Field observation of oxalic acid and related SOA in Xi'an, China

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Motivation and Method

Dicarboxylic acids and related organic compounds are important atmospheric secondary organic aerosols (SOA) because of their abudance and ubiquity. However, their formation mechanism remains unclear. In the spring, summer and winter of 2009 size-segregated (9-stages) aerosols were collected in the urban center of Xi'an, inland China and analyzed for dicarboxylic acids (C_2–C_{11}), ketocarboxylic acids (C_2–C_7), α-dicarbonyls and inorganic ions. Moreover, compound-specific stable carbon isotopic composition of the diacids and related organics were determined.

Results and Discussion

Total diacids on the 9 stages were 932–2240, 1067–1544 and 1185–3286 ng m^{-3} in the spring, summer and winter, repsectively, with oxalic acid being the dominant species. Keto-carboxylic acids and dicarbonyls are 1–2 orders of magnitude lower, especially in winter. Strong linear correlations between oxalic acid and sulfate were observed in the sumer and winter, suggesting both share a common formation pathwy, for instance, aqeuous-phase oxidation [1]. However, in the spring dust storm periods oxalic acid well correlated with nitrate rather than sulfate. Most of the above organic, sulfate, and nitrate were enriched in the fine mode (<2.1μm) during the summer and winter, but largly stayed in the coarse mode (>2.1μm) during the spring dust storm periods. Isotopic compsitions of the above organics on the 9-stages suggest that oxalic acid is formed via partitioning of water-soluble prescursors, mainly glyoxal and methylglyoxa, into the aerosol aqueous-phase and subsequent oxidation [2]. During the dust storm events the aqeuous-phase of the dust surface was largely formed via water vapor absorption by $Ca(NO_3)_2$ that is produced by heterogeneoue reactions of gaseous HNO_3 and/or NOy with dust[3].

[1] Cheng *et al*. (2015) *Atmos. Res*. (in press). [2] Wang *et al*. (2012) *Environ. Sci. Technol*. 46, 4873-4891.[3] Wang *et al*. (2013) *Atmos. Chem. Phys*. 13, 819-8