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DISTRIBUTIONS OF LIPID CLASS COMPOUNDS IN ANTARCTIC AEROSOLS COLLECTED AT SYOWA STATION (ABSTRACT)

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Antarctic aerosol samples collected from Syowa Station were studied for the molecular distributions of saturated and unsaturated monocarboxylic acids, α,ω-dicarboxylic acids and oxocarboxylic acids using capillary gas chromatography (GC) and GC/mass spectrometry (GC/MS). Normal saturated monocarboxylic acids were detected in the range of C_8–C_{28} (3.4–8.1 ngm^{-3}). Their distribution showed a maximum at C_{16} with an even carbon number predominance, except for C_9 which was more abundant than C_8 and C_{10}. The lower molecular weight (C_{12}–C_{19}) monocarboxylic acids dominate in the Antarctic aerosols, suggesting that the organic aerosols mainly originate from marine organisms through sea-to-air emissions and subsequent atmospheric transport over Antarctica. However, unsaturated monocarboxylic acids ($C_{16:1}$, $C_{18:1}$; 0.40–0.91 ngm^{-3}), which are much more abundant than the saturated ones in marine algae and sea surface microlayers, were detected at relatively low concentrations. Depletion of unsaturated acids in the aerosols can be explained by selective photochemical degradation of the acids in the atmosphere. This is consistent with the relatively abundant presence of C_9 monoacid, which is a photooxidation product of unsaturated fatty acids such as oleic acid. The depletion of unsaturated fatty acids is also supported by the abundant presence of C_9 α,ω-dicarboxylic acid (azelaic acid), which is a specific counterpart of photooxidation of unsaturated fatty acid containing a double bond predominantly at the C-9 position. Relative abundance of azelaic acid carbon content in total aerosol carbon content (TC) was found to be positively correlated with solar radiation, suggesting that the photochemical transformation of the Antarctic aerosols is intensified in summer. Mid-chain oxocarboxylic acids (4-oxooctanoic and 4-oxononanoic acids; 0.4–1.0 ngm^{-3}) were also detected in the Antarctic aerosols. We propose that mid-chain oxocarboxylic acids are possible intermediates to the production of low molecular weight diacids such as succinic acid (C_4), which have been abundantly detected in the Antarctic aerosols.

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