Optical Properties and Atmospheric Transformations of Organic Aerosol Emitted from Burning of Urban Materials

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Abstract

Large-scale forest fires significantly contribute to the atmospheric burden of organic aerosol (OA). Wildfire events increasingly occur at the wildland-urban interface (WUI), burning not only biomass but also a wide range of urban materials. The chemical composition and properties of OA from WUI fires are poorly characterized. This presentation will discuss the mass absorption coefficients (MAC), chemical composition, and photochemical aging of OA from pyrolysis and smoldering of common urban materials. OA samples were collected and aged by exposing them to simulated solar radiation directly on the Teflon filter collection substrates. The MAC values of the unaged and aged OA were measured by spectrophotometry after extracting OA in suitable solvents or directly on optical substrates. The samples were analyzed using ultrahigh pressure liquid chromatography photodiode array high resolution mass spectrometry (UPLC-PDA-HRMS) with either atmospheric pressure photo ionization (APPI) and electrospray ionization (ESI) to ensure detection of both polar and nonpolar OA components. The samples were further investigated using temperature programed desorption (TPD) stage interfaced with direct analysis in real time (DART) ionization source to assess volatilities of prominent individual species in OA. We find that that MAC values range over an order magnitude depending on the material. Exposure to solar radiation can either reduce MAC (photobleaching) or increase it (photoenhancement), reflecting complex aging mechanisms driven by condensed phase photochemical reactions in OA. The OA samples contain a number of unique compounds that can be used as markers of WUI fires, including metal complexes and halogen-containing compounds.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

BBURNED: Biomass Burning Uncertainty: ReactioNs, Emissions and Dynamics

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