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Chemical Composition of Remote Coastal Atmospheric Aerosol in Southern Taiwan

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Extended Abstract

This study is focused on the chemical composition of atmospheric particulate matter (PM) in spring 2015 in the coastal region of Hengchun Peninsula to understand the aerosol chemistry in the remote region of the southernmost tip of Taiwan, which is far away from any specific pollution sources. The aerosol chemical characteristics include the composition of inorganic salts, carbohydrates, sugar alcohols, anhydrosugars, and organic acids.

The average mass concentration of PM in Hengchun coastal area is 25.59±12.27 μg/m^3. The concentration of species in PM is in the following order: SO_4^{2-} > Cl^- > Na^+ > NO_3^- > NH_4^+; the corresponding concentrations of these five species are 3.46 ± 2.18 μg/m^3, 2.15 ± 0.98 μg/m^3, 2.14 ± 1.37 μg/m^3, 1.50 ± 0.77 μg/m^3 and 1.27 ± 1.15 μg/m^3 respectively. The main distributions of the species are the primary coarse mode and the photochemical submicron-droplet mode. This indicates sea spray and photochemical products significantly contribute to remote coastal aerosol.

Generally, K^+ and levoglucosan are regarded as molecular indicators of biomass burning aerosol [1,2], however the particle size peaks of K^+ concentration are mainly at 6.2 μm, 1.8 μm, and 0.54 μm, whereas although levoglucosan showed up in the particle size peaks of submicron droplet mode, its concentration peaks differed from those of K^+. This indicated that despite the slightly presence of long-range transport of biomass burning aerosols in the coast atmosphere environment during the period of study, there is no prominent burning in close range. Moreover, coarse mode K^+ also indicated that K^+ in the coastal region came from sea spray and crustal matters.

Among the organic acids of remote coastal aerosol, oxalate appeared the highest concentration. Oxalate is the final product of dicarboxylates [3]; it constitutes 35.4 ± 26.7% of the total carboxylates, followed by acetate, the most important monoacid, which accounts for 28.9 ± 21.9% of the total carboxylates. Non-sea salt sulfate (nss-SO_4^{2-}) accounted for 11.58 ± 7.62% of the PM mass concentration. The correlation coefficient, *r*, between oxalate and nss-SO_4^{2-} was as high as 0.919 and the peak concentration of both was generated in the submicron droplet size mode at 0.54 μm. However, in the 0.32~1.0 μm particle size range, the average oxalate/nss-SO_4^{2-} ratio is as high as 15.7%, far exceeding the average 5.88% of suburban southern Taiwan. This indicated that the photo-generation potential of carboxylates in the submicron droplet size mode was higher than that of inorganic sulfate.

An overview of the aerosol chemistry composition showed that the main contributing sources of the remote atmospheric particulates in Hengchun area were sea spray and photochemical products, as well as long-range transport of biomass burning.

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