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Low precursor concentration leading to unexpectedly high secondary organic aerosol yields

Tianzeng Chen (1,3), Yongchun Liu (1,2,3), Hong He (1,2,3)

(1) State Key Joint Laboratory of Environment Simulation and Pollution Control, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, Beijing 100085, China, (2) Center for Excellence in Regional Atmospheric Environment, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen 361021, China, (3) University of Chinese Academy of Sciences, Beijing 100049, China

It is generally recognized that current atmospheric quality model underestimates the level of ambient secondary organic aerosol (SOA) [1], but the cause of this underestimation remains elusive [2,3]. This needs to perform more chamber studies to disclose the mechanism. In this work, SOA formation from a wide range of precursor concentration (tens of ppb to hundreds of ppb levels) was investigated in the 30 m^3 indoor smog chamber. The results showed that the SOA yield curves were similar to those obtained previously at high precursor concentrations [4]. However, the SOA yields measured at low precursor concentration was higher than those predicted by the curve obtained at high concentration. With lower precursor concentration, the irradiation time for the inflection points of intermediate products (e.g., 4-oxo-2-pentenal ($C_5H_6O_2$) and 2-methyl-4-oxo-2-pentenal ($C_6H_8O_2$)) was much shorter. In addition, the SOA formed at low precursor concentration showed a higher f_{44} and a lower f_{43} compared to the counterpart experiments, indicating the more-oxidized SOA formed [5,6]. The higher SOA yield measured at lower precursor concentration can be explained by the low-volatile products formed through the further oxidation of semi-volatile intermediates. This work will help for understanding SOA formation and improving the performance of the chemical transport models about SOA simulations.

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