PA7) Chemical Characteristics of $PM_{2.5}$ in Ulaanbaatar, Mongolia in the Winter of 2008

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1. Introduction

Mongolia is experiencing rapid rates of urbanization similar to other Asian countries. Ulaanbaatar is experiencing 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. There is rare research about air pollution in Ulaanbaatar Mongolia. The objective of this study then was to investigate the major chemical species in fine particles($PM_{2.5}$) in Ulaanbaatar, Mongolia in the winter season.

2. Method

Samplers were installed at the rooftop of the National Agency for Meteorology, Hydrology and Environmental Monitoring(NAMHEM) of Mongolia 10m above the ground. The sampling was done 12-hour interval from January 7 to February 16, 2008. 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 metal as well as prebaked quartz-fiber filter for carbon analysis. Water soluble ions and carbonaceous particles were analyzed by ion chromatography and sunset OC/EC analyzer, respectively. Heavy metals(Cr, As, Cd, Mn, Zn and Pb etc.,) were also analyzed bys the ICP-MS (Elan6100/Perkin Elmer, USA).

3. Result and discussion

Although there is no Mongolian standard for $PM_{2.5}$, the proposed USEPA 24-h average standard of 35μg m^{-3} was exceeded almost three times, 98.15±51.34μg m^{-3}, during the sampling period especially night time due to coal and wood burning for heating and cooking. Weekly variation of $PM_{2.5}$ concentration was shown Fig. 1. $PM_{2.5}$ mass concentration was lower than 80μg m^{-3} during the weekend and increased at the beginning of weekday and reached peak value of 130.26μg m^{-3} on Friday. This weekly pattern was highly influenced by traffic density(Country Synthesis Report, 2006). Fig. 2 shows frequency distribution of $PM_{2.5}$ during the entire measurement period. The highest frequency was observed, around 110±150μg m^{-3} in Ulaanbaatar, Mongolia during the sampling period. The pollution level was classified into three categories based on the average $PM_{2.5}$ concentrations: Best20%-$PM_{2.5}$ concentration<54.04μg m^{-3}, Worst20%-$PM_{2.5}$ concentration>136.55μg m^{-3} and Avg. - ranged within above limitations. Concentration of $PM_{2.5}$ during the worst20% period increased 152% than that during Best20%.

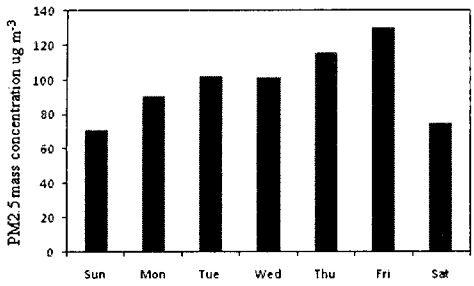

Fig. 1. Weekly variation of $PM_{2.5}$ mass concentrations in Ulaanbaatar, Mongolia.

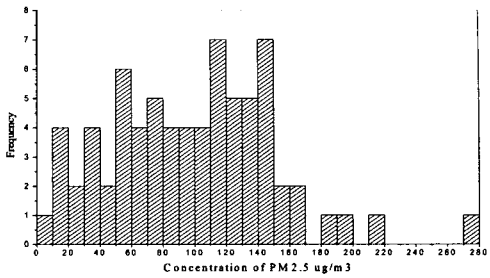

Fig. 2. Frequency distribution of $PM_{2.5}$ during the entire measurement period.

The major components of $PM_{2.5}$ such as sulfate(SO_4^{2-}), nitrate(NO_3^-), ammonium(NH_4^+), elemental carbon(EC), organic carbon(OC), and heavy metals(Cr, As, Cd, Mn, Zn and Pb etc.,) will be further discussed.

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