The Role of Photochemistry in Secondary Aerosol Formation and Evolution during High Particulate Matter Episodes at a Suburban Site in Hong Kong

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Chemical transformation of secondary aerosols was investigated for high particulate matter (PM) episodes in Hong Kong. Five out of ten episodes across different seasons were characterized by medium-range transport with high solar irradiation, implying the importance of episode type. We used one particular episode of this type to examine in detail the evolution of aerosols. Photochemical aging led to mode size shifting for sulfate and organics, as well as increases in sulfur oxidation ratio and carbon oxidation state. Production of secondary inorganic speices sulfate and secondary organic aerosols (SOA) was very efficient in the course of six hours. Initially, "fresh" SOA—semi-volatile oxygenated organic aerosols (SVOOA)—was formed at a rate faster than that of "aged" SOA—low-volatility oxygenated organic aerosols (LVOOA). A transformation from SVOOA to LVOOA at the later stage of photochemical aging was clearly observed, resulting in a 20-fold increase of LVOOA. This conversion was further supported by mass spectral evolution, which showed an increase of the most oxidized ion (CO_2^+) and decreases of moderately oxidized ones ($C_2H_3O^+$, $C_3H_3O^+$ and $C_3H_5O^+$). The observed fast-changing features of secondary aerosols observed suggest that the dynamic nature of aerosol formation and transformation should be included in chemical transport models.

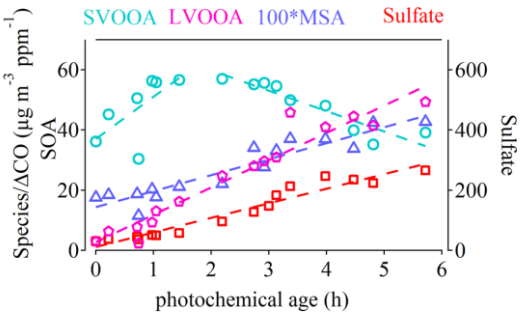

Figure 1. Photochemical production of secondary species

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