A Unique On-line Method to Infer Water-Insoluble Particulate Mass-Fractions

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The mass, size, and water-insoluble chemical composition of particulate matter below 2.5μm (PM2.5) significantly effects air quality, climate, and human health. Carbonaceous material, such as Black Carbon (BC) can contribute to water-insoluble PM2.5 and their subsequent effects. BC is formed from the incomplete combustion of fossil fuels and biomass (Novakov et al. 2000) and tends to be emitted below 30 nm (Akhter et al. 1985). BC is defined by optical properties and in this study, it is quantified by an ability to absorb energy at 670 nm wavelengths. BC aerosol is water-insoluble when freshly emitted (~ 1 day) but can add water-soluble materials in surface oxidation and condensation reactions during its atmospheric lifetime (Koehler et al. 2009). Hence as a BC particle ages, it can modify the overall insoluble fraction, hygroscopic properties, and reduce the critical water-vapor required to initiate heterogeneous nucleation

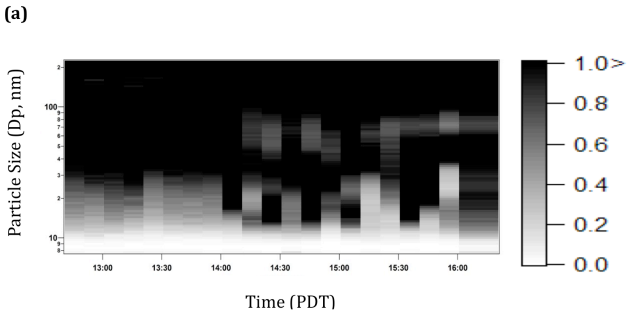

Figure 1. The comparison of water to butanol particle counts for weekday measurement.

Particle number, size, and composition information is important for constraining aerosol effects on air quality, climate, and health. The composition of particles, especially from vehicular sources, may contain insoluble black carbon (BC) material that modify particle nucleating properties. For this study, ambient aerosol was sampled from the South Coast Air Quality Management District (SCAQMD) instrument station located 15 m from the I-710 freeway in Long Beach, California. A water-based condensation particle counter (CPC) and a butanol-based CPC provided particle number concentration data. Both instruments were coupled with a Scanning Mobility Particle Sizer (SMPS) and particle number and size were recorded. Real time particle insoluble mass fractions are estimated with the SMPS data sets; theoretical mass fractions are calculated from ideal hygroscopicty single parameter , κ- values. This is the first time that this experimental method has been employed and used to infer online insoluble mass fractions.

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