Seminar Series 2012-2013

Southern Ontario Centre for Atmospheric Aerosol Research
University of Toronto

Towards a Mechanistic Understanding of Particulate Matter Redox Cycling at the Molecular Level

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Particulate matter (PM) results in adverse health effects when inhaled, partially due to its ability to catalyse redox cycling reactions in solution. To determine which particles to target for reduction to improve public health, it is important to understand what species are making particles toxic. Our understanding of the chemical constituents of particles that lead to oxidative capacity, however, is rather poor. Directly emitted combustion particles from motor vehicles are known to be redox active, but less is understood about how atmospheric oxidation and processing might affect oxidative capacity and, potentially, the toxicity of inhaled particles. It has been hypothesized that for organic constituents, small redox active species known as quinones can be responsible for this activity, but few studies have attempted to account for redox activity based on the concentrations of these species.

Our goals are to examine the chemical nature of the oxidative capacity of organic and combustion-derived particles using an cell-free assay that has been linked to particle toxicity. To do so, three systems are examined. In the first, two-stroke engine exhaust is oxidized in the laboratory to examine the effect on oxidative capacity. In the second, we generate particles in the laboratory by oxidizing naphthalene, a two-ring polycyclic aromatic hydrocarbon, and attempt to rationalize the observed redox activity by quantifying redox active products. In the third, we look at diesel exhaust particles, where redox activity occurs at the particle surface, suggesting a different chemical constituent than the previous two systems. The contrast of these systems can highlight the limitations of inferring toxicity from oxidative capacity for particles of different compositions.

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Wallberg Building, 200 College Street, Room 407

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