Primary Organic Aerosols in the Urban Atmosphere: Insights from Aerosol Mass Spectrometry

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High concentrations of primary organic aerosol (POA) are often observed at urban locations. Fossil fuel combustion has long been assumed to be a major contributor to urban POA. However, cooking activities and residential wood combustion during cold seasons may also release significant amounts of POA into the urban atmosphere. Understanding the concentrations and physical chemical properties of POA from various anthropogenic sources, e.g., cooking, wood burning, and vehicles, is critical for evaluating aerosol's impacts on urban air quality (i.e., health effects) as well as climate (i.e., aerosol radiative effects). Since cooking and biomass burning mostly release modern carbon, determining the mass concentrations of POA from these sources may also be important for understanding and validating previous findings that OA observed over urban areas is dominated by modern carbon. This is important for estimating overall emission factors for urban centers as well as for carbon footprint estimates. In this presentation, we will discuss source apportionment of POA in the urban atmosphere via multivariate factor analyses of ambient aerosol data acquired with aerosol mass spectrometers. The data sets examined here will cover various urban centers from around the world and the findings will be relevant for air quality analysis of modern-day cities. We will discuss the identification and validation of different POA factors, primarily based on mass spectral features, diurnal patterns, and correlations with tracer species. Finally, we will report the average concentrations, elemental ratios, and size distributions of POA factors including hydrocarbon-like OA (HOA), cooking OA (COA), and biomass burning OA (BBOA). A comparison of POA observations between winter and summer will also be reported.