PA45) Chemical Characteristics of $PM_{2.5}$ Particles during Winter Haze Events in Ulaanbaatar, Mongolia

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1. Introduction

Mongolia is experiencing rapid rates of urbanization similar to other Asian countries, resulting in air pollution problems by the growing number of automobiles, and industrialization. Ulaanbaatar is also inherently vulnerable to air pollution because of its topography and climate. Rare research was done about air pollution in Ulaanbaatar Mongolia. The objective of this study is to investigate of the major chemical species in fine particles($PM_{2.5}$) in Ulaanbaatar, Mongolia during winter season.

2. Method

Samplers were installed at the rooftop of the National Agency for Meteorology, Hydrology and Environmental Monitoring(NAMHEM) of Mongolia at 10m above the ground. The sampling was done 24-hour interval from December 15, 2007 to January 7, 2008, and 12-hour interval from January 7 to February 16, 2008 due to high aerosol loading. The sampling was carried out based on the USA EPA procedure. $PM_{2.5}$ sampling was conducted using low volume particulate samplers (URG-1018, and 286). Flow rates were maintained at 16.0L min^{-1}. Teflon filter was used to analyze the mass concentration, water soluble ion, and heavy metals as well as prebaked quartz-fiber filter for carbon analysis. Water soluble ions and carbonaceous particles were analyzed by ion chromatography(Dionex, DX-120) and sunset OC/EC analyzer(Sunset lab., RT3015), respectively. Elemental species(Cr, As, Cd, Mn, Zn, Pb, Cr, Cu, Fe, Mg, Ni, K, Ca) were also analyzed by ICP-MS(Elan6100/Perkin Elmer, USA) and ICP/OES(Optima 5300 DV).

3. Result and Discussion

Chemical characteristics of $PM_{2.5}$ particles were carried out in Ulaanbaatar, Mongolia for the first time. Ambient fine particles were monitored in Ulaanbaatar, Mongolia between 15 December 2007 and 15 February 2008. The mean $PM_{2.5}$ mass concentration was 111.3±48.4μg m^{-3} which was 3 times higher than the US EPA 24-hour standard, 35μg m^{-3}, at urban site of Ulaanbaatar, Mongolia during the winter season.

Temporal variation of water-soluble ionic components of $PM_{2.5}$ particles in Ulaanbaatar, Mongolia from December 15, 2007 to February 15, 2008 was shown in Fig. 1. The concentration of water-soluble ionic components varied between 9.46 and 57.29 with mean of 28.73±9.06 during the sampling period. Sulfate(SO_4^{2-}), ammonium(NH_4^+), and nitrate(NO_3^-) are three dominant ionic components in fine particles in Mongolia, Ulaanbaatar for the entire sampling period.

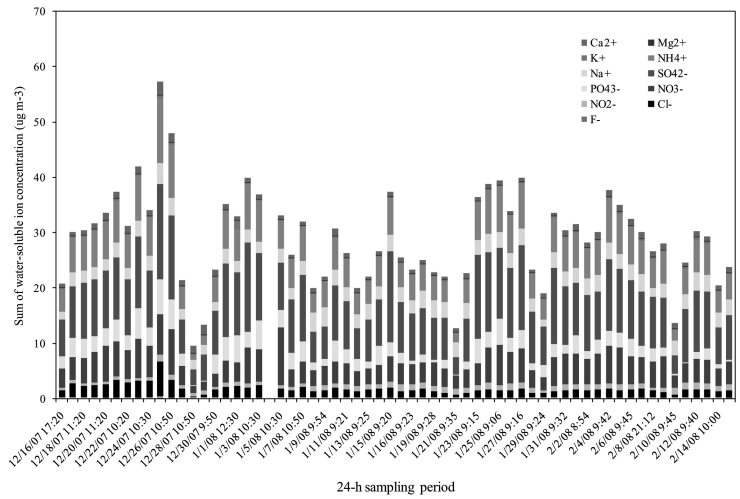

Fig. 1. Temporal variation of water-soluble ionic components of $PM_{2.5}$ particles in Ulaanbaatar, Mongolia during the sampling period.

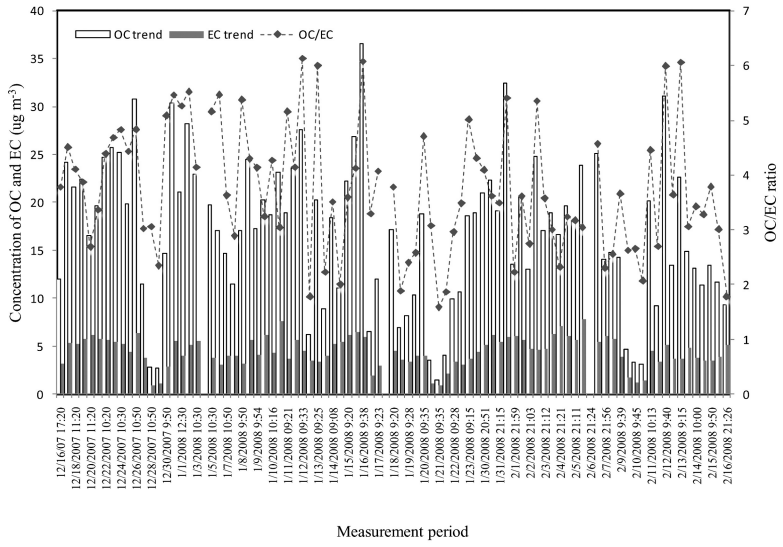

Fig. 2. Temporal variation of OC, EC and OC/EC measurement by TOT method in Ulaanbaatar for the entire sampling period.

The temporal variation of OC, EC and OC/EC measurement by TOT method in Ulaanbaatar for the entire sampling period was shown in Fig. 2. Daily average concentrations in Ulaanbaatar during the entire sampling period varied between 1.48 and 36.57μg m^{-3} for OC, with a mean of 16.9±67.64μg m^{-3}, and between 0.92 and 7.82μg m^{-3} for EC, with a mean of 4.46±1.53μg m^{-3}. The average OC/EC ratio varied between 1.59 and 6.14 with a mean of 3.74±1.16.

The air pollution level was classified into three categories based on the daily average fine particulate mass concentration: Best20%(daily average values for the 20% least polluted days),

Worst20%(daily average values for the 20% most polluted days) and Avg(daily average values during the entire sampling periods)(Kim et al., 2006). $PM_{2.5}$ mass concentration during the Worst20% condition was 3.3 times higher than that during Best20% condition, which is mainly due to increase of OC, SO_4^{2-}, and NH_4^+. Chemical characteristics of $PM_{2.5}$ particles during haze period will be discussed.

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