Field observation of hydroxy diacids in PM2.5 and insights into their formation from aliphatic diacids through heterogeneous oxidation

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Aliphatic dicarboxylic acids (DCA) are significant constituents of oxygenated organic aerosol. Laboratory studies indicated that the major heterogeneous oxidation product of aerosol-phase aliphatic DCAs was the corresponding hydroxy DCAs (hDCAs). In this work, we focused our field investigation on hydroxy DCAs and report their ambient abundance in an urban environment, and their correlations with other measured aerosol species. Good correlations (R~0.5-0.9) were observed between DCAs and hDCAs, supporting the precursor-product relationships between the two as suggested by laboratory studies. Moderate to good correlations were also observed for DCAs/hDCAs with oxidant potential (Oₓ=O₃+NO₂) (R~0.5-0.9) and sulfate (R~0.2-0.8) in summer. Oₓ might act as a gas phase oxidant indicator, hinting that gas phase oxidation might play a role in formation of hDCAs. The effect of estimated LWC and sulfate was examined and illustrated through the contour plots. It was found that the episodic formation of DCAs and hDCAs was more associated with high concentration of sulfate, suggesting commonality in their formation pathways. However, high hDCA was not always associated with high estimated LWC. Long range transport contribution might explain such an observation. More efforts are needed to understand the formation conditions and mechanisms for hydroxyl dicarboxylic acids.