

Characterization of Aerosols Collected During KORUS-AQ Sampling Period in Olympic park, Seoul, Korea using Low-Z Particle EPMA and ATR-FTIR Techniques

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In this work, low-Z particle EPMA (electron probe X-ray microanalysis) and ATR-FTIR (attenuated total reflectance Fourier transform infrared) spectroscopy were applied to characterize aerosol samples collected during KORUS-AQ (Korea-US Air Quality) sampling period (5/23 ~ 6/5, 2016) at Olympic park, Seoul, Korea. PM_{2.5-10} and PM_{1-2.5} samples were characterized individually based on secondary electron image and chemical composition using low-Z particle EPMA. PM₁₋₂, PM_{0.5-1}, and PM_{0.25-0.5} bulk samples were investigated by ATR-FTIR technique and a homemade curve fitting tool. As a result of low-Z particle EPMA analysis, individual aerosol particles were mainly composed of primary and secondary soil-derived particles (such as aluminosilicate, CaCO₃, SiO₂, TiO₂, and/or reacted types), marine-derived particles (mostly reacted sea salts), organics (organic carbon, (NH₄)₂SO₄/NH₄HSO₄-containing, K-containing, biogenic), heavy metal-containing particles, Fe-rich, and particles from combustion such as soot, tar ball, and fly ash. Proportion of organic particles in PM_{1-2.5} fraction significantly increased from 5/25 until 5/28, which might be due to a haze episode (5/25 ~ 5/31, high PM concentration). Also, noticeable amounts of heavy metal-containing particles such as Pb, Cu, Zn, Mn, Cr, V, Sn, Zr, La, As, Sb, Ni, Cd, and Co were observed in both PM_{1-2.5} and PM_{2.5-10} fractions (around 3.4%; overall 278 out of 8027 particles). The results of ATR-FTIR show that PM₁₋₂, PM_{0.5-1}, and PM_{0.25-0.5} samples were mainly composed of NH₄⁺, SO₄²⁻, NO₃⁻, and organics. During the haze event, average ratio of NO₃⁻/SO₄²⁻ was about 17.5, 12.7, and 1.7 times higher than non-haze days in PM₁₋₂, PM_{0.5-1}, and PM_{0.25-0.5} fractions, respectively. Decrease of NO₃⁻/SO₄²⁻ ratio was significant from AM to PM in most samples and relatively higher in submicron fractions.