AEROSOL OPTICAL PROPERTIES DURING THE FORMATION OF BROWN CARBON AEROSOL

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Light absorbing organic aerosol is referred to as brown carbon (BrC). Light absorption by BrC is highly uncertain, with BrC composed of a diverse range of organic species that absorb light at UV-visible wavelengths <500 nm. BrC formed from α-dicarbonyl gas (such as glyoxal and methylglyoxal) reacting with ammonium-containing particles has been of recent interest,[1] with glyoxal and methylglyoxal estimated to contribute significantly to atmospheric organic aerosol.[2] Notably, BrC can be formed through aqueous droplet chemistry or *via* heterogeneous reaction on particle surfaces.

We use laser-based spectroscopy in laboratory studies of BrC aerosols, including for reactions in aqueous droplets or *via* heterogeneous reactions on solid particle surfaces. Photoacoustic and cavity ring-down spectroscopy afford non-contact measurements of aerosol absorption (σ_{abs}) and extinction (σ_{ext}) cross sections respectively. A suite of spectrometers measure σ_{abs} and σ_{ext} at the visible wavelengths 405, 514 and 658 nm. Laboratory-generated seed particles of ammonium sulfate (AS) passed to a reaction volume where the humidity and concentration of α-dicarbonyl gas was controlled. The aerosol reacted for ~15 minutes prior to size-selection with a differential mobility analyser and subsequent measurement of σ_{abs} and σ_{ext}. From these measurements, we determined the intrinsic microphysical properties of real and imaginary refractive index. Fig. 1(a) shows the wavelength dependence in the measured σ_{abs} for the reaction of methylglyoxal with aqueous AS particles, with the BrC formation rate in aerosols (minutes) accelerated compared to that in bulk solutions (>10 days). Fig. 1(b) shows the σ_{abs} for BrC formed *via* the heterogeneous reaction of glyoxal on solid AS particles, with BrC formed only when the ambient humidity is >30%, but remains below the deliquescence humidity of AS. Our current effort is focussed on the design of an injection flow tube reactor with the capability of measuring the UV photobleaching of BrC aerosols.

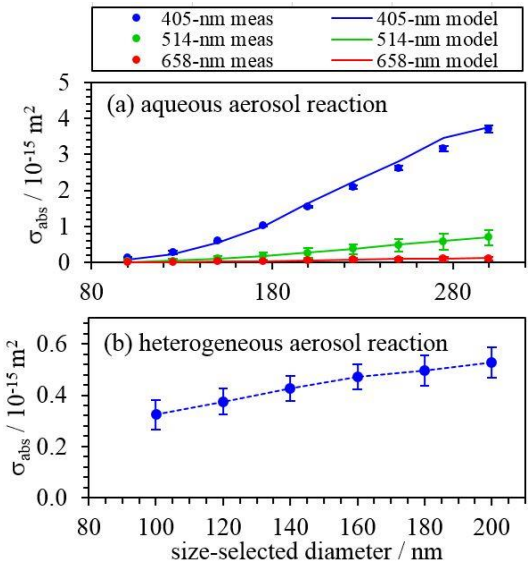

Fig. 1 - *(a) The measured size-dependent σ_{abs} for BrC formed from the reaction of methylglyoxal with aqueous AS particles. Measurements are fit to Mie theory (solid lines), in combination with the measured σ_{ext}, for retrieval of n-RI and k-RI. (b) The measured size-dependent σ_{abs} for BrC formed from the reaction of glyoxal on solid AS particle surfaces.*

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