Supplement for "Wavelength- and NO_x-dependent complex refractive index of SOA generated from photooxidation of toluene" by T. Nakayama et al.

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S1. Calibration procedure of the PASS-3

Detail descriptions of performance of the 3λ-photoacoustic spectrometer (Droplet Measurement Technologies, PASS-3) are in preparation in a separated paper (Nakayama et al. manuscript in preparation). Here, only brief descriptions of the calibration procedures, which were conducted for the present study, are given.

The $b_{sca}(\lambda)$ obtained by the PASS-3 was calibrated by using monodisperse polystyrene latex (PSL) particles. PSL particles with diameters of 203, 299, or 400 nm (Duke Scientific), generated by an atomizer, were dried using a diffusion dryer with silica gel and then passed through a differential mobility analyzer (DMA) (TSI, model 3081) and an aerosol particle mass analyzer (APM) (Kanomax, model 3601). The generated aerosols were supplied to the PASS-3 instrument and a condensation particle counter (CPC) (TSI, model 3772). Calibration factors for $b_{sca}(\lambda)$ were estimated by comparing the $b_{sca}(\lambda)$ data obtained by the PASS-3 with those calculated based on Mie theory by applying particle diameter and particle number density, and literature refractive index [Nikolov and Ivanov, 2000]. Strong particles size dependence of the calibration factors for b_{sca}(532 nm) were found, while no significant size dependence was observed for b_{sca}(405 nm) and b_{sca}(781 nm). The results may be explained by the difference in truncation errors, because the polarization plane of 532 nm laser beam is in perpendicular to view plane, while those of 405 and 781 nm is in parallel. Therefore, the b_{sca}(532 nm) data obtained by the PASS-3 were not used in this work.

The b_{abs}(405 and 781 nm) obtained by the PASS-3 was calibrated by polydisperse propane soot particles. Calibration factors for the $b_{abs}(\lambda)$ were estimated by comparing the $b_{sca}(\lambda)$ obtained by the PASS-3 with those obtained from subtraction of the corrected $b_{sca}(\lambda)$ from the $b_{ext}(\lambda)$ determined by change in laser power passing through cell in the presence and absence of the soot particles. The b_{abs}(532 nm) obtained by the PASS-3 was calibrated by monodisperse nigrosin particles. Similar to the

experiments for PSL described above, nigrosin particles (Wako Chemicals), generated by the atomizer, were passed through the diffusion dryer, DMA, and APM to obtain monodisperse particles. The monodisperse nigrosin particles with diameters of 200, 250, or 300 nm were supplied to the PASS-3 and the CPC. The b_{abs}(532 nm) obtained by the PASS-3 was compared with those calculated based on Mie theory using particle diameter, particle number density, and literature refractive index [Dinar et al. 2008, Garvey and Pinnick, 1983, Lack et al. 2006]. The b_{abs}(532 nm) was also calibrated using gaseous light absorption by NO_2. NO_2/air (1-6 ppmv) gases was prepared by diluting 10 ppmv NO_2 (Japan Fine Products) in air with synthetic air and supplied to the PASS-3. The b_{abs}(532 nm) obtained by the PASS-3 was compared with those determined by the change in the laser power passing through the cell in the presence and absence of NO_2. As results, uncertainties associated with the calibration were estimated to be 8, 6, 10, 8, and 6% for b_{abs}(405 nm), b_{sca}(405 nm), b_{abs}(532 nm), b_{abs}(781 nm), and b_{sca}(781 nm), respectively.

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