INVESTIGATING THE SECONDARY ORGANIC AEROSOLS FROM BIOMASS BURNING EMISSION SOURCES

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Biomass burning is a major source of atmospheric aerosols on both global and regional scales. The contribution of biomass burning sources to the ambient aerosols has long been studied by employing water-soluble potassium (K^+) or/and saccharide anhydrides such as levoglucosan as tracer compounds in receptor modeling. Recent chamber and field measurements suggested that while levoglucosan was present at high concentrations in primary biomass burning emissions, a group of nitrogen-containing aromatic compounds (NACs) was found at elevated levels in the aging smoke plumes during air mass transport and was therefore suggested to be tracer compounds for SOA originated from biomass burning.

Detailed chemical speciation were conducted on one-year $PM_{2.5}$ filter samples in order to get a better understanding of the biomass burning impact on particulate matter levels in Hong Kong. The filter samples were analyzed for $PM_{2.5}$ mass, major ions, organic and elemental carbon, trace elements, non-polar organic compounds (PAHs, alkanes, hopanes and steranes), and biomass burning organic markers (anhydrosugars and NACs).

Levoglucosan was measured at a higher average concentration level of 135 ng/m^3 in winter and a lower level of 39 ng/m^3 in summertime. The levoglucosan-to-mannosan ratio varied significantly (2.7–37.8) throughout the year, suggesting that the ambient aerosols were affected by mixed types of biomass combustion emissions. The total NAC concentrations ranged from 0.10 to 34.9 ng/m^3 and a much higher concentration level was observed during winter. Positive correlations among NACs, levoglucosan, and K^+ ($R = 0.57\sim0.71$) suggest that they originated from similar emission sources. Although vehicle exhaust has been well documented as one of the sources for nitrophenols, the strong correlations among NACs (nitrophenols and nitrocatechols) indicate that biomass burning is the dominant sources for these compounds in the sampling area. Receptor modeling analysis using Positive Matrix Factorization (PMF) on the speciated dataset showed that the inclusion of both anhydrosugars and NACs as tracers enabled the identification of two biomass burning sources (primary and secondary). During winter when the biomass burning influence was more significant, the two biomass burning sources attributed up to 40% of the observed OC, while the PMF run without including NACs reported approx. 21% attributable to biomass burning, and using K^+ alone as the biomass burning tracer in PMF reported approx. 16%. The comparison between different PMF runs indicates a significant contribution to $PM_{2.5}$ OC from biomass burning emission-derived SOC.