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Chemical composition and source apportionment of $PM_{2.5}$ in Seoul, Korea during 2012-2013

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$PM_{2.5}$ samples were collected at a centrally located urban site of KIST (Korea Institute of Science and Technology) in Seoul, Korea, every day from October 2012 to September 2013. Sources were identified using Chemical Mass Balance (CMB) model and two multivariate models. The averaged $PM_{2.5}$ mass concentration was 41.5 $\pm$ 27.7 μg m^{-3}, and seasonally averaged $PM_{2.5}$ concentration was high in the following order: Winter (57.2 $\pm$ 32.7 μg m^{-3}), spring (48.5 $\pm$ 27.6 μg m^{-3}), fall (28.6 $\pm$ 10.5 μg m^{-3}), and summer (22.7 $\pm$ 12.9 μg m^{-3}). Secondary inorganic species and organic matter were the major chemical component occupying about 73.7% – 87.9% of $PM_{2.5}$ mass concentration in all seasons. The maximum value of sulfate was 11.2 μg m^{-3}in winter, however, the fraction of sulfate concentration was highest in summer (31.4%) due to the active photochemical reactivity. The maximum nitrate concentration was measured as 13.4 μg m^{-3}in winter because the cooler temperature is the favorable condition for the formation of particulate nitrate. The highest concentrations of elemental carbon and soil were observed in fall and spring, which were caused by the frequent occurrence of biomass burning and Asian dust events, respectively. 7 sources were attributable to $PM_{2.5}$ mass concentration in Seoul. The main sources were secondary sulfate (24.2%), secondary nitrate (27.3%), biomass burning (14.9%), and vehicle (8.9%). The contributions from other carbon source (5.5%), geological source (5.5%), and marine aerosol (0.8%) were relatively less than those of main sources. Compared to the results from the previous study, contributions of secondary nitrate and vehicle were overestimated and underestimated, respectively, due to the limitation of source profiles used in this study. On the other hand, $PM_{2.5}$ concentration in Seoul was highly affected by long-range transported pollution from northern China in January 2013. The contribution of other carbon source, which was the residual carbonaceous component after source apportionment analysis, was the highest at 10.6% in winter. This suggests that about 10.6% of $PM_{2.5}$ concentration cannot be estimated by local sources and can be attributable to the polluted aerosols transported from China. In this presentation, more detailed comparisons among CMB, Positive Matrix Factorization (PMF) and Solver for Mixture Problem (SMP) models will be presented.