Optical properties of secondary organic aerosol from diesel and gasoline engine exhaust

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Introduction

Black carbon (BC) is considered to be the most potent light-absorbing material in the visible region. Light-absorbing organic carbon (brown carbon or BrC) may also act as sources of significant absorption. Recently, several studies have reported the enhancement of light absorption due to coating of BC (lensing effect) and light absorption of primary organic aerosols (POA) emitted from diesel engine exhast [*e.g.*, 1]. However, optical properties of secondary organic aerosol (SOA) generated from vehicle engine exhaust have not been well-studied.

Experimental

In this study, SOA was generated in a smog chamber by irradiating UV light after addition of OH precursor (H_2O_2) or adding O_3 to diesel or gasoline engine exhaust. Absorption and scattering coefficents at 375, 405, 532, and 781 nm were measured using photoacoustic spectrometers (PAS) after passage through a thermo-dennudar (TD) maintained at 300°C or bypass line maintained at room temperature. Size distribution and chemical property of particles were simultaneously measured using a scanning mobility particle sizer (SMPS) and an time-of-flight aerosol mass spectrometer (AMS), respectively.

Results and discussion

By paasing through the TD, most of non-refractory materials detected by the AMS were removed. The absorption enhancement factor (E_{abs}) was determined from the ratio of light absorption for particles that did not and did pass through the TD. The contributions of the lensing effect and light absorption of SOA (BrC) were estimated from the temporal variations of the E_{abs} values and their wavelength dependence. As results, the enhancement of light absorption due to the lensing effect was found to increase with the formation of SOA, while the contribution of light absorption by the SOA was small under our experimental conditions.

[1] Guo *et al*. (2014) *Atmos. Environ*. **94**, 428-437.