Health effects of photochemically aged combustion-derived particles

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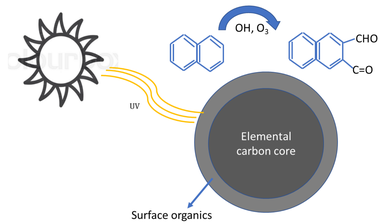
The Problem

- Atmospheric aging of combustion-derived particles induces changes to their chemical composition that may lead to adverse health effects, such as pulmonary and cardiovascular diseases
- The effect of aging on biological responses to combustion particles is poorly understood



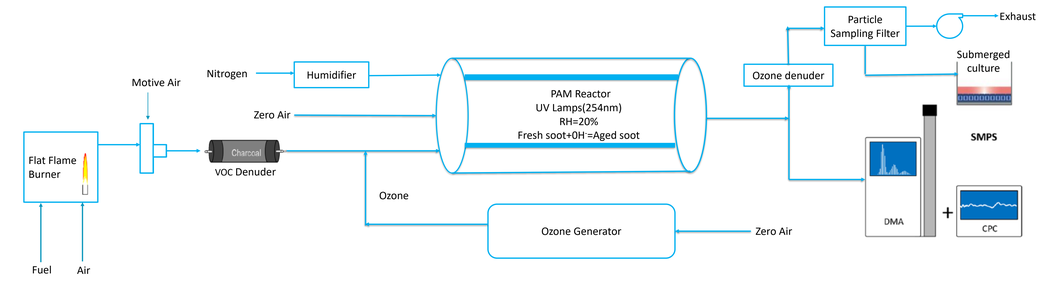
Objective

Study the effect of photochemical aging on the chemical composition of combustion particles and compare the cellular response to fresh and photochemically aged combustion particles

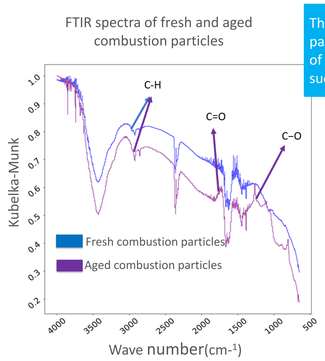
Methods

- Photochemically age combustion particles in an oxidation flow reactor
- Characterize the fresh and aged combustion particles
- Expose the fresh and aged particles to A549 cells at different doses and times

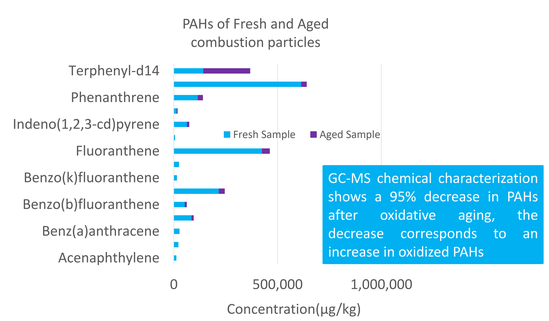
Experimental Setup



Results

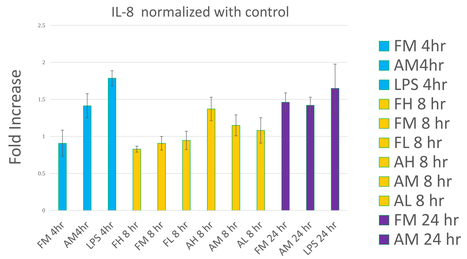


The aging of combustion particles leads to the addition of oxidized function groups, such as C-O and C=O



GC-MS chemical characterization shows a 95% decrease in PAHs after oxidative aging, the decrease corresponds to an increase in oxidized PAHs

Fresh(F) and Aged(A) combustion particles of High(H), Medium(M), and Low(L) doses of 12µg/cm², 6µg/cm² and 1.5µg/cm² were each exposed to A549 cells at 4-, 8-, and 24-hour periods



Higher IL8 responses for aged(A) combustion particles at 4- and 8-hours of exposure

Key Findings and Future Work

- Aging of combustion particles leads to changes in their chemical composition, as shown by the FTIR and GC-MS spectra
- The total PAH content in fresh combustion soot decreased by 95% after oxidative aging
- Higher and more rapid IL8 responses to aged combustion particle
- Composition changes may cause these observed differences

Future work

- Evaluate the effect of secondary organic aerosols on aged combustion particles
- Evaluate additional biological endpoints study to understand the effects of atmospheric aging

Acknowledgments

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