PA25) Monitoring of Ultrafine Particles at an Urban Site in Seoul, Korea during Winter Season

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1. Introduction

Urban air is polluted by local and regional emission sources, particularly vehicle exhausts. Although ultrafine particles are a distinct, short-lived exposure phenomenon not covered in emission inventory approaches(McMurry et al., 2004), ultrafine particles are emitted from gasoline as well as diesel vehicles(Wiedensohler et al., 2002). In this study, we aimed to characterize the effect of vehicle emissions on the urban air in Seoul, Korea during winter. A monitoring site located adjacent to a wooded hill was chosen as a representative urban site. Tracers of vehicle emission such as ultrafine particles, NO_x, CO, and SO_2 were monitored at fixed intervals for one week. Weekly and diurnal variations were examined, and the relations among the indicators of vehicle exhaust were investigated.

2. Monitoring Scheme

Twenty-four hour, integrated measurements of particle size distribution and gas concentrations of urban air were made at an urban site located in the Korea Institute of Science and Technology during the period from February 4 to 10, 2003.

Ultrafine particle concentration was measured by a Scanning Mobility Particle Sizer(SMPS; TSI Inc., model 3936 L25) system consisting of an electrostatic classifier(EC; TSI Inc., model 3071) and an ultrafine condensation particle counter(UCPC; TSI Inc., model 3025) with an impactor having a cutoff diameter(D50) of 812nm. Besides, concentrations of NO, NO_2, NO_x, CO, SO_2, and O_3 were monitored every 2 min by using a chemiluminescence NO-NO_2-NO_x analyzer(TEI, model 42C), trace level gas filter correlation CO analyzer(TEI, model 48C), pulsed fluorescence SO_2 analyzer(TEI, model 43A), and UV photometric O_3 analyzer(TEI, model 49C). All gas analyzers were calibrated before monitoring.

3. Results and Discussion

The weekly variations of the two size-segregated particle number concentrations are plotted in Figure 1. Figure 2 presented diurnal variation of hourly average gaseous concentration and ultrafine particles. The daily average concentrations of ultrafine particles and accumulation mode particles were $1.31 \sim 2.55 \times 10^3$ and $1.18 \sim 1.73 \times 10^3$ particles/cm^3, respectively. With the exception of 9 a.m., all particles size distributions were very similar and did not show a pronounced mode across the size distribution. The ultrafine particle concentration increased with increasing NO_x concentration. The obtained determination coefficient(R^2) of 0.65 was higher than that 0.43 obtained by Park et al. (2008) for ultrafine particles(3~100nm) in urban Gwangju, Korea. The relations between ultrafine particles and CO and SO_2 were not significant with R^2 of 0.36 and 0.47, respectively. However, CO showed a significant relation with NO_x(R^2 is 0.78).

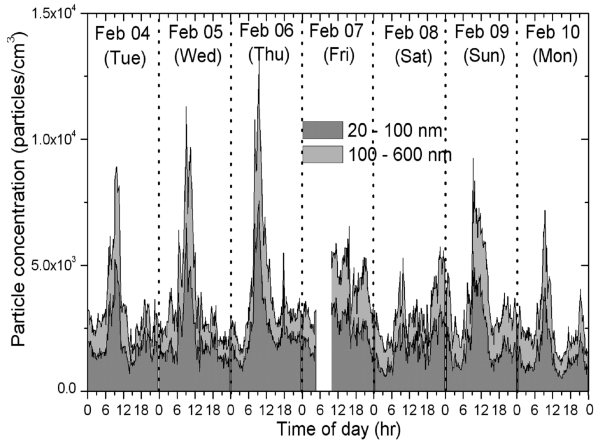

Fig. 1. Weekly variations of the two size-segregated particle number concentrations.

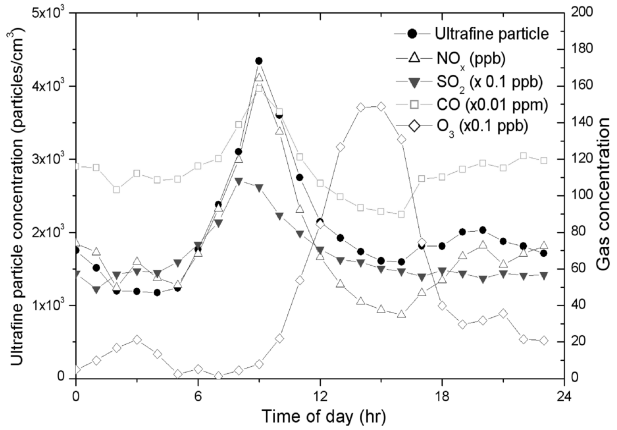

Fig. 2. Diurnal variation of hourly average gaseous concentration and ultrafine particles.

The particle and gas concentration characteristics at the urban monitoring site were different from those at the roadside sites. Wind direction is the dominant factor affecting ultrafine particle contamination near urban roads. Ultrafine particles and NO_x are good indicators representing the transport of vehicle exhaust from urban roads, while SO_2 and CO can also be used as indicators but only in particularly favorable wind conditions.

Acknowledgements

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References

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