Estimation of source apportionment using the UNMIX model of ambient $PM_{2.5}$ in Seoul area, Korea

Yeong-Jin Jeong, Tae-Ho Lee, and InJo Hwang
Department of Environmental Engineering, Daegu University, Gyeongsan, Gyeongbuk, 712-714, Korea

Keywords: air quality, $PM_{2.5}$, source apportionment, UNMIX, Seoul
Presenting author email: ihwang@daegu.ac.kr

Many countries recently have developed and carried out policies to control air pollutants, focusing their effort on establishing new environmental guidelines as well as in evaluating the pollution sources more accurately. Therefore, one of these efforts was to survey the physicochemical properties of atmospheric particulate matter (PM) and thereby, quantitatively understand to what extent the specific pollution sources affect the adjacent regional atmosphere (Yi and Hwang, 2013). The Seoul (capital of Korea) has severe air pollution problems, and a variety of governmental policies, such as expansion of the use of liquefied natural gas and low-sulfur fuels and movement of industrial sources out of the city, have been implemented to improve urban air quality. The objective of this study was to estimate the $PM_{2.5}$ composition at the sampling sites by surveying concentration trends after analyzing the mass concentration of $PM_{2.5}$ samples and the elements, ions, and carbon in $PM_{2.5}$. UNMIX was applied to identify the existing sources and apportionment of the PM mass to each source. These results suggest the possible role for maintain and manage ambient air quality of Seoul, and achieve reasonable air pollution strategies.

The ambient $PM_{2.5}$ samples were collected at 9 sampling sites (Hwagok, Guro, Banghak, Hyoje, Dongdaemun, Sinsa, Guui, Yongin, and Ui) in Seoul area. $PM_{2.5}$ samples were collected using Partisol 2300 (Thermo, USA) from September 2008 to March 2010. The samples were collected on Teflon, nylon, and quartz filters every 6 days. These filters were used for analysis of elemental, ionic species, and EC/OC by ICP, IC, and TOT method. The UNMIX model was used to develop source profiles and to estimate their mass contributions.

The five sources were identified as soil, secondary aerosol, vehicle/road dust, Ca related, and industry/oil/biomass burning. The average contributions of all the sources identified during the sampling periods were showed in Figure 1. The result of the UNMIX modeling showed that the source were apportioned by industry/oil/biomass burning 11.5 % (2.97 $\mu g/m^3$), Ca related 2.2 % (0.57 $\mu g/m^3$), vehicle/road dust 37.3 % (9.62 $\mu g/m^3$), secondary aerosol 39.5 % (10.20 $\mu g/m^3$), and soil 9.5 % (2.46 $\mu g/m^3$), respectively. Figure 2 shows comparison of source contributions between UNMIX and PMF model in the Hyoje sampling site. In the case of industry/oil/biomass burning and secondary aerosol source contributions of the PMF result showed slightly higher than the UNMIX result. On the other hand, in the case of vehicle/road dust and soil source contributions of the UNMIX result showed slightly higher than the PMF result.

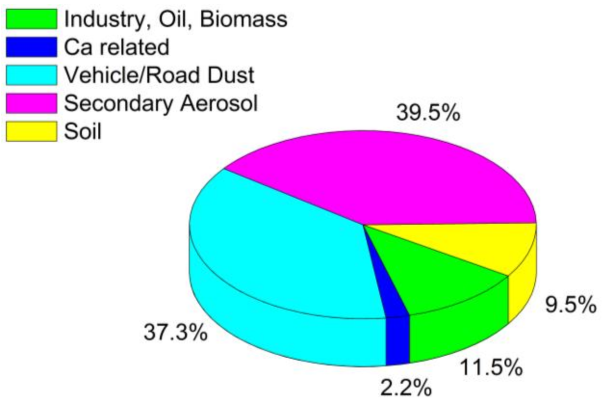

Figure 1. Average source contributions for the sampling periods at the Hyoje sampling site.

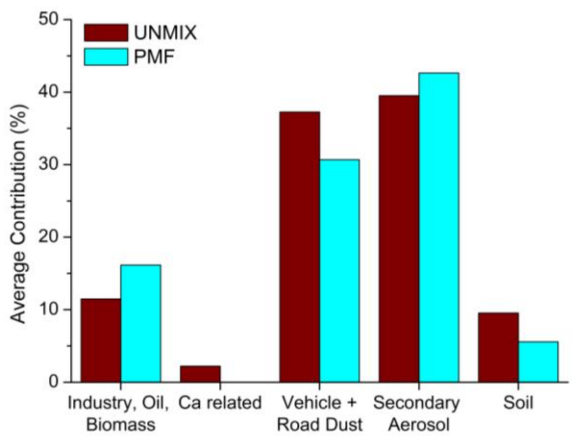

Figure 1. Comparison of source contributions between UNMIX and PMF in Hyoje sampling site.

This work was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science and Technology (grant No: 2012-0007782), and supported by National Institute of Environmental Research (NIER) under contract No. 2012-294.

Yi, S.M. and Hwang, I. (2013) Aerosol and Air Quality Research. (submitted).