Seasonal variations of molecular distribution and carbon isotopic compositions (^{13}C and ^{14}C) of *n*-fatty acids in aerosols of Qingdao, China

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Aerosol deposition is an important pathway for the delivery of terrestrial organic carbon (OC) to marginal seas, thus, understanding the sources and radiocarbon ages of coastal aerosols is essential to evaluate the contributions of atmospheric deposition to marginal sea OC burial. However, few studies have quantified the seasonal variations in both ^{13}C and ^{14}C isotopic compositions of aerosol OC on molecular level. In this study, we first investigated the seasonal variations of the distribution and carbon isotopic compositions (^{13}C and ^{14}C) of *n*-fatty acids (*n*-FAs) in aerosols from Qingdao, China, which lies at the boundary of the East Asian continent and the Yellow Sea. On a carbon-normalized basis, *n*-FAs content was lower in winter owing to smaller contributions from both terrestrial and marine biomass. The $\delta^{13}C$ and $\Delta^{14}C$ values of the short-chain FAs (SC-FAs, C_{16}, C_{18}) were both higher than those of the middle and long-chain FAs (MLC-FAs, C_{20}-C_{30}). The ^{14}C ages of the SC-FAs (16-1888 yr) were generally younger than those of the MLC-FAs (1310-6806 yr), suggesting that more contributions of pre-aged OC to the MLC-FAs in aerosols. The oldest ^{14}C ages of *n*-FAs (597-6806 yr) were all found in winter, suggesting more contributions from pre-aged OC which resided in reservoirs (e.g., soils) for thousand years, especially for the MLC-FAs. This seasonal age pattern was also supported by back trajectory analysis which revealed that 85% of the winter air masses originated from northern East Asian continent that contained pre-aged soil OC. Overall, our study provided a dataset of aerosol OC components to constrain the OC sources quantitatively and to better understand the delivery of atmosphere OC to marginal seas.