



Relating hygroscopicity and mass spectral features of organic aerosol particulate matter

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A hygroscopicity tandem differential mobility analyzer (HTDMA) was used to measure the water uptake (hygroscopicity) of secondary organic aerosol (SOA) formed during the chemical and photochemical oxidation of several organic precursors in a smog chamber. Electron ionization mass spectra of the non-refractory submicron aerosol were simultaneously determined with an aerosol mass spectrometer (AMS), and correlations between the two different signals were investigated. SOA hygroscopicity was found to strongly correlate with the relative abundance of the ion signal m/z 44 expressed as a fraction of total organic signal (MF_{44}). m/z 44 is due mostly to the ion fragment CO_2^+ for all types of SOA systems studied. The analysis was also performed on ambient organic aerosols from two field experiments at the remote site Jungfraujoch, and the megacity Mexico City, where similar results were found. A simple empirical linear relation between the hygroscopicity of organic aerosol at subsaturated RH, as given by the hygroscopic growth factor (GF) or “ κ_{org} ” parameter, and MF_{44} was determined. The use of this approximation could introduce a significant simplification in the parameterization of hygroscopicity of the organic aerosol component in atmospheric models, since MF_{44} is correlated with the photochemical age of an air mass and the database for AMS measurements is constantly being expanded around the world.