The correction for positive sampling artifacts in ambient organic carbon measurements

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Ambient POC (particle-phase organic carbon) is known not only as the first or second largest contributor to the total ambient $PM_{2.5}$ mass, but also as causes of visibility reduction and climate changes (Na *et al*., 2004; Kim *et al*., 2000). Therefore, improvement of the measurement methods for ambient POC has been one of the key research subjects because there have been challenges in selectively collecting POC from the mixture of gas-phase OC (GOC) and POC (Olson and Norris, 2005). To understand the compositional characteristics of ambient $PM_{2.5}$ and establish reduction strategies of ambient $PM_{2.5}$ mass, it is of very importance to accurately collect and quantify POC. Quartz filters are the most widely used media to collect POC and elemental carbon (EC). However, quartz filters are easy to adsorb GOC because of their large surface area. The POC concentration without removing the GOC from $PM_{2.5}$ sample results in overestimation of the POC. The objective of this study is to estimate the OC and EC concentrations in ambient $PM_{2.5}$ samples. Also, this study is investigated corrections to OC concentration for positive sampling artifacts in ambient $PM_{2.5}$ samples. To estimate the POC and GOC, $PM_{2.5}$ sampler with two channels was used.

The ambient total $PM_{2.5}$ samples along with OC/EC were collected from January 2014 to December 2014 at the Daegu University, Gyeonsan-si, in Korea. The $PM_{2.5}$ samples were collected on Teflon, nylon, and quartz filters every three days year round. The OC and EC were collected by a $PM_{2.5}$ sampler with two channels, that is, channel 1 is quartz filter behind Teflon filter (QBT) and channel 2 is quartz filter behind quartz filter (QBQ). A thermal/ optical carbon analyzer (Sunset Laboratory, Forest Grove, OR, USA) was used to quantify OC and EC running on NIOSH (National Institute of Occupational Safety and Health) 5040 Method and modified NIOSH method. The modified NIOSH method with extended analysis time was employed to fully volatilize OC collected on the filter before the end of the He region. The residence times for the NIOSH 5040 are 60 s at 250 ºC, 500 ºC, and 650 ºC, and 90 s at 850 ºC in the He atmosphere followed by 30 s at 650 ºC and 750 ºC, 60 s at 850 ºC, and 120 s at 900 ºC in the O_2/He atmosphere.

The trends of $PM_{2.5}$ concentrations during the sampling period are presented in Figure 1 (red line denotes $PM_{2.5}$ standard for 24h in Korea). The seasonal average mass concentrations show a peak in winter (winter 38.5 $\mu g/m^3$ > spring 37.0 $\mu g/m^3$ > fall 24.1 $\mu g/m^3$ > summer 21.7 $\mu g/m^3$). Table 1 compares POC and GOC obtained from two different sampling configurations. The POC concentration obtained from the QBQ is higher than that found on the QBT. The POC concentration of the QBQ is estimated to be approximately 13% higher than that of the QBT. More detailed information on $PM_{2.5}$ and OC/EC seasonal characteristics involving positive artifacts will be addressed during the presentation.

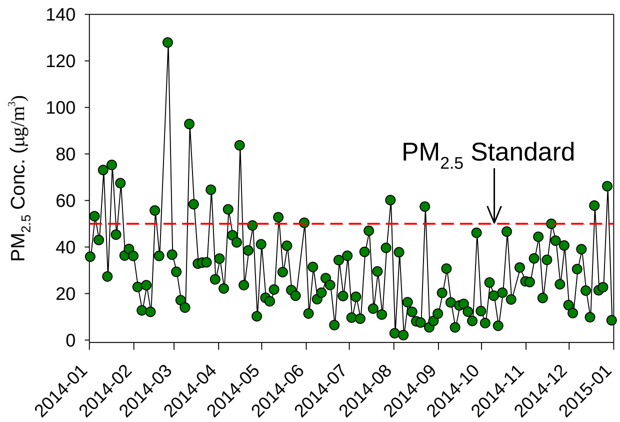

Figure 1. The trends of $PM_{2.5}$ concentration during the sampling period.

Table 2. POC and GOC measured from four sampling configurations ($\mu gC\ cm^{-2}$).

Configuration	QBT	QBQ
Front filter	5.43±1.65	5.43±1.65
Backup filter	1.20±0.32	0.64±0.19
POC estimated	4.23±1.38	4.79±1.47

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