



Supplement of

Chemical characterization of organic compounds involved in iodine-initiated new particle formation from coastal macroalgal emission

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S1. Integrated OH exposure measurement

SO₂ decay experiment was conducted to estimate integrated OH exposure in the experimental apparatus, following Lambe et al. 2015. We replaced the macroalgal emission flow by a humidified air flow containing 200 ppbv SO₂ from standard gas cylinder. SO₂ was consumed by the reaction with OH while flowing through 254 nm UV light and the bag reactor. SO₂ mixing ratio at the outlet of the bag reactor was measured with and without UV lamp on, using a Model 43i-TLE SO₂ analyzer (Thermo Scientific Inc.). OH exposure was calculated from the equation

$$\text{OH}_{\text{exp}} = \ln(\text{SO}_{2 \text{ lamp off}} / \text{SO}_{2 \text{ lamp on}}) / k_{\text{OH}+\text{SO}_2}$$

where $k_{\text{OH}+\text{SO}_2}$ is $9.49 \times 10^{-13} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$ (Burkholder et al. 2015) .

SO_{2 lamp off} and SO_{2 lamp on} were measured to be 18 and 13 ppbv, respectively. OH_{exp} was then calculated to be to be $3.2 \times 10^{11} \text{ molecules cm}^{-3} \text{ s}$. This is equivalent to 2.4 days assuming $1.5 \times 10^6 \text{ molecules cm}^{-3}$ ambient average OH.

Reference

Burkholder, J. B., Sander, S. P., Abbatt, J., Barker, J. R., Huie, R. E., Kolb, C. E., Kurylo, M. J., Orkin, V. L., Wilmouth, D. M. and Wine P. H. "Chemical Kinetics and Photochemical Data for Use in Atmospheric Studies, Evaluation No. 18," JPL Publication 15-10, Jet Propulsion Laboratory, Pasadena, 2015.

Lambe, A. T., Chhabra, P. S., Onasch, T. B., Brune, W. H., Hunter, J. F., Kroll, J. H., Cummings, M. J., Brogan, J. F., Parmar, Y., Worsnop, D. R., Kolb, C. E., and Davidovits, P.: Effect of oxidant concentration, exposure time, and seed particles on secondary organic aerosol chemical composition and yield, *Atmos. Chem. Phys.*, 15, 3063-3075, 10.5194/acp-15-3063-2015, 2015.

S2. The measurement details of GC-MS and FIGAERO-iodide-CIMS

GC-MS

300 milliliters of air sample from the canister was pulled through a cryogenic trap in the quadrupole GC-MS system (model TH-300B) and cooled to $-160\text{ }^{\circ}\text{C}$ for pre-concentration. After being trapped, the concentrated VOCs were flash desorbed by heating to $100\text{ }^{\circ}\text{C}$ and transferred to a DB-624 column ($60\text{ m}\times 0.25\text{ mm}\times 1.4\text{ }\mu\text{m}$). CO_2 and moisture are removed before injection. The initial temperature for the chromatographic column was $41\text{ }^{\circ}\text{C}$, maintained for 6 min, and then raised to $180\text{ }^{\circ}\text{C}$ at a rate of $6\text{ }^{\circ}\text{C min}^{-1}$. Qualitative identification of VOCs was performed using a full MS scan from 50 to 500 Th. The most probable identity of an analyte was obtained based on the first ranked matching by comparing with the reference mass spectra in the NIST library.

FIGAERO-iodide-CIMS

A sample flow was directly drawn into a turbulent flow ion-molecule reactor (IMR). Gaseous products were ionized as their corresponding adduct ions with I. Particulate products collected on the PTFE membrane filter were desorbed by a flow of heated UHP N_2 . The temperature of the N_2 increased from 20 to $200\text{ }^{\circ}\text{C}$ in 50 min. The desorbed molecules entered the IMR and were charged by the same ionization mechanism. Background HNO_3 was inevitable in the experimental apparatus containing macroalgae and natural seawater. So the cluster ions containing NO_3^- or HNO_3 were observed occasionally. ToF-MS was configured to measure singly charged molecular ions of 7-720 Th with a MS resolution of ~ 4500 . Mass calibration was conducted using the ions of NO_3^- , CF_3O^- , $\text{C}_2\text{F}_3\text{O}_2^-$, $\text{C}_3\text{F}_5\text{O}_2^-$, I_3^- for gaseous products and NO_3^- , I^- , IHNO_3^- , $\text{IC}_2\text{F}_3\text{HO}_2^-$, I_3^- for particulate products. Reliable formula identification of ion peaks was corroborated by high accuracy of fits ($<20\text{ ppm}$) and isotope patterns. Background signal in the gas phase was determined by measuring a UHP N_2 flow. The signal during the last 3 minutes of the soak period of PTFE membrane filter was regarded as background signal in the particle phase. Background

signals were then subtracted from the intensities of compound formulas.

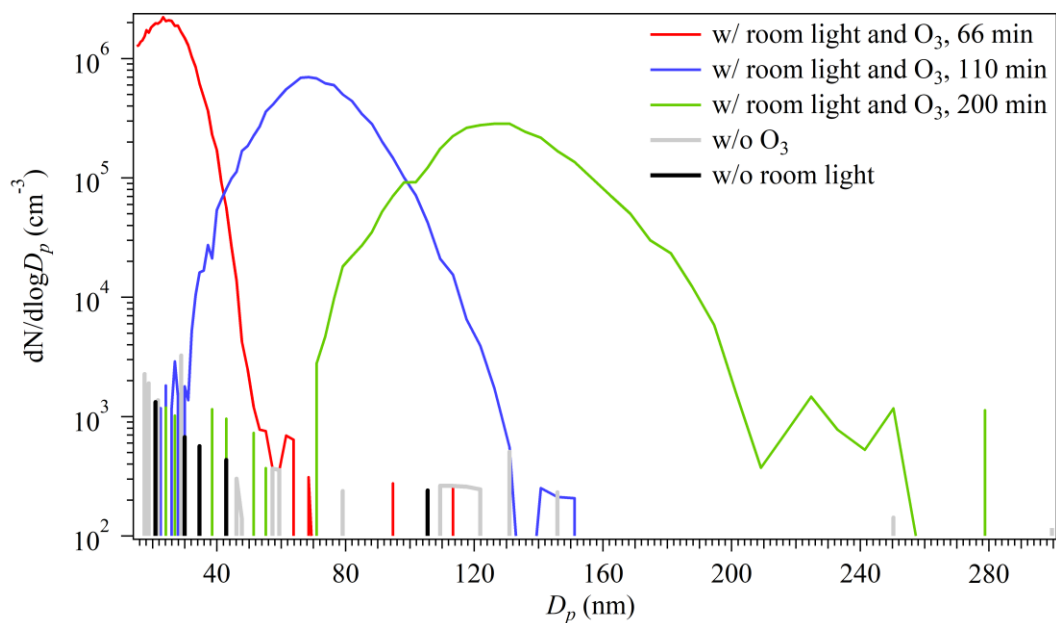


Figure S1. Particle number size distributions with and without room light and ozone.

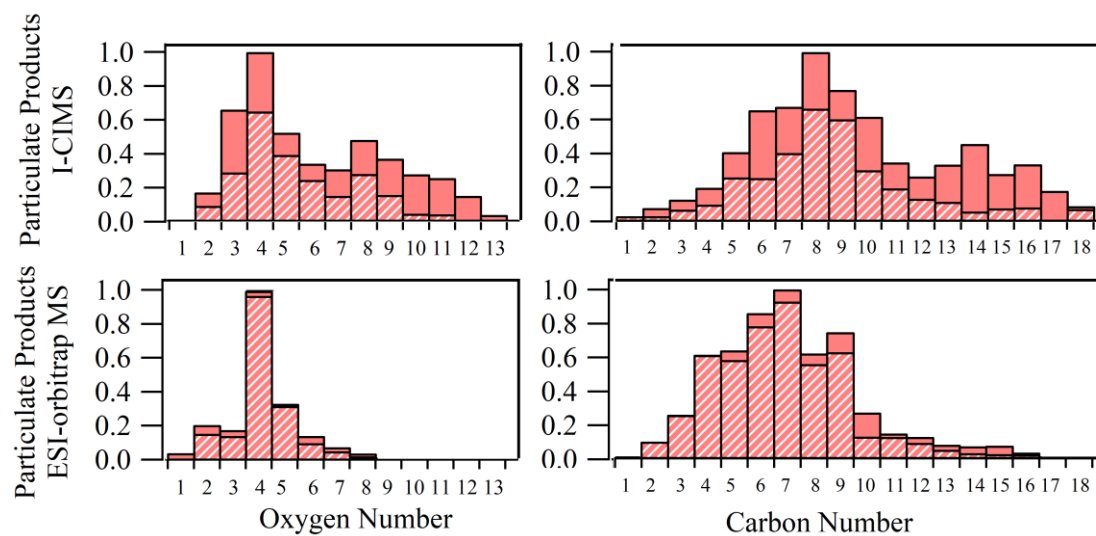


Figure S2. Oxygen and carbon atom number distributions of particulate products measured by iodide-CIMS and ESI-orbitrap MS in a typical ozonolysis experiment (dynamic mode). Hatched bars indicate the fractions of formulas observed by both mass spectrometers.