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Characterization of Primary Organic Aerosol Emissions from Meat Cooking, Trash Burning, and Combustion Engines with High-Resolution Aerosol Mass Spectrometry and Comparison with Ambient and Chamber Observations

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Organic aerosol (OA) emissions from motor vehicles, meat-cooking and trash burning are analyzed here using a high-resolution aerosol mass spectrometer (AMS) and supporting instrumentation. A semi-quantitative comparison of emission factors highlights the potential importance of meat cooking as an OA source. GC-MS and AMS mass spectra are compared for the first time and show high similarity, but with more fragmentation in the AMS due to higher vaporization temperatures. High resolution data show that aerosols emitted by combustion engines and plastic burning are dominated by hydrocarbon-like organic compounds. Meat cooking and especially paper burning contain significant fractions of oxygenated organic compounds; however, their unit-resolution mass spectral signatures are very similar to mass spectral signatures from hydrocarbon-like OA or primary OA, and very different from the mass spectra of ambient secondary or oxygenated OA (OOA). Thus, primary OA from any of these sources is very unlikely to be a significant direct source of ambient OOA. There are significant differences in high-resolution tracer m/z's that may be useful for differentiating these sources from each other. Unlike in most ambient spectra, all of these sources have low total m/z 44 and this signal is not dominated by the CO2+ ion. All sources have high m/z 57, which is low during high OOA ambient periods. Spectra from paper burning are similar to some types of biomass burning OA, with elevated m/z 60. Meat cooking aerosols also have slightly elevated m/z 60, while motor vehicle emissions have very low signal at this m/z.