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CONCENTRATION CHANGES OF DICARBOXYLIC ACIDS AND WATER SOLUBLE ORGANIC CARBON IN THE ARCTIC AEROSOLS AT POLAR SUNRISE (ABSTRACT)

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Arctic aerosol samples were collected at Alert (82.5°N, 62.3°W) in February to June, 1991 using a high volume air sampler and quartz fiber filter, and were studied for total carbon and nitrogen, water soluble organic carbon, and individual dicarboxylic acids, ketoacids and α-dicarbonyls. Filter samples were analyzed with CHN analyzer for total carbon (88–639 ng/m^3) and nitrogen (16–153 ng/m^3) contents. Total carbon comprised 2.4–11% of total aerosols (2.5–9.1 μ/m^3). Samples were extracted with pure water and analyzed for water soluble organic carbon (41–300 ng/m^3). Low molecular weight dicarboxylic acids and related polar compounds were extracted with pure water and then derivatized to dibutyl esters and dibutoxy acetal esters with 14% BF_3/n-butanol. The derivatives were determined using a capillary gas chromatography (GC) and GC-mass spectrometer. A homologous series of dicarboxylic acids (C_2–C_{11}) were detected in the arctic aerosol samples with concentration range of 7.4–85 ng/m^3. In all of the samples, oxalic acid (C_2) was the dominant species, followed by malonic (C_3) or succinic (C_4) acid. ω-Oxocarboxylic acids (C_2–C_4, C_9), pyruvic acid (C_3) and α-dicarbonyls (C_2, C_3) were also detected in the water soluble fraction of the aerosols.

Total dicarboxylic acids showed a maximum concentration in early April and decreased toward the summer. The peak of the diacids appeared at the polar sunrise, suggesting that they are in situ produced in the arctic atmosphere as a result of photochemical oxidations of anthropogenic unsaturated hydrocarbons, which are abundantly transported to the Arctic from mid-latitude. On the other hand, ω-oxocarboxylic acid such as glyoxylic acid (C_2) peaked one or two weeks earlier than the peak of diacids, suggesting that they are likely intermediates to the formation of dicarboxylic acids (*e.g.*, oxalic acid). Water soluble organic carbon showed an increase from February to April and then a decrease toward June. In contrast, total carbon content showed a decreasing trend from February to June. These results suggest that water soluble organic compounds, including dicarboxylic acids and ketoacids, are abundantly produced in the arctic atmosphere at the polar sunrise.

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