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Molecular Distributions and Stable Carbon Isotopic Composition of Diacids, Oxoacids, and *α*-dicarbonyls in $PM_{2.5}$ from Underground Coal Fire Field in Inner Mongolia, North China: Implications for Anthropogenic Origin of Azelaic Acid

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To understand the characteristics of chemical components and diacids, oxoacids and *α*-dicarbonyls in atmospheric aerosols at underground coal fire environment, we collected fine aerosols ($PM_{2.5}$) from Wuhai, Inner Mongolia, North China, where the underground coal fire occurs severely. $PM_{2.5}$ samples were analyzed for the measurements of carbonaceous components, stable carbon isotopic composition ($\delta^{13}C$) of total carbon (TC), and molecular distribution and compound-specific $\delta^{13}C$ of diacids, oxoacids and *α*-dicarbonyls. Oxalic acid (C_2) was the most abundant diacid species, accounting for 44-63% (avg. 51%) of total diacids, followed by phthalic acid (Ph) (14%). Azelaic acid (C_9) was the third most (7%) abundant diacid, followed by succinic (C_4) and malonic (C_3) acids. The correlations between C_2 and ωC_2, ωC_3 and C_3 were significant, but not with SO_4^{2-}, which indicate that C_2 was mainly derived by *in-situ* secondary formation and/or primary emission from the underground coal combustion at local scale and less aged. C_9 diacid showed a significant correlation with C_2, C_3, ωC_2 and ωC_3 as well as with Ph acid and C_3/C_4 mass ratios. Such correlations demonstrate that C_9 diacid should have been mainly derived from *in-situ* secondary formation from its precursors emitted from underground coal fires. In addition, $\delta^{13}C$ of C_9 (−27.0 ± 0.9‰) was comparable with that of Ph acid and similar to the $\delta^{13}C$ of organic matter in coals, which support its origin of underground coal fire. However, further research is needed to confirm the relative importance of coal combustion for C_9 diacid loading in atmospheric aerosols.