Policies on particulate matter miss adequate tools: organic aerosols

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19th ETH Conference on Combustion Generated Nanoparticles

Zurich, Switzerland, 28 June – 1 July 2015

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Content of presentation

Part 1

- **Concern on present PM-policies**
- **Fraction-by-Fraction Approach**
- **Black Carbon and Organic Aerosols**

Part 2

- **Main trends on organic aerosols from recent symposia**

Concern on present PM-policies (1)

- **Aspects that are not considered include**:
  - Chemical composition and specific toxicity
  - Specific risks of the ultrafine fraction
  - Relation to sources
  - Particle numbers concentration
  - Particle surface area
  - Absorptivity

Concern on present PM-policies (2)

- **What does this mean?**
  - Claims on health protection are imprecise
  - No guidance on addressing priority sources
  - No stimulus to have co-benefits with climate objectives

- **How to change?**
  - Fraction by fraction: chemical composition and size
  - Research agenda: new priorities

Fraction-by-Fraction policy

size - chemical composition

- Evidence that size (ultrafine fraction, 30-170 nm) is a crucial factor for cardiovascular and olfactory induced effects
- ***PM_{10}/$PM_{2.5}$ -policy may be effective for respiratory effects, but not necessarily for cardiovascular and olfactory effects (Janssen, 2011)***
- BC and POA emissions and atmospheric SOA production are predominantly in the 30-170 nm size

Ultrafine particles

specific health risks

Primary

- **Black Carbon**
- **Primary Organic Aerosol** (**POA**)
- Metals (combustion, metallurgical processes)
- Abrasion particles (traffic)
- Natural (Sea salt, Saharan dust)

Secondary

- **Secondary Organic Aerosol** (**SOA**)
- Inorganic aerosol
  - Sulphates (ultrafine?)
  - Nitrates (ultrafine?)
- Natural (Natural haze)
- Resuspended aerosol: ultrafine?

Black Carbon Particles

2011/2012 Focus on Black Carbon:

- Better correlation with short-term health endpoints than $PM_{10}/PM_{2.5}$ (Jansen, et al, 2011; WHO, 2012)
- BC-sources are well known; emissions in ultrafine mode
- BC-policy is coherent with policies to reduce emissions of particle numbers from heavy vehicles (EUROVI)
- Climate forcer: AQ-policies on BC result in less warming
- Potential co-benefits of integrated policy furthers implementation of AQ legislation in MS

(EFCA Policy Initiative No.3 , 2012)

Organic Aerosols

2013-2015 Focus on Organic Aerosols:

- POA: semi-volatile PolyCyclic Aromatics (PCAs), co-emitted with BC deposit at particle surfaces; several PCA‘s are carcinogenic
- SOA: under summersmog conditions POA are oxidised in part and converted into ‚*reactive oxidative species (ROS)*‘;
- ROS considered reponsible for ‚*oxidative stress*‘
- SOA production with exhausts from biofuels faster
- POA/SOA might be the more toxic fraction, BC being rather the carrier

Organic Aerosols and EFCA

- Literature review (EFCA , 2014):
  - POA/SOA relevant for climate: Brown Carbon as climate forcer
  - Major knowledge gaps, both with respect to air quality and climate

- Too early for a new EFCA Policy Initiative
- Discussions at EFCA symposia (Amsterdam 2014; Brussels 2015)

EFCA session at the

NCGG

VVM network of environmental professionals

7th International Symposium on Non-CO_2 Greenhouse Gases (NCGG7)

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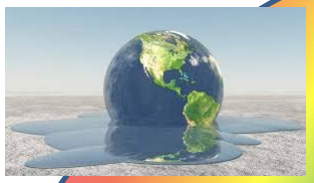
Fraction-by-fraction approach in air quality policy on PM

COMPOSITION



Secondary organic aerosol (SOA)

Brown carbon

Black carbon

SIZE

Hygrosc. growth

Ice nuclei

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Uncertainty in radiative forcing effects of particles

- Model inputs AND validation (developing countries); more complex than gases (size and composition)
  - Validation: **Database is too limited**
  - Organic aerosols in chemistry or climate models: Early stage of development (semi-volatile, ignore chemical reactivity)
- One Atmosphere

Main points from the

EFCA

Karlsruhe Institute of Technology

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International Symposium on Ultrafine Particles

5th International Symposium on Ultrafine Particles (UFP-5)

Ultrafine Particles – Air Quality and Climate

May 4 – 5 2015, Brussels

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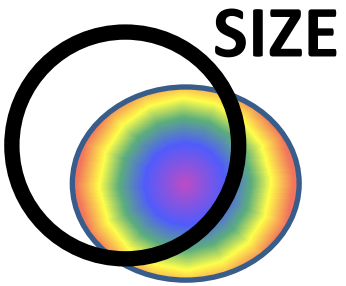
Main points

- Health effects: Cardiovascular mortality is highest for 30-50 nm **size fraction** of UFP
- Number concentration measurements
- Black carbon
- Nucleation
  - gases
  - also in urban areas



Research agenda organic aerosols based on panel discussion

- **Emission Inventories:**
  - Improved, more complete emission inventories
  - Origin of organic carbon in urban areas (source apportionment)
- **Atmospheric chemistry/toxicity:**
  - Particle – cell interactions experiments
  - Make laboratory experiments more atmospherically relevant/under more realistic conditions
  - Assessment of physicochemical and toxicological properties of PM for health effects
  - Combination of air quality and nanoparticle engineering
- **Atmospheric exposure:**
  - Indoor air quality, processes between indoor and outdoor air