Optical Characterization of End-Member Mixtures Found in Urban Indoor Air

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Multiple acute and chronic adverse health effects occur in association with exposure to particulate matter, such as black carbon (BC). Recently, a multi-wavelength optical method was refined for distinguishing BC from other major components in urban indoor air, such as ammonium sulfate and environmental tobacco smoke (ETS). However, further work is needed to refine this method for the quantitative analysis of ETS. Little work has been done to look at the methodological issues of the optical reflectance measurements for samples that contain mixed-source particles. In this study, six different mixtures were made on filters with each consisting of two end-members, of which all are composed of either kerosene soot (a proxy for graphite black carbon), sidestream tobacco smoke (a proxy for ETS), or ammonium sulfate. Our preliminary results show that ammonium sulfate can change the absorption pattern of BC substantially when the mass loading of ammonium sulfate is high. Mixtures of BC and ETS show a flattening of the absorption curve, i.e. a decrease in the UV region and an increase in the IR region. This is consistent with our observations of NYC indoor air filter samples, suggesting that optical density (OD) of mixtures is not a straightforward addition of the OD of its various components, and that further investigation is needed for better understanding the dependence of a mixture's optical density on the wavelength of light emitted.