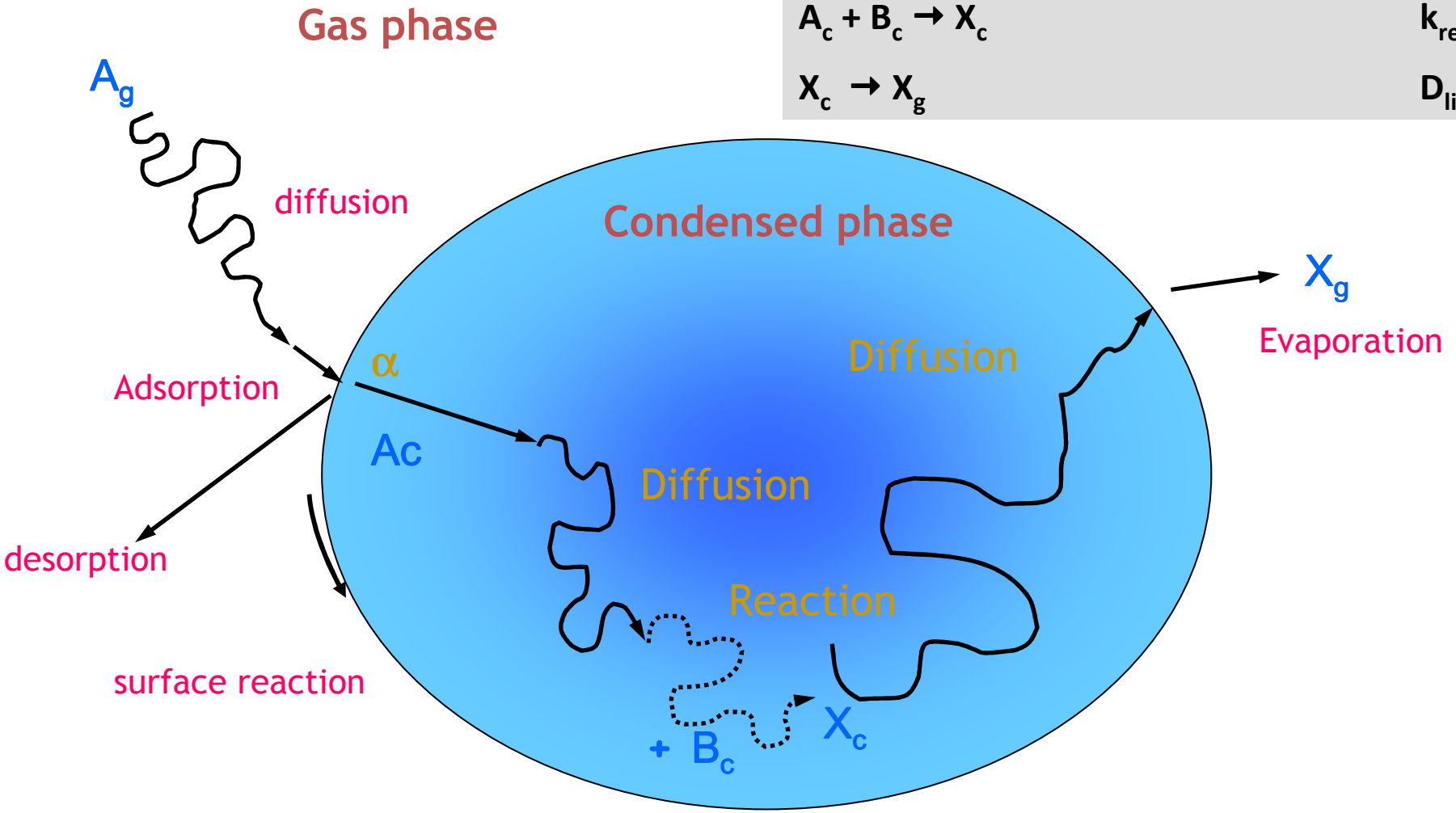
Organic aerosols

Aging

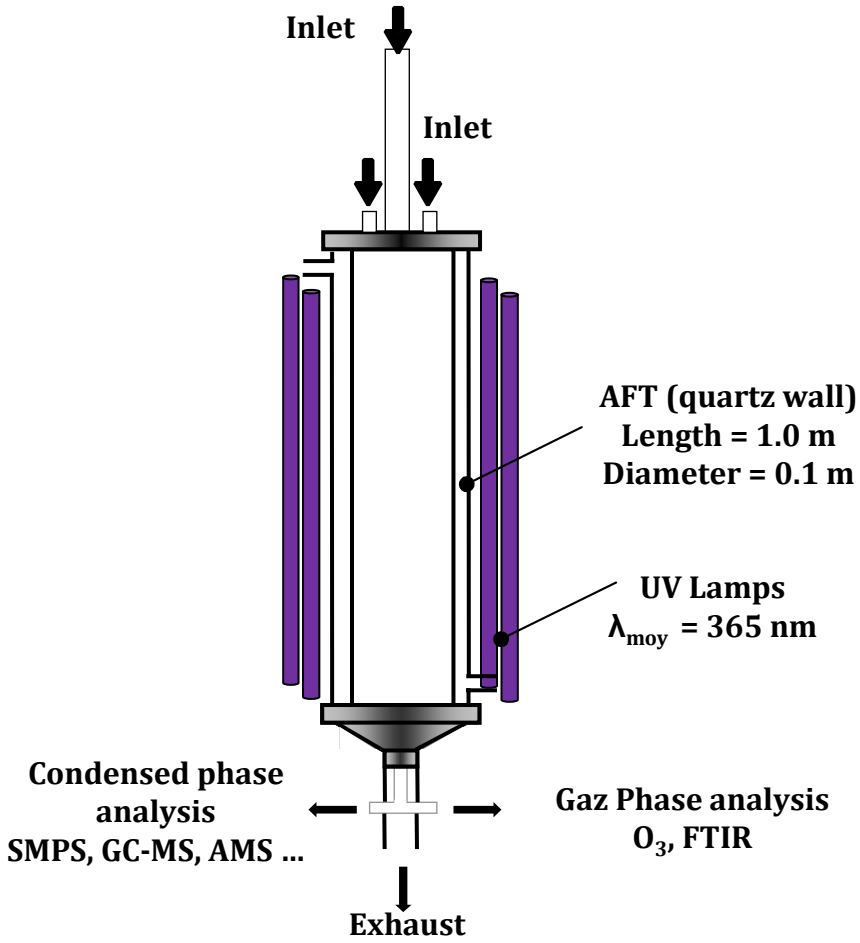


Heterogeneous reactivity

$A_g\ (\infty) \rightarrow A_g(surf)$	Dg
$A_g(surf) + B_c(surf) \rightarrow B_c(surf)$	k_{surf}
$A_g(surf) \rightarrow A_c$	α
$A_c + B_c \rightarrow X_c$	k_{reac}
$X_c \rightarrow X_g$	D_{liq}

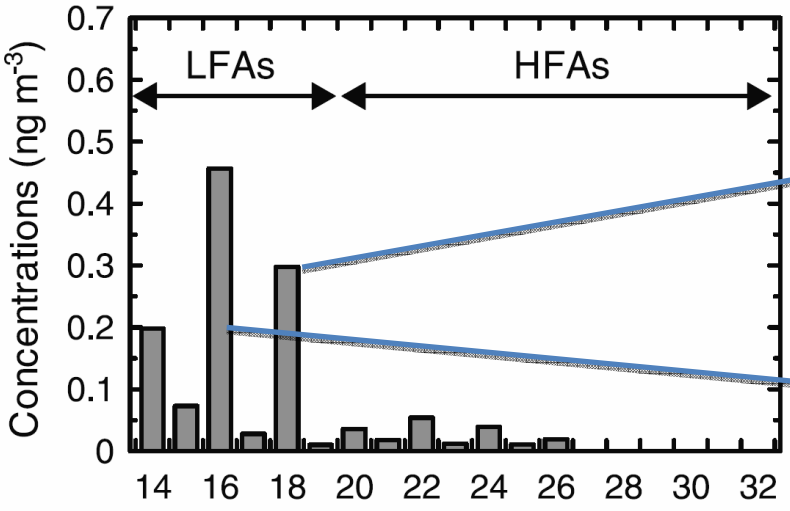


Laboratory measurement



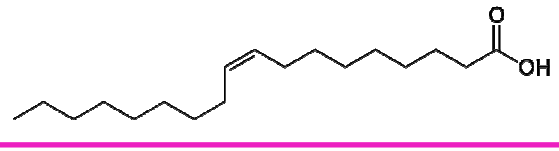
- Objectives:
  - Reactivity of organic aerosols with photoxydant ($Cl^{\cdot}$, O_3)
  - Kinetic of oxidation reaction
  - Oxidation products

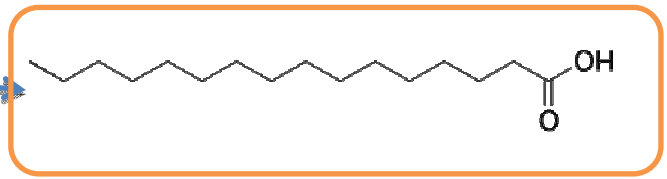
Fatty acids



Carbon Number of Fatty Acids in the remote marine air mass

Oleic acid (C18)



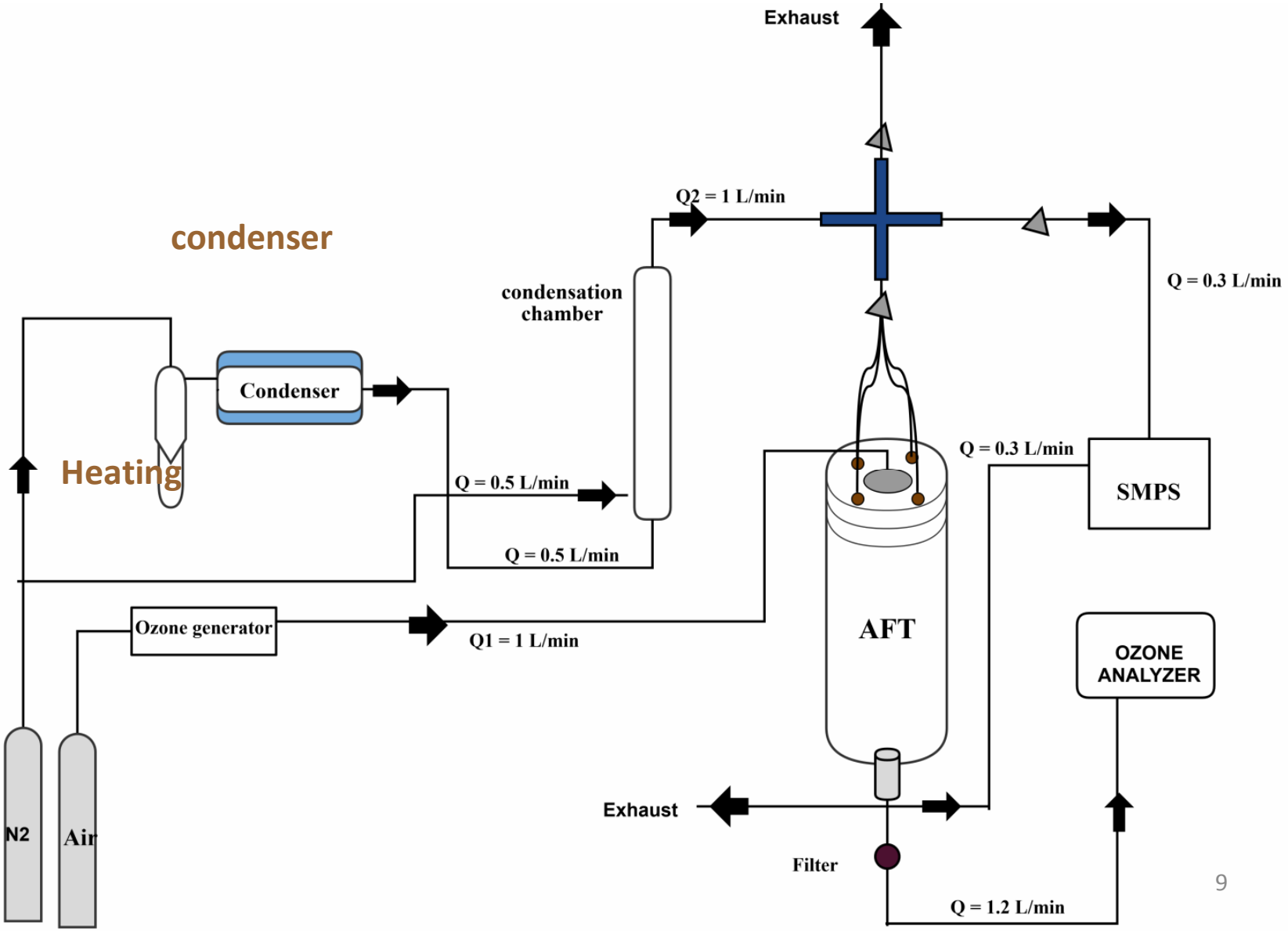


Palmitic acid (C16)

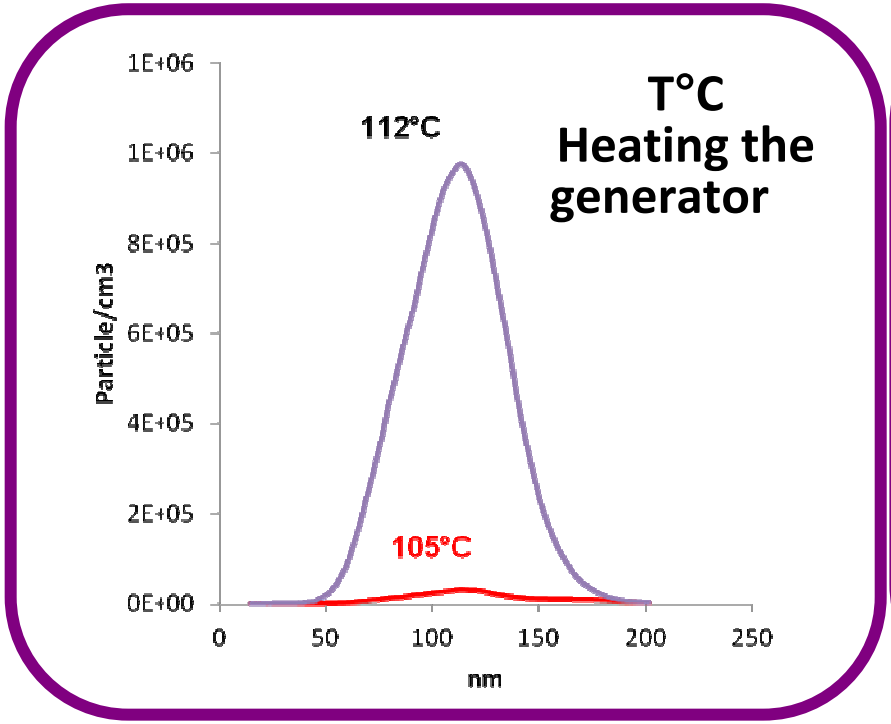
Mochida et al., JGR, 107, 4325, 2002

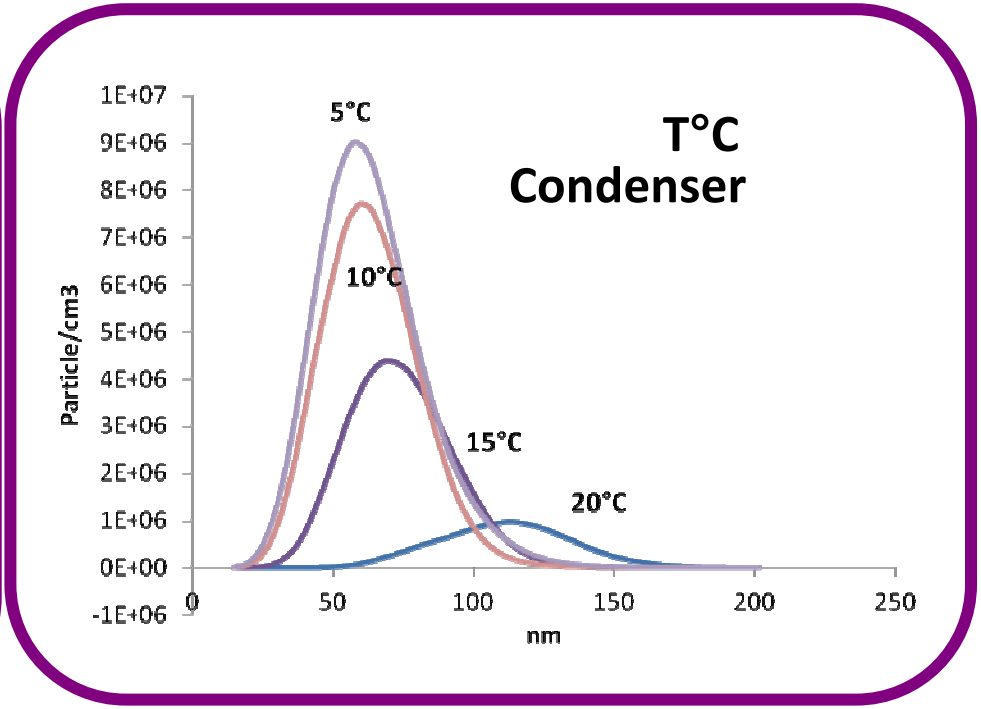
Ciuraru , J. of Atmos. Chem, 2013
Mendez, ACP, 2013
Mendez et al. Jphys.Chem. A.118.9471-9481.2014

Experimental Setup

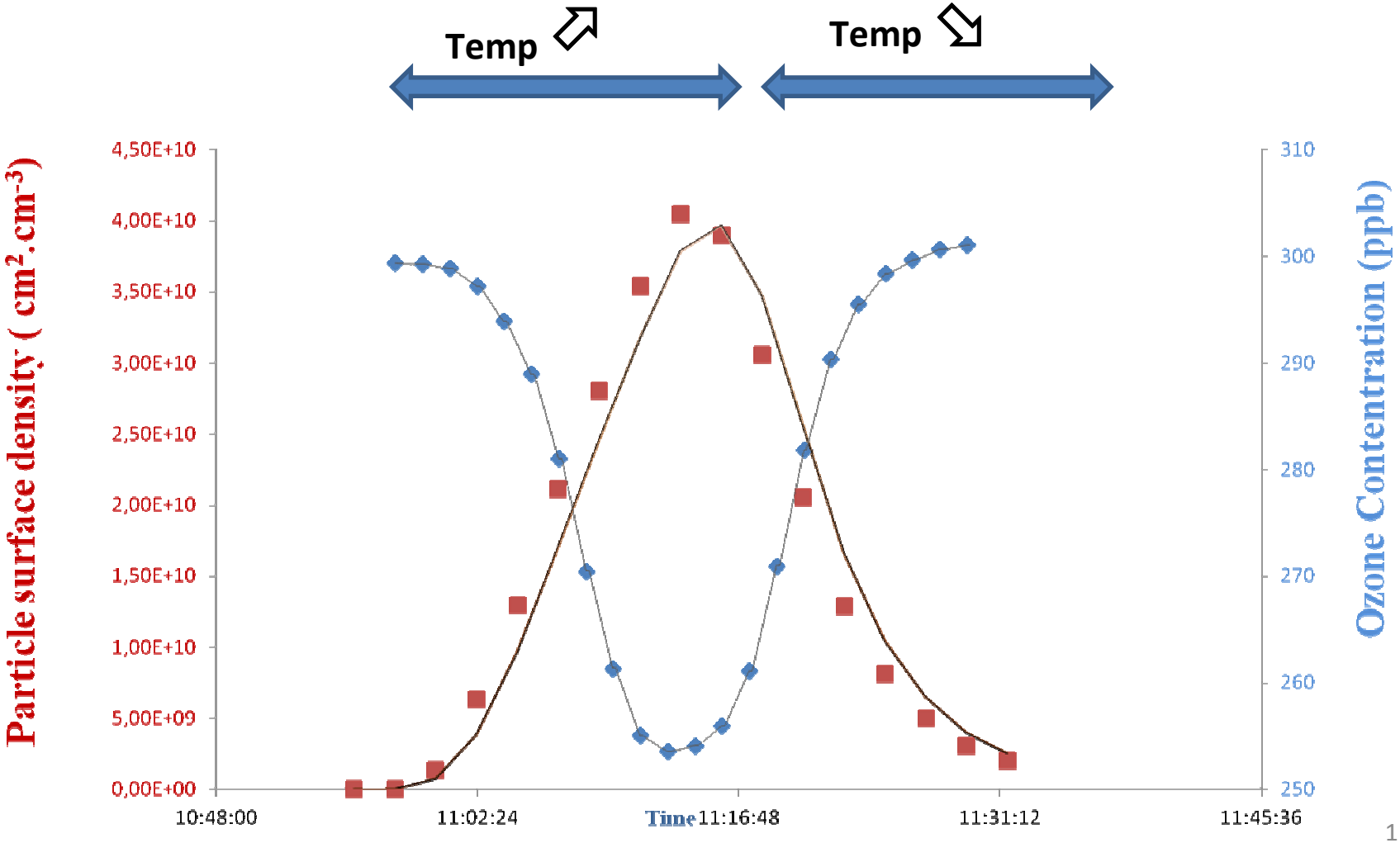


Particles distribution function of T°C

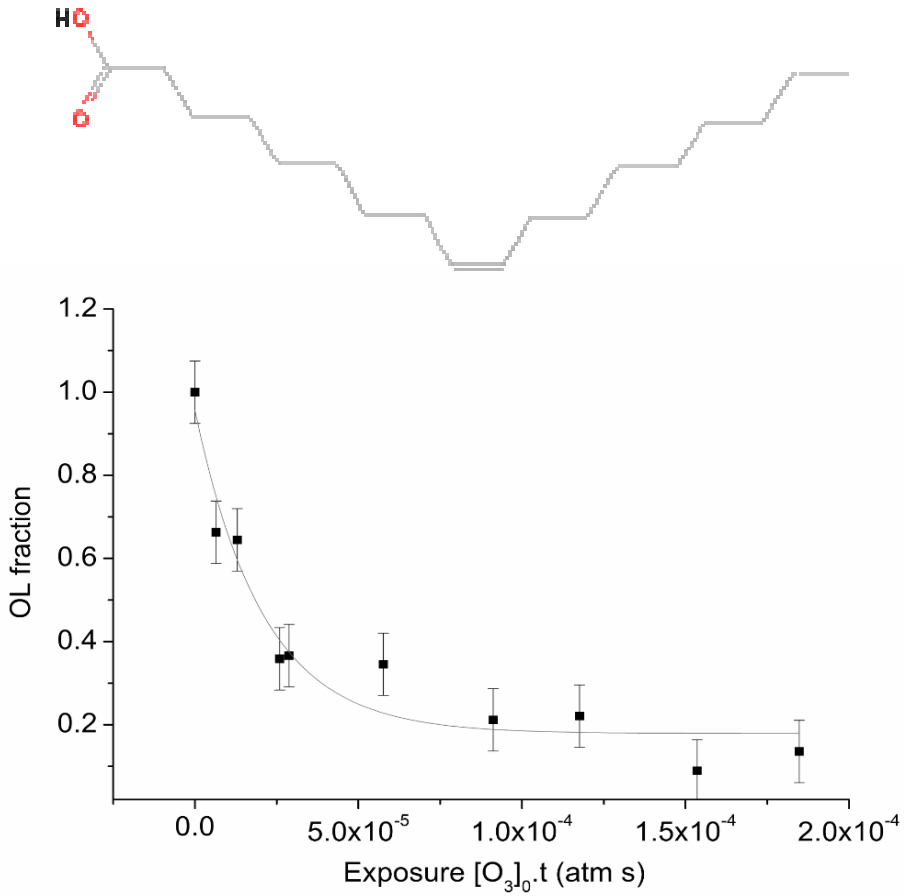


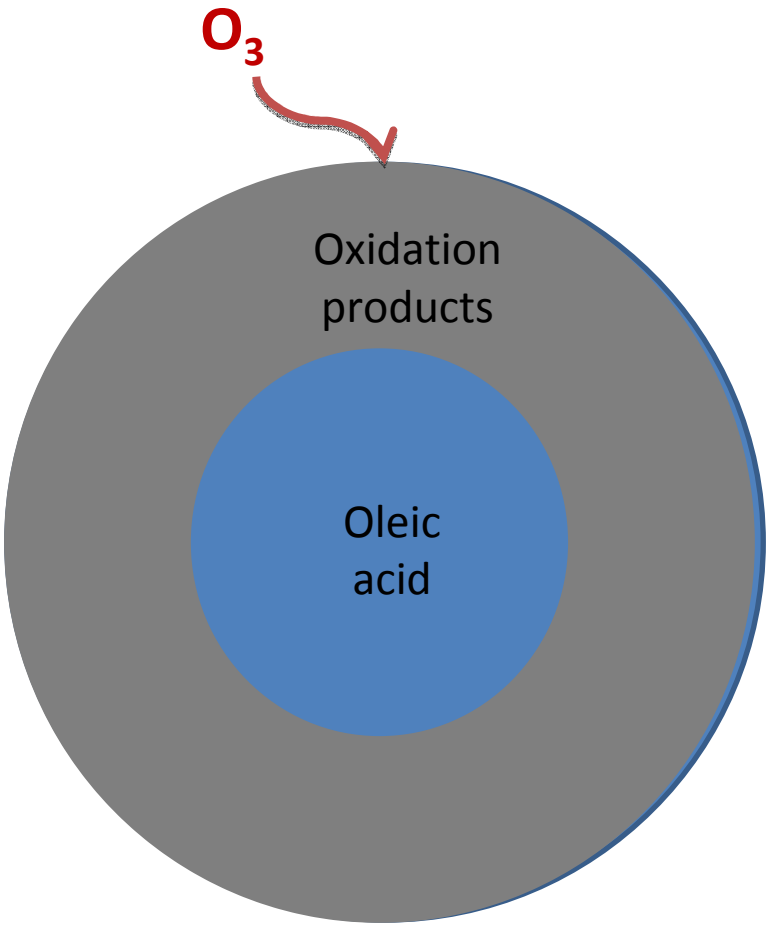


Ozonolysis of Oleic Acid



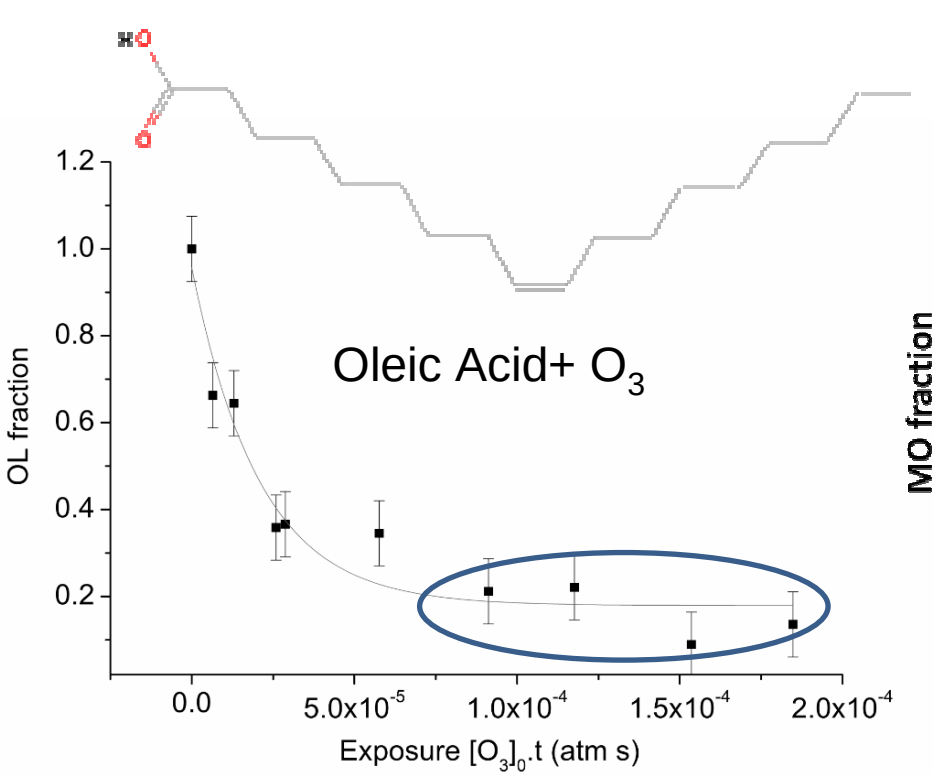
Oleic acid oxidation

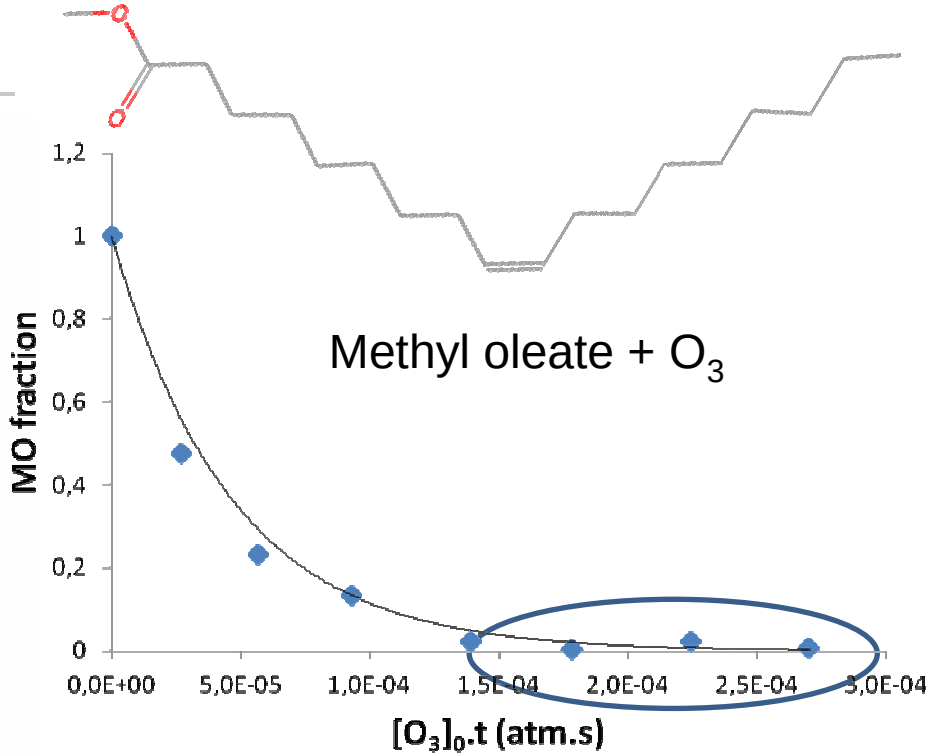




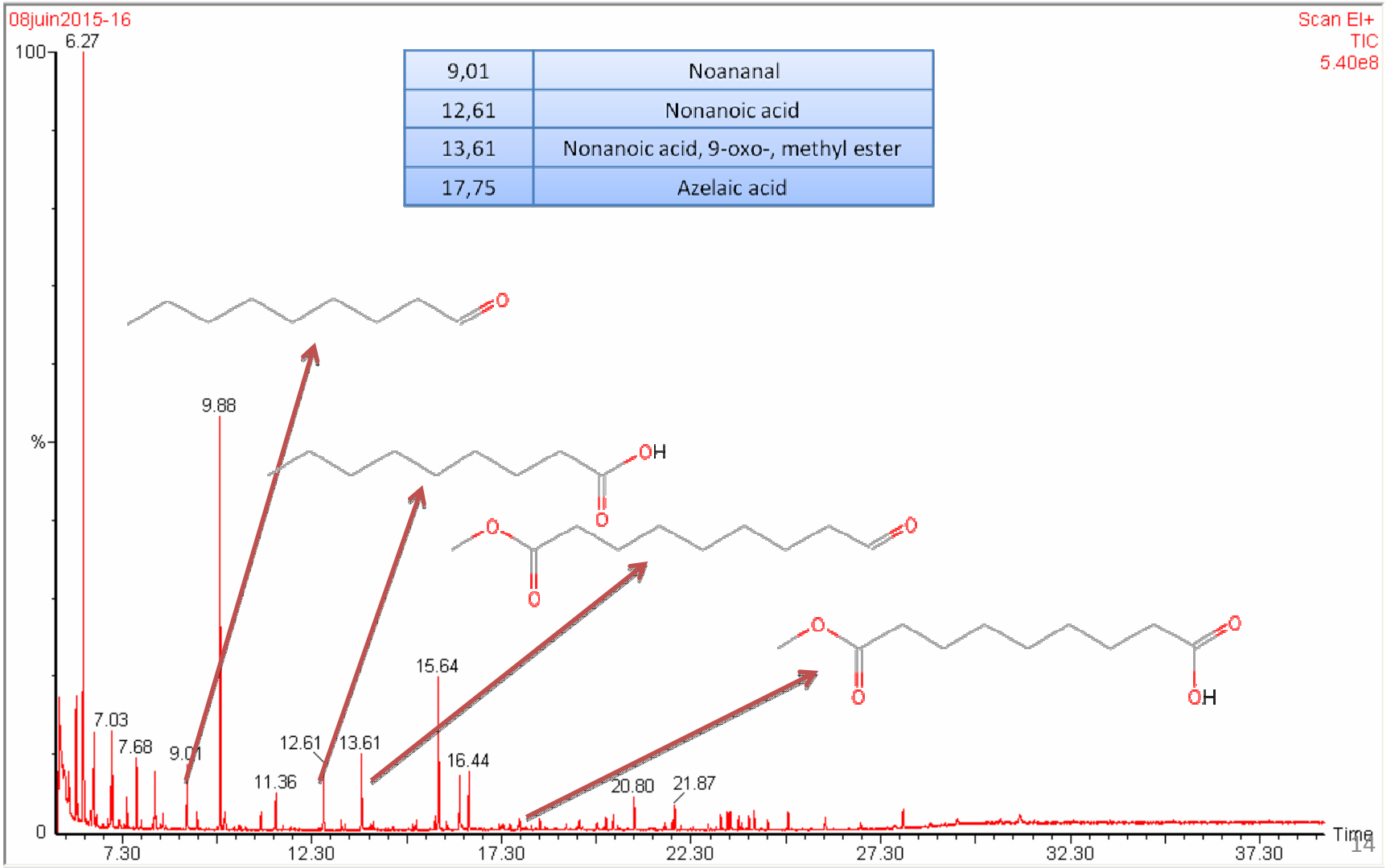
Mendez et al. J Phys.Chem. A,118,9471-9481,2014

Comparison between Oleic acid and Methyl oleate



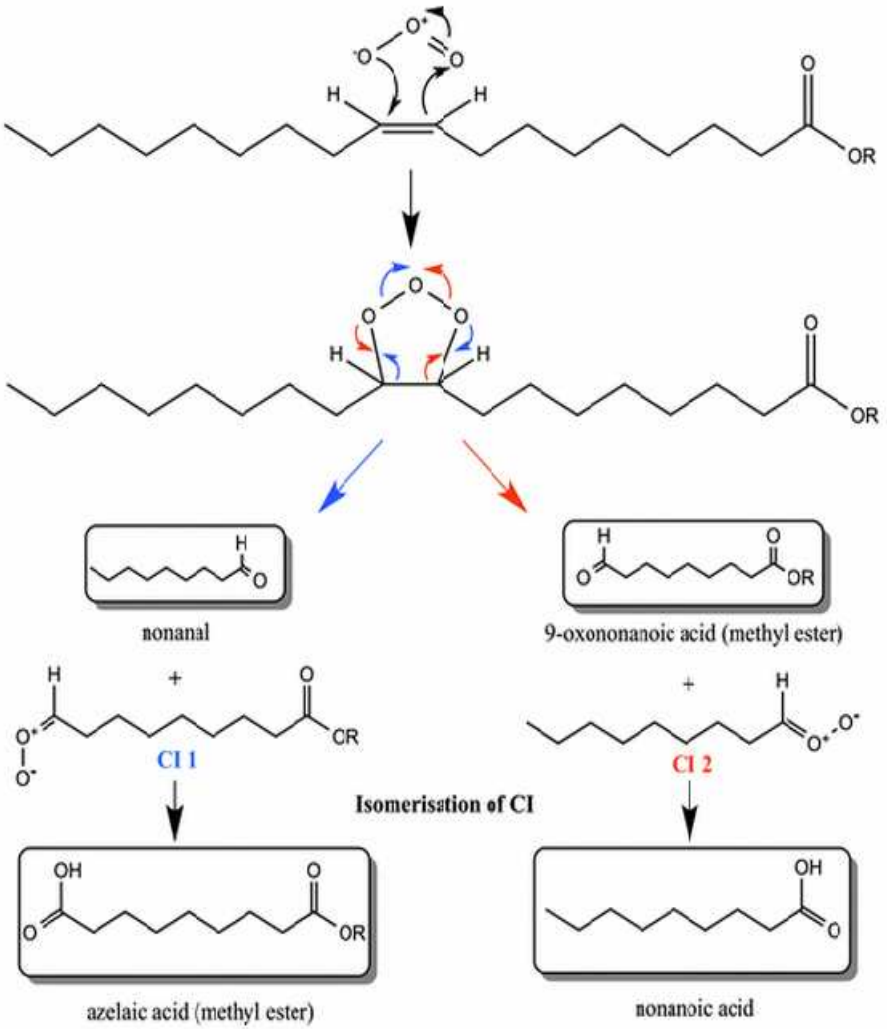


Products identification



9,01	Noananal
12,61	Nonanoic acid
13,61	Nonanoic acid, 9-oxo-, methyl ester
17,75	Azelaic acid

Oxidation mechanism



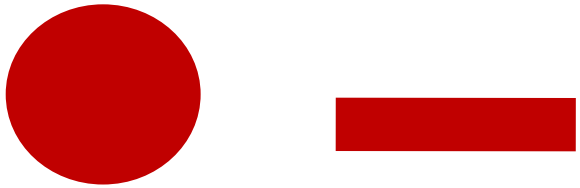
R = -CH_3 / -H

Pfrang et al. 2014, phys Chem Chem phys 13220-13228

Future directions

Laboratory

Particules/surface coating

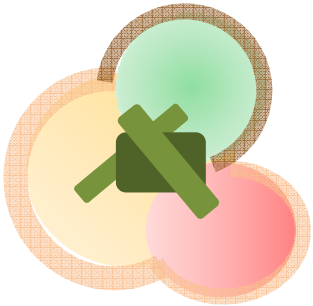


1 oxydant

RH= 0

Atmosphere

Complex mixture



multi oxydants

0 < RH < 102 %

[D .J. Donaldson,et al. 2006]

Thank you !