LUND UNIVERSITY

Chamber Studies of Secondary Aerosol Formation from Light Duty Vehicle Exhausts

Nordin, Erik; Nilsson, Patrik; Eriksson, Axel; Kajos, Maija; Rissler, Jenny; Svenningsson, Birgitta; Swietlicki, Erik; Bohgard, Mats; Kulmala, Markku; Pagels, Joakim

Published in:
International Aerosol Conference

2010

Link to publication

Citation for published version (APA):
Nordin, E., Nilsson, P., Eriksson, A., Kajos, M., Rissler, J., Svenningsson, B., Swietlicki, E., Bohgard, M., Kulmala, M., & Pagels, J. (2010). Chamber Studies of Secondary Aerosol Formation from Light Duty Vehicle Exhausts. *International Aerosol Conference*, P3W38-P3W38.

Total number of authors:
10

General rights
Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.
• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: https://creativecommons.org/licenses/

Take down policy
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

Download date: 20. Apr. 2024

Chamber studies of secondary aerosol formation from light duty vehicle exhausts

Nordin[1], Erik, Z.[1], Nilsson[1], Patrik[1], Eriksson[1, 2], Axel[1,2], Kajos[3], Maija, K.[3], Rissler[1], Jenny[1], Svenningsson[2], Birgitta[2], Swietlicki[2], Erik[2], Bohgard[1], Mats[1], Kulmala[2,3], Markku[2,3] and Pagels[1], Joakim[1]

[1]Division of Ergonomics and Aerosol Technology, Lund University, P.O. Box 118 SE-221 00 Lund, Sweden
[2]Division of Nuclear Physics, Lund University, P.O. Box 118 SE-221 00 Lund, Sweden
[3]Department of Physic, University of Helsinki, P.O. Box 64, FIN-00014 University of Helsinki, Finland

Keywords: SOA Formation, Ageing, Combustion Aerosols

Particulate matter from anthropogenic combustion sources has been considered a health and environmental issue for a long time. Formation of secondary organic aerosol (SOA) from combustion processes is a subject that is not well known, because it involves a large number of complicated physical and chemical processes (Hallquist *et al.*, 2009). The aim of this study was to investigate secondary aerosol formation, by ageing light duty vehicle exhausts.

The campaign focused on secondary aerosol formation from idling gasoline (Volvo V40 1998), diesel (VW Passat 1998) and ethanol (Volvo V70 2009) fueled cars. Ammonium sulfate or primary particles from the diesel car are utilized as condensation seeds, with an initial concentration of about 20 µg/m^3. The experiments are monitored by several particle characterization instruments and gas analyzers (figure 1), including a HR-TOF Aerosol Mass Spectrometer. After extraction of the exhaust, it is left in the Teflon chamber for 30 minutes to allow mixing and to enable sampling of the fresh exhaust. The UV-lights are then turned on for 5h.

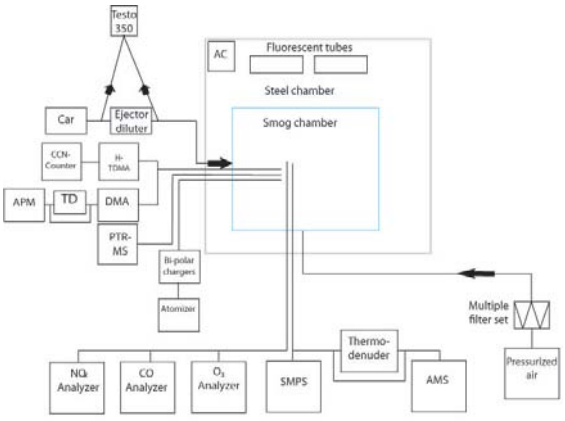

Figure 1: The measurement setup

The ageing experiments take place in a 6 m^3 fluorinated ethylene propylene chamber (Lindskog *et al.*, 2009). The chamber is placed in a 21 m^3 temperature controlled steel chamber. Exhaust is extracted from a car operating on idling load for about 15 minutes. The exhaust is injected via a heated stainless steel inlet (140 ^{0}C) with a flow rate of 0.0055m^3/s, the total dilution ratio in the chamber is about 200 times.

An example of an experiment involving the gasoline car is given in figure 2. The ratio between secondary organics and the sulfate seed increases almost four times during oxidation of the gasoline exhausts. The increase in organics/salt-ratio is due to condensation of the SOA on the salt seeds (figure 2). The ammonium sulfate particles are used to reduce vapor losses and to quantify particle wall losses.

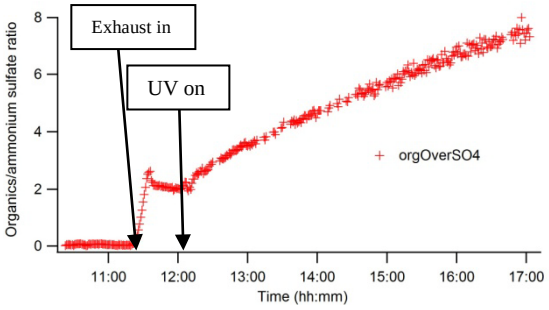

Figure 2: The ratio between organics and sulfate from gasoline exhausts (Volvo V40 1998), the UV-lights started at 12:00 and ended at 17:00.

The organic matter origins from unburned and partly oxidized hydrocarbons in the gasoline fuel, the hydrocarbons are then oxidized in reactions initiated by UV. The oxidation decreases the vapor pressure of the hydrocarbons, which causes them to partition to the particle phase (Robinson *et al.*, 2007).

This project is funded by the Swedish Research Council Formas under grants 2007-1205 and 2008-1467

Hallquist *et al.* (2009) *The formation, properties and impact of secondary organic aerosol: current and emerging issues.* Atmos. Chem. Phys. Discuss., 9, 3555-3762

Lindskog, M. & Nordin, E. (2009) *Ageing of Diesel Aerosols – Design and Implementation of a Teflon Simulation Chamber*, Master's Thesis, Lund University

Robinson *et al.* (2007) *Rethinking Organic Aerosols: Semivolatile Emissions and Photochemical Aging.* Science, 315, 1259-1262