Title *

Generating biodiesel and fossil diesel exhaust particles with varied physico-chemical properties for toxicological studies

Abstract *

Diesel exhaust (DE) is classified as carcinogenic and is suspected to play an important role in the adverse effects of ambient PM in urban areas. Candidates for toxicologically relevant particle properties include the specific surface area and surface reactivity of the solid black carbon core, the liquid organic fraction including polycyclic aromatic hydrocarbons (PAHs), and transition metals. We here describe an approach where the particle composition and properties can be varied over a wider range and in a more systematic way compared to previous studies while maintaining realistic engine operation conditions.

The set-up includes a modern heavy duty diesel engine using fuel blends of RME biodiesel and fossil diesel and exhaust gas sampling through a partial flow dilution tunnel. Particles in the exhaust were characterized using real-time aerosol mass spectrometry, and Transmission Electron Microscopy. Toxicological studies, including nanomaterial characterisation require large amount of PM (~100 mg). A High Volume Cascade Impactor (HVCI 900, BGI Inc.) followed by methanol extraction was used to collect the particles.

Altering the degree of exhaust gas recirculation (a common NO_x reduction strategy) from low to high levels allowed us to generate PM with particle mass fractions ranging from: black carbon core: 30-90%, organic aerosol (primarily from lube oil): 10-70% and PAHs: 0.5-20%. The morphology varied from aggregates (primary particle diameter ~20 nm) to larger droplets (high PAH case).

Currently, the dispersability in exposure medium of the collected material is investigated, preliminary in-vitro studies are carried out, together with detailed nanomaterial characterization of collected material. Finally particles will be used for pulmonary exposure studies in mice to identify relationships between particle physico-chemical properties and biomarkers of genotoxicty, inflammation and cardiovascular effects.

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Affiliations and Authors *

Author Information
Louise Gren (Presenting)

Affiliations
Ergonomics & Aerosol Technology, Lund University, Lund, Sweden

Author Information
Vilhelm B Malmborg

Affiliations
Ergonomics & Aerosol Technology, Lund University, Lund, Sweden

Author Information
Pravesh Shukla

Affiliations
Combustion Engines, Lund University, Lund, Sweden

Author Information
Kirsten I Kling

Affiliations
National Research Centre for the Work Environment, Copenhagen, Denmark

Author Information
Christina Isaxon

Affiliations
Ergonomics & Aerosol Technology, Lund University, Lund, Sweden

Author Information
Axel C Eriksson

Affiliations
Ergonomics & Aerosol Technology, Lund University, Lund, Sweden

Author Information
Per A Clausen

Affiliations
National Research Centre for the Work Environment, Copenhagen, Denmark

Author Information
Ulla B Vogel

Affiliations
National Research Centre for the Work Environment, Copenhagen, Denmark

Author Information
Martin Tuner

Affiliations
Combustion Engines, Lund University, Lund, Sweden

Author Information
Joakim PAgels

Affiliations
Ergonomics & Aerosol Technology, Lund University, Lund, Sweden