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## Seasonal Changes in Molecular Distributions of Diacids, Oxoacids and $\alpha$ -Dicarbonyls in PM<sub>2.5</sub> in Tianjin, North China: Implications for Origins and Secondary Formation Pathways in Cold and Warm Periods

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Organic aerosols (OA) that make up a large fraction (up to 90%) of the fine aerosol (PM<sub>2.5</sub>) mass have severe impact on the Earth's climate system and can cause adverse risk to human health. Diacids and related compounds are ubiquitous in PM<sub>2.5</sub> in different environments and accounts for a substantial fraction in OA. Because of their high water-solubility, they can influence the hygroscopic properties and capacity of cloud condensation nuclei formation activity of aerosols and thus affect the indirect radiative forcing in the atmosphere. However, their origins, secondary formation and transformations and seasonality are not fully understood yet. To better understand the seasonal characteristics, origins and photochemical processing of OA in the Tianjin region, North China, we studied the molecular distributions and seasonal variations of water-soluble diacids, oxoacids and  $\alpha$ -dicarbonyls in PM<sub>2.5</sub> collected at an urban and a suburban sites in Tianjin, an ideal location to study the aerosols, over a one-year period from July 2018 to June 2019. We found significant changes in concentrations and composition of diacids and related compounds from season to season at both the sites. Here, based on the results obtained together with the meteorology, oxidants (O<sub>3</sub> and NO<sub>2</sub>) and SO<sub>2</sub>, loading and the backward air mass trajectories, we discuss the possible origins and possible secondary formation pathways of diacids and related compounds in the Tianjin region.