



Characteristics and formation mechanisms of fine particulate nitrate in typical urban areas in China: Insights from aerosol mass spectrometry

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Nitrate is an important component of atmospheric fine aerosols, thus elucidation of its temporal variations and formation pathways is essential. This study analyzed the aerosol nitrate data collected by using the Aerodyne aerosol mass spectrometers (AMS) in a few Chinese cities, including Beijing, Nanjing and Lanzhou, during summer and winter, respectively. Results showed that nitrate could occupy a significant mass fraction of submicron aerosol (PM₁) mass (10-24%), and the mass fractions increased with the increase of total PM₁ mass, indicating that secondary formation of nitrate was enhanced and became more important during heavy PM pollution events. Since Aerodyne AMS is able to provide highly time-resolved measurement data, the diurnal cycles of nitrate were obtained, and results showed that the patterns were similar during summer and winter in Nanjing, and the temperature, a.k.a, thermodynamic equilibrium and gas/particle partitioning, appeared to be a dominant factor influencing the nitrate concentration in Nanjing. However, nitrate during winter in Beijing showed an opposite trend. While in Lanzhou, boundary layer height variations could affect the nitrate significantly. We also further discussed the formation mechanisms of nitrate, by considering the thermodynamic equilibrium of ammonium-sulfate-nitrate system. This study is valuable to improve understanding of the fine particulate nitrate and its role in air pollution and haze formation.