CHARACTERISTICS OF AIRBORNE PARTICULATE AEROSOLS IN IKSAN, KOREA

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In order to investigate the characteristics of airborne particulate aerosols and to better understand the influence of long-range air pollution transport from the Asian continent to the southwest part of the Korean peninsula, intensive measurements of $PM_{2.5}$ and PM_{10} aerosol samples were conducted in Iksan (35° 57′ 58″ N, 126° 57′ 20″ E), which is a small city located 200 km south of Seoul as well as southwestern part of Korean peninsula, closed to China continent than other regions. $PM_{2.5}$ and PM_{10} samples were collected on 47mm Zefluor membrane filters (0.2μm pore size) using by 3-stage filter pack and URG $PM_{2.5}/PM_{10}$ cyclone sampler, from October 17 to November 1, 2004. The flow rate was 16.7 L min^{-1} and PM aerosols samples were collected twice a day during daytime (09:00-18:00) and nighttime (18:00-09:00). Sampled filters were weighed before and after sampling using an electronic balance (Satorius CP225D, detection limit 10 μg) and the net weight were determined to measure $PM_{2.5}$ and PM_{10} mass loading by considering cumulative flow meter. Filters were extracted with 10~20 mL deionized water in an ultrasonic bath for 20 min. The aqueous extract was analyzed for major water-soluble inorganic ions using ion chromatography (DX-100, Dionex). The analytical uncertainties were checked by calculating relative standard deviation (RSD) obtained from replicated sample injections. The RSDs for anions were 2.45%, 3.13%, and 1.29% for SO_4^{2-}, NO_3^-, and Cl^-, respectively. The RSDs for cations were 1.31%, 3.48%, 7.44%, 4.65%, and 4.98% for Na^+, NH_4^+, K^+, Mg^{2+}, and Ca^{2+}, respectively. The average concentrations of PM mass concentration and its chemical species in fine mode (< 2.5 μm) and coarse mode (2.5~10 μm) are presented in Table 1. The average mass concentration of fine PM and coarse PM were 51.35 ± 29.70 and 28.14 ± 11.81 μg/m^3, respectively. The average $PM_{2.5}/PM_{10}$ mass ration was 0.62 ± 0.10, indicating that fine particles contributed a large portion to PM_{10}. For the average $PM_{2.5}/PM_{10}$ of individual chemical species, sulfate, ammonium, and potassium ions had higher concentrations in fine mode than in coarse mode, while sodium, magnesium, and calcium ions were likely to exist in coarse particle mode. Nitrate and chloride ions had an intermediate level with an average of 0.65 and 0.60. The results suggest that the nature of possible emission sources of these chemical species. Fine particle mode species may be emitted from combustion of fossil fuels or transformed through atmospheric chemical reactions between gaseous precursors and free radicals and sunlight. The ammonium was found to be exist as $(NH_4)_2SO_4$ in fine particles, with a molar ration of NH_4^+ to SO_4^{2-} of 4.71 and 4.74 for fine mode particles and coarse mode particles. Although potassium concentrations showed the lowest among all the ionic species analyzed in this study, except for Mg^{2+}, this could be emitted from two sources: anthropogenic and natural. The natural source of potassium could be soil dust particles, while anthropogenic sources were considered to be biomass burning and vegetation. Taking into account the regional and seasonal characteristics of sampling site in this study, fine particulate potassium is assumed to originate from biomass burning. Sodium, magnesium, and calcium ions were distributed in coarse particle mode since these are major components of sea salt and soil particles.

Table 1. Fine ($PM_{2.5}$) and coarse ($PM_{2.5-10}$) particulate matter concentrations (± standard deviation) and mass ratio of $PM_{2.5}/PM_{10}$.

	Fine	Coarse	$PM_{2.5}/PM_{10}$		
	μg/m^3	μg/m^3	Average	Max	Min
Mass	51.35 ± 29.70	28.14 ± 11.81	0.62 ± 0.10	0.79	0.36
Cl^-	1.26 ± 1.21	0.66 ± 0.46	0.60 ± 0.17	0.87	0.26
NO_3^-	7.33 ± 7.90	3.14 ± 3.01	0.65 ± 0.11	0.88	0.44
SO_4^{2-}	4.73 ± 2.61	1.43 ± 0.98	0.78 ± 0.06	0.91	0.69
Na^+	0.24 ± 0.07	0.34 ± 0.21	0.46 ± 0.16	0.93	0.22
NH_4^+	4.62 ± 4.06	1.26 ± 1.42	0.81 ± 0.09	0.99	0.62
K^+	0.61 ± 0.32	0.23 ± 0.19	0.73 ± 0.08	0.89	0.53
Mg^{2+}	0.02 ± 0.03	0.08 ± 0.04	0.20 ± 0.09	0.43	0.07
Ca^{2+}	0.10 ± 0.06	0.47 ± 0.21	0.17 ± 0.05	0.28	0.09