PA2) Seasonal Comparison of Characteristics of Particulate Matter Collected from the Non-ferrous Metal Industrial Complex of Ulsan, Korea

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1. Introduction

In the last decades, particulate matter(PM) pollution has become a serious problem in many countries(Almeida et al., 2005; Fang et al., 2002; Sharma and Maloo, 2005). The levels of PM pollution and the number of deaths from cancer, cardiovascular and respiratory diseases has a significant relationship(Burnett, 1995; Roemer, 1993; Schwartz and Morris, 1995). In particular, the health effects of fine particle such as $PM_{2.5}$ which has higher deposition rates into the lung are more serious than those of coarse particles.

Ulsan, the largest industrial city in Korea, has the large industrial complexes(ICs) including non-ferrous metal IC, petrochemical IC and mechanical/ shipbuilding IC. The industrial emissions of air pollutants in the metropolitan city of Ulsan almost go up to 60% of the total air emissions(Lee et al., 2006). This work presents comparison of characteristics of $PM_{2.5}$ obtained from the non-ferrous metal IC in Ulsan, Korea in four different seasons.

2. Methods

$PM_{2.5}$ samples were taken in the central part of non-ferrous metal IC in Ulsan. The daily $PM_{2.5}$ samplings were carried out in August in 2006 for summer sampling, December in 2006 for winter sampling, May in 2007 for spring sampling, and November in 2007 for fall sampling. Four to eight samples were collected from each site for each day. The PQ200 air sampler operated at a constant flow rate of 16.7L min^{-1} was used for $PM_{2.5}$ sampling. The $PM_{2.5}$ samples were collected on glass fibre filters with a diameter of 47mm(Schleicher and Schuell, Germany) and a pore size of 2㎛. Before measuring weight of filters before and after sampling, they were stored in a desciccator located in the conditioned room with a relative humidity of 40±3% and temperature of 21±2℃ for 48 hrs. The $PM_{2.5}$ concentrations were analyzed by a gravimetric analysis using an electronic microbalance which has 0.01mg of sensitivity. The meteorological data such as temperature, humidity, wind speed and wind direction were taken from Ulsan Meteorological Station. The wind roses in the sampling period were obtained using a Korean software for atmosphere dispersion modelling(AirMaster, version 2.0).

3. Results and discussion

Fig. 1 shows the daily $PM_{2.5}$ concentrations during summer, winter, spring and fall sampling periods in the non-ferrous metal IC. The results show that the $PM_{2.5}$ concentrations of the fall sampling periods were the highest, followed by the summer and the spring sampling periods. These indicate that the high humidity in the summer and fall seasons could greatly affect to the increase of $PM_{2.5}$ concentrations in the non-ferrous metal IC. When considering the wind directions(Fig. 2) the prevailing winds in summer time and spring time included the directions where significant sources of $PM_{2.5}$ including smelting and treatment of non-ferrous metals are located. In particular, the winds in the summer time may bring particles from activities concerning with the emissions

loading and unloading from ships in the wharf area. The lowest concentrations of $PM_{2.5}$ were identified in the winter sampling periods. This is probably due to the lower humidity in the winter time. In addition, the winds in the winter sampling periods mostly came from the north which may not pass through significant $PM_{2.5}$ source areas, resulting in the lower $PM_{2.5}$ concentrations.

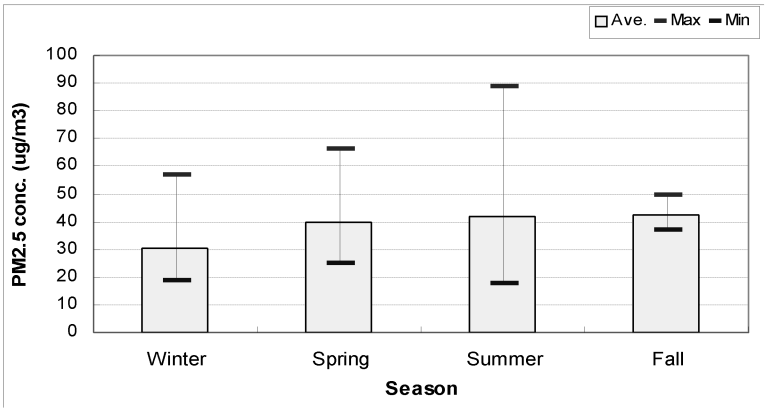

Fig. 1. Seasonal comparison of $PM_{2.5}$ concentrations in the non-ferrous metal IC.

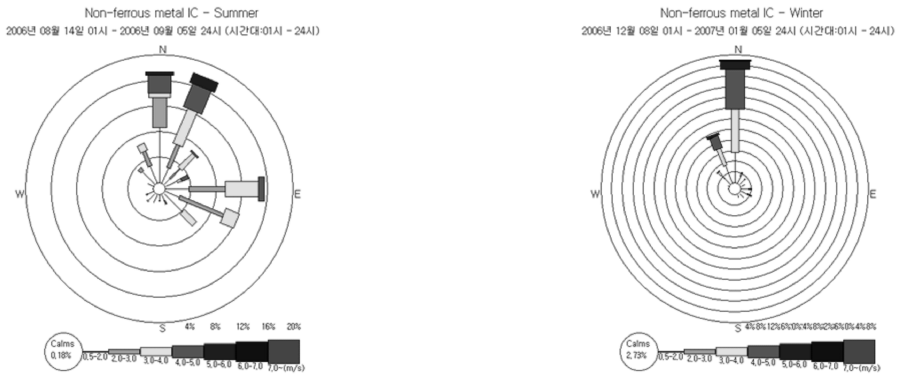

Fig. 2. Wind roses at the non-ferrous metal IC site for summer and winter.

References

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