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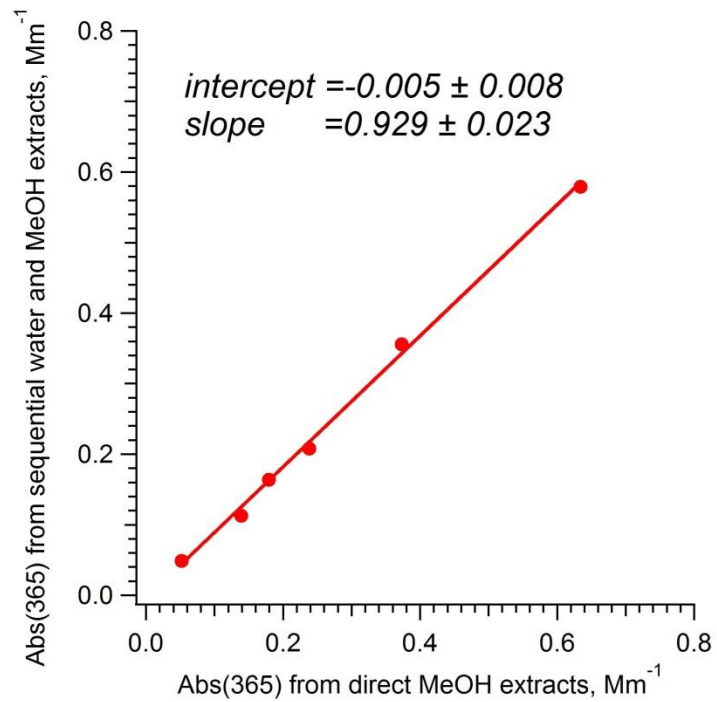
Supplement of

Optical properties and aging of light-absorbing secondary organic aerosol

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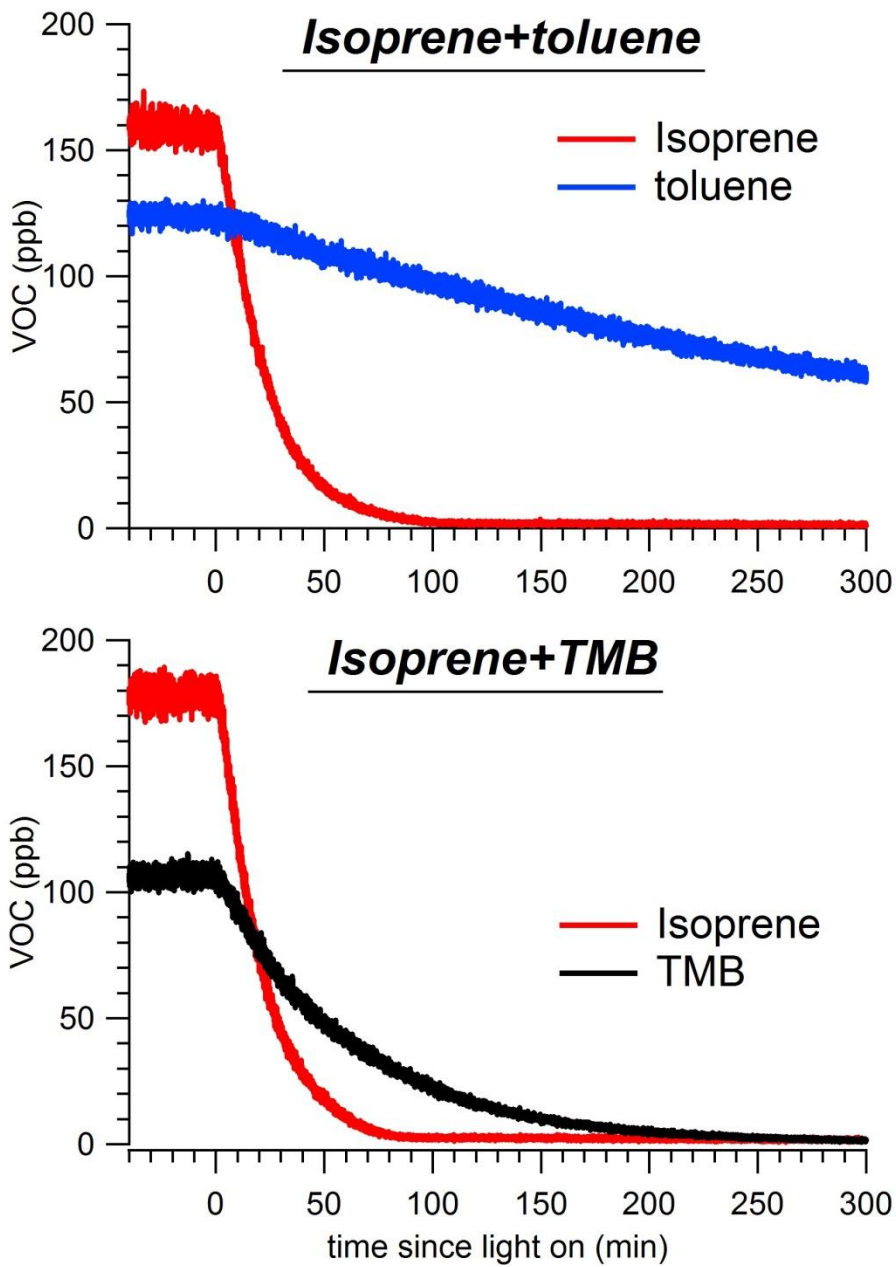
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21 Figure S1. Brown carbon light absorption at 365 nm retrieved from the sequential extraction
22 process compared to that from direct methanol extraction.

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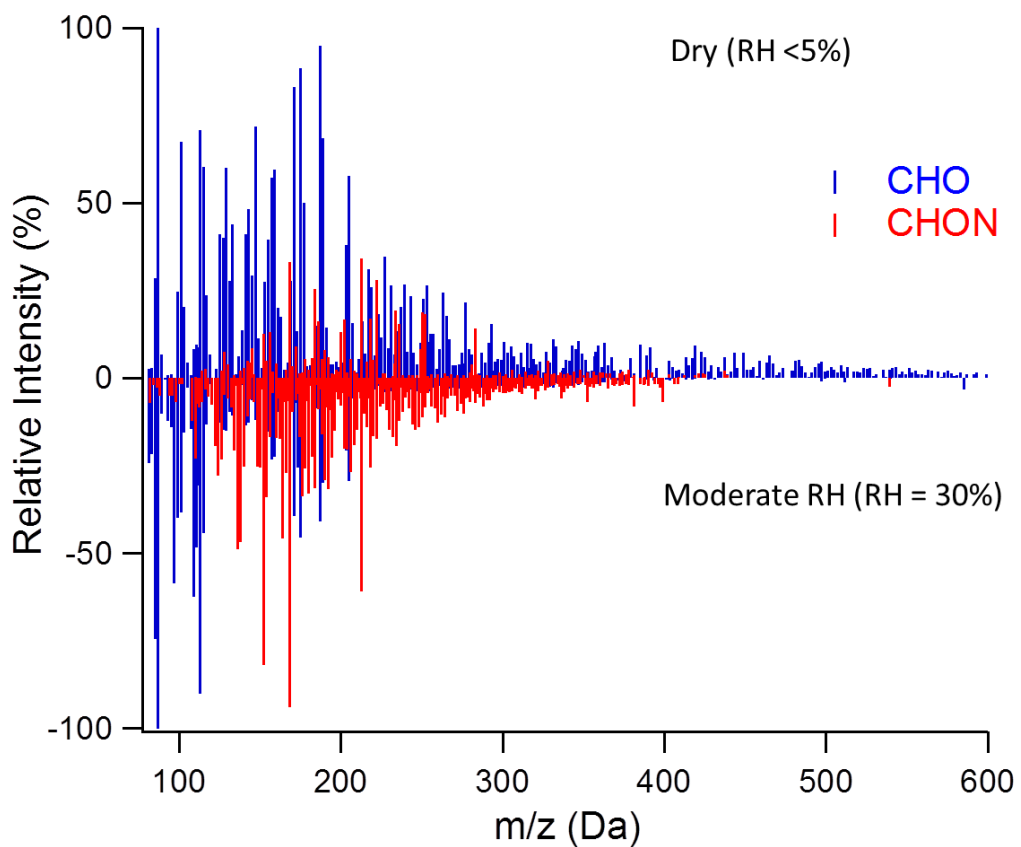
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27 Figure S2. Evolution of VOC concentrations in mixed-precursors experiment as a function of
28 time. Note that isoprene reacts much faster than aromatic VOCs.

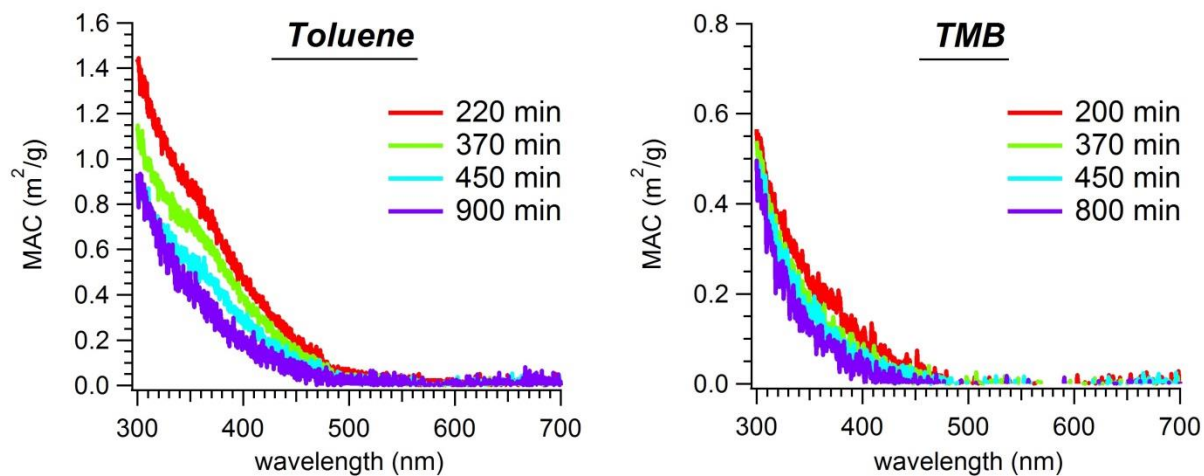
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31 Figure S3. Negative mode nano-DESI/HRMS spectra of toluene-SOA samples generated under
32 dry (positive intensities) and moderate RH conditions (negative intensities). Detailed methods
33 are described in Lin et al. (2015).

34



35

36 Figure S4. MAC spectra of toluene and TMB SOA formed in aging experiments, in the presence
37 of NO_x at 30% RH.

38

39 Table S1. MAC values of SOA from the four VOC precursors under NO_x-free and high-NO_x
 40 conditions at 30% RH through the 300-700 nm range. Note that values below detection limit are
 41 not excluded.

wavelength, nm	MAC, m ² g ⁻¹							
	Isoprene NO _x -free	Isoprene high-NO _x	α-pinene NO _x -free	α-pinene high-NO _x	TMB NO _x -free	TMB high-NO _x	Toluene NO _x -free	Toluene high-NO _x
300	0.013	0.026	0.058	0.129	0.109	0.522	0.061	1.557
305	0.011	0.021	0.042	0.103	0.088	0.476	0.050	1.444
310	0.009	0.018	0.030	0.082	0.068	0.427	0.044	1.344
315	0.006	0.016	0.022	0.070	0.054	0.396	0.037	1.264
320	0.004	0.013	0.015	0.061	0.043	0.369	0.031	1.194
325	0.005	0.011	0.009	0.051	0.035	0.340	0.028	1.136
330	0.004	0.011	0.007	0.043	0.030	0.304	0.023	1.079
335	0.002	0.009	0.005	0.039	0.026	0.276	0.019	1.030
340	0.003	0.008	0.003	0.035	0.025	0.248	0.019	0.987
345	0.002	0.007	0.003	0.032	0.024	0.229	0.016	0.947
350	0.001	0.006	0.000	0.029	0.023	0.204	0.015	0.907
355	0.002	0.007	0.000	0.026	0.022	0.179	0.014	0.875
360	0.001	0.005	0.001	0.023	0.022	0.162	0.011	0.831
365	0.001	0.004	-0.001	0.021	0.020	0.148	0.010	0.787
370	0.000	0.003	-0.002	0.019	0.017	0.135	0.006	0.746
375	0.000	0.002	-0.003	0.016	0.014	0.118	0.003	0.699
380	-0.001	0.001	-0.002	0.013	0.011	0.103	0.001	0.645
385	-0.001	0.000	-0.003	0.011	0.008	0.094	0.001	0.597
390	0.000	-0.001	-0.003	0.009	0.005	0.083	0.000	0.555
395	0.000	-0.002	-0.003	0.007	0.004	0.073	-0.002	0.518
400	0.000	-0.003	-0.004	0.006	0.002	0.059	-0.001	0.481
405	-0.001	-0.003	-0.006	0.005	0.001	0.050	-0.002	0.443
410	-0.002	-0.004	-0.007	0.005	0.001	0.049	-0.004	0.411
415	-0.003	-0.003	-0.007	0.004	0.000	0.043	-0.004	0.383
420	-0.002	-0.004	-0.005	0.002	0.000	0.037	-0.004	0.354
425	-0.002	-0.004	-0.006	0.001	-0.001	0.035	-0.005	0.319
430	-0.002	-0.004	-0.007	0.001	-0.001	0.029	-0.005	0.292
435	-0.002	-0.005	-0.006	0.000	-0.001	0.026	-0.006	0.269
440	-0.002	-0.004	-0.006	-0.001	-0.001	0.024	-0.006	0.243
445	-0.001	-0.004	-0.005	-0.002	-0.001	0.020	-0.006	0.216
450	-0.001	-0.005	-0.006	0.000	-0.001	0.020	-0.007	0.192
455	-0.002	-0.005	-0.007	0.000	-0.002	0.023	-0.007	0.175
460	-0.002	-0.006	-0.007	-0.001	-0.002	0.021	-0.008	0.157
465	-0.002	-0.005	-0.006	-0.001	-0.002	0.015	-0.008	0.137
470	-0.002	-0.005	-0.007	-0.002	-0.002	0.012	-0.007	0.118
475	-0.002	-0.005	-0.007	-0.003	-0.002	0.010	-0.006	0.098
480	-0.002	-0.006	-0.007	-0.002	-0.002	0.004	-0.007	0.078
485	0.000	-0.007	-0.006	-0.002	-0.002	-0.001	-0.007	0.058
490	0.000	-0.007	-0.006	-0.003	-0.002	-0.006	-0.006	0.049
495	-0.001	-0.007	-0.007	-0.003	-0.002	-0.009	-0.008	0.047
500	-0.001	-0.007	-0.007	-0.003	-0.002	-0.009	-0.007	0.045
505	-0.001	-0.007	-0.007	-0.003	-0.002	-0.007	-0.007	0.040
510	-0.002	-0.007	-0.006	-0.001	-0.002	-0.011	-0.009	0.031
515	-0.002	-0.007	-0.006	-0.003	-0.002	-0.012	-0.007	0.026
520	-0.002	-0.006	-0.006	-0.004	-0.002	-0.009	-0.007	0.028
525	-0.002	-0.006	-0.005	-0.003	-0.002	-0.012	-0.008	0.023
530	-0.002	-0.006	-0.007	-0.003	-0.002	-0.017	-0.007	0.016
535	-0.002	-0.006	-0.006	-0.002	-0.002	-0.015	-0.007	0.014
540	-0.002	-0.006	-0.005	-0.003	-0.002	-0.011	-0.009	0.009
545	-0.003	-0.006	-0.006	-0.004	-0.002	-0.010	-0.009	0.009
550	-0.003	-0.007	-0.007	-0.002	-0.002	-0.012	-0.009	0.006

555	-0.003	-0.007	-0.007	-0.001	-0.002	-0.016	-0.009	0.003
560	-0.003	-0.006	-0.007	-0.002	-0.002	-0.017	-0.009	0.006
565	-0.003	-0.006	-0.005	-0.004	-0.002	-0.014	-0.009	0.009
570	-0.001	-0.007	-0.004	-0.004	-0.002	-0.014	-0.008	0.010
575	0.001	-0.009	-0.005	-0.003	-0.002	-0.016	-0.006	0.009
580	0.004	-0.009	-0.005	-0.003	-0.002	-0.016	-0.003	0.010
585	0.002	-0.009	-0.006	-0.003	-0.002	-0.015	-0.004	0.010
590	0.000	-0.007	-0.005	-0.003	-0.002	-0.016	-0.007	0.007
595	-0.001	-0.006	-0.004	-0.004	-0.002	-0.015	-0.007	0.004
600	0.000	-0.006	-0.004	-0.006	-0.001	-0.017	-0.006	0.000
605	-0.001	-0.005	-0.003	-0.006	-0.001	-0.018	-0.005	-0.001
610	-0.001	-0.006	-0.001	-0.004	-0.001	-0.018	-0.006	0.000
615	-0.002	-0.006	-0.002	-0.003	-0.001	-0.018	-0.008	0.001
620	-0.002	-0.006	-0.003	-0.003	-0.001	-0.013	-0.006	0.000
625	-0.001	-0.006	-0.002	-0.004	-0.001	-0.012	-0.005	-0.008
630	-0.003	-0.007	-0.003	-0.006	-0.001	-0.007	-0.009	-0.016
635	-0.005	-0.007	-0.004	-0.007	-0.002	-0.011	-0.012	-0.015
640	-0.004	-0.006	-0.004	-0.005	-0.002	-0.015	-0.009	-0.013
645	-0.004	-0.005	-0.003	-0.002	-0.001	-0.015	-0.006	-0.009
650	-0.004	-0.005	-0.005	-0.004	-0.001	-0.005	-0.008	-0.007
655	-0.002	-0.006	-0.004	-0.004	-0.001	-0.006	-0.008	-0.006
660	-0.001	-0.007	-0.002	-0.002	-0.001	-0.008	-0.010	-0.007
665	-0.003	-0.008	-0.006	-0.002	-0.002	0.001	-0.009	-0.011
670	-0.004	-0.008	-0.005	-0.002	-0.002	-0.004	-0.007	-0.007
675	-0.002	-0.007	-0.003	-0.001	-0.002	-0.002	-0.006	-0.009
680	-0.002	-0.006	-0.003	-0.002	-0.001	0.002	-0.006	-0.014
685	-0.002	-0.006	-0.001	-0.002	-0.001	-0.007	-0.008	-0.016
690	-0.004	-0.005	-0.003	-0.003	-0.001	-0.005	-0.009	-0.017
695	-0.006	-0.006	-0.008	-0.005	-0.001	-0.010	-0.009	-0.013
700	-0.005	-0.004	-0.007	-0.007	-0.002	-0.018	-0.007	-0.008

43 Table S2. Mass concentrations of aromatic- and isoprene- derived SOA in the mixed-precursor
 44 experiments, estimated using two-product model described in section 2.1.

Aromatic VOC	Reacted aromatic VOC (ppb)	Reacted isoprene (ppb)	Modeled aromatic-derived SOA ($\mu\text{g}/\text{m}^3$)	Modeled isoprene-derived SOA ($\mu\text{g}/\text{m}^3$)	Modeled total SOA ($\mu\text{g}/\text{m}^3$)	Measured total SOA ($\mu\text{g}/\text{m}^3$)
toluene	47.97	156.49	9.64	56.90	66.54	69.57
toluene	55.73	156.70	15.93	62.68	78.61	84.57
TMB	121.89	175.37	6.27	23.08	29.35	32.36

45

46

47 Table S3. MAC values through the 300-700 nm range of SOA samples collected in toluene and
 48 TMB aging experiments, in which SOA were formed under high-NO_x conditions at 30% RH.
 49 Note that values below detection limit are not excluded.

wavelength, nm	Toluene				TMB			
	220 min	370 min	450 min	900 min	200 min	370 min	450 min	800 min
300	1.429	1.118	0.883	0.907	0.558	0.530	0.486	0.460
305	1.338	1.046	0.829	0.839	0.505	0.468	0.444	0.405
310	1.254	0.979	0.784	0.781	0.450	0.410	0.390	0.353
315	1.184	0.932	0.746	0.721	0.405	0.367	0.337	0.301
320	1.124	0.888	0.707	0.657	0.370	0.325	0.303	0.256
325	1.075	0.850	0.675	0.604	0.344	0.292	0.285	0.238
330	1.025	0.816	0.647	0.566	0.319	0.263	0.253	0.211
335	0.983	0.786	0.620	0.528	0.301	0.242	0.220	0.180
340	0.946	0.748	0.586	0.476	0.277	0.218	0.191	0.157
345	0.910	0.730	0.565	0.450	0.256	0.202	0.171	0.143
350	0.875	0.717	0.547	0.431	0.230	0.185	0.165	0.128
355	0.846	0.692	0.529	0.412	0.212	0.166	0.154	0.112
360	0.806	0.663	0.513	0.387	0.204	0.157	0.142	0.101
365	0.767	0.636	0.489	0.356	0.193	0.140	0.127	0.094
370	0.728	0.606	0.461	0.327	0.187	0.117	0.109	0.086
375	0.683	0.568	0.434	0.300	0.183	0.108	0.096	0.074
380	0.632	0.525	0.402	0.270	0.158	0.099	0.080	0.060
385	0.586	0.490	0.368	0.244	0.136	0.091	0.070	0.052
390	0.546	0.457	0.338	0.230	0.129	0.084	0.068	0.043
395	0.510	0.421	0.314	0.210	0.111	0.071	0.063	0.042
400	0.475	0.387	0.293	0.188	0.102	0.064	0.057	0.035
405	0.438	0.354	0.269	0.180	0.096	0.058	0.047	0.026
410	0.407	0.327	0.243	0.166	0.085	0.055	0.040	0.021
415	0.379	0.304	0.225	0.144	0.077	0.050	0.038	0.015
420	0.352	0.280	0.204	0.131	0.068	0.042	0.035	0.011
425	0.317	0.254	0.181	0.125	0.061	0.033	0.030	0.010
430	0.292	0.227	0.163	0.119	0.050	0.027	0.021	0.009
435	0.269	0.205	0.146	0.103	0.040	0.023	0.019	0.004
440	0.244	0.189	0.136	0.091	0.042	0.016	0.019	0.001
445	0.218	0.167	0.121	0.076	0.037	0.014	0.014	-0.005
450	0.194	0.148	0.105	0.065	0.033	0.015	0.009	-0.008
455	0.177	0.133	0.094	0.065	0.031	0.009	0.007	-0.010
460	0.160	0.118	0.087	0.060	0.016	0.003	0.006	-0.007
465	0.140	0.108	0.082	0.049	0.006	-0.002	0.002	-0.005
470	0.122	0.098	0.074	0.038	0.007	-0.007	-0.002	-0.009
475	0.103	0.082	0.061	0.039	0.004	-0.007	-0.003	-0.015
480	0.083	0.062	0.047	0.033	-0.004	-0.007	-0.001	-0.022
485	0.064	0.043	0.035	0.019	-0.011	-0.009	-0.005	-0.027
490	0.055	0.036	0.029	0.018	-0.007	-0.013	-0.014	-0.022
495	0.052	0.035	0.030	0.017	-0.005	-0.013	-0.014	-0.022
500	0.050	0.034	0.028	0.011	-0.009	-0.013	-0.011	-0.024
505	0.046	0.030	0.025	0.009	-0.008	-0.013	-0.011	-0.023
510	0.037	0.026	0.023	0.011	-0.009	-0.011	-0.013	-0.026
515	0.032	0.025	0.022	0.009	-0.011	-0.014	-0.008	-0.025
520	0.034	0.023	0.021	0.015	-0.010	-0.012	-0.009	-0.027
525	0.029	0.016	0.015	0.009	-0.016	-0.013	-0.013	-0.032
530	0.023	0.012	0.012	0.003	-0.014	-0.011	-0.013	-0.029
535	0.020	0.011	0.012	0.006	-0.008	-0.010	-0.016	-0.024
540	0.015	0.010	0.013	0.005	-0.013	-0.021	-0.013	-0.022
545	0.015	0.008	0.014	0.007	-0.017	-0.016	-0.011	-0.023
550	0.013	0.004	0.009	0.005	-0.019	-0.010	-0.009	-0.028
555	0.010	0.005	0.005	-0.002	-0.019	-0.016	-0.008	-0.027

560	0.013	0.003	0.005	-0.008	-0.016	-0.020	-0.015	-0.025
565	0.015	0.001	0.004	-0.005	-0.014	-0.017	-0.018	-0.026
570	0.017	-0.001	0.002	-0.002	-0.024	-0.015	-0.018	-0.026
575	0.017	-0.005	0.000	-0.005	-0.039	-0.019	-0.018	-0.023
580	0.018	-0.007	-0.002	-0.005	-0.047	-0.021	-0.017	-0.023
585	0.017	-0.005	-0.002	-0.007	-0.041	-0.023	-0.016	-0.028
590	0.014	-0.004	-0.001	-0.005	-0.028	-0.022	-0.016	-0.022
595	0.011	-0.003	-0.001	-0.003	-0.024	-0.017	-0.017	-0.022
600	0.007	-0.003	0.002	-0.002	-0.018	-0.019	-0.018	-0.032
605	0.006	-0.004	0.001	-0.003	-0.016	-0.019	-0.021	-0.029
610	0.007	-0.005	-0.001	-0.010	-0.018	-0.016	-0.022	-0.032
615	0.007	-0.006	-0.001	-0.009	-0.014	-0.018	-0.015	-0.035
620	0.006	-0.003	-0.002	-0.010	-0.012	-0.021	-0.009	-0.028
625	-0.001	-0.005	-0.003	-0.014	-0.009	-0.019	-0.016	-0.025
630	-0.010	-0.005	-0.002	-0.006	-0.007	-0.014	-0.015	-0.028
635	-0.009	-0.002	0.001	-0.002	-0.011	-0.015	-0.012	-0.026
640	-0.006	-0.006	-0.003	-0.005	-0.011	-0.015	-0.013	-0.024
645	-0.003	-0.004	-0.001	-0.007	-0.013	-0.017	-0.013	-0.026
650	-0.001	0.000	0.003	-0.008	-0.010	-0.021	-0.014	-0.020
655	0.001	-0.002	0.002	-0.009	-0.016	-0.024	-0.012	-0.025
660	-0.001	-0.002	0.003	-0.005	-0.017	-0.026	-0.008	-0.029
665	-0.005	-0.002	-0.001	0.000	-0.002	-0.022	-0.008	-0.027
670	0.000	-0.008	-0.006	0.000	-0.002	-0.018	-0.009	-0.026
675	-0.003	-0.011	-0.005	0.000	-0.009	-0.018	-0.012	-0.025
680	-0.007	-0.009	-0.005	-0.002	-0.011	-0.017	-0.016	-0.033
685	-0.009	-0.007	0.003	-0.007	-0.013	-0.015	-0.009	-0.028
690	-0.010	-0.007	0.006	-0.014	-0.013	-0.021	-0.012	-0.028
695	-0.006	-0.001	0.001	-0.011	-0.007	-0.017	-0.015	-0.028
700	-0.001	-0.001	-0.001	-0.002	-0.012	-0.013	-0.016	-0.015

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51

52 Table S4. Imaginary part of the refractive index derived from toluene SOA formed under high
 53 NO_x conditions through the 300-700 nm range.

Wavelength, nm	k_high	k_low	Wavelength, nm	k_high	k_low
300	0.0609	0.0409	580	0.0062	-0.0004
305	0.0597	0.0385	585	0.0063	-0.0005
310	0.0586	0.0364	590	0.0065	-0.0003
315	0.0577	0.0341	595	0.0063	-0.0002
320	0.0567	0.0316	600	0.0062	-0.0001
325	0.0561	0.0295	605	0.0062	-0.0002
330	0.0553	0.0281	610	0.0060	-0.0008
335	0.0543	0.0266	615	0.0057	-0.0008
340	0.0535	0.0244	620	0.0056	-0.0009
345	0.0528	0.0234	625	0.0053	-0.0012
350	0.0515	0.0226	630	0.0051	-0.0005
355	0.0503	0.0220	635	0.0047	-0.0001
360	0.0488	0.0210	640	0.0044	-0.0003
365	0.0469	0.0195	645	0.0040	-0.0005
370	0.0447	0.0182	650	0.0036	-0.0008
375	0.0425	0.0170	655	0.0035	-0.0007
380	0.0401	0.0154	660	0.0032	-0.0004
385	0.0380	0.0142	665	0.0028	0.0001
390	0.0365	0.0136	670	0.0025	0.0001
395	0.0352	0.0125	675	0.0021	0.0001
400	0.0340	0.0114	680	0.0017	-0.0001
405	0.0328	0.0110	685	0.0011	-0.0007
410	0.0317	0.0103	690	0.0007	-0.0014
415	0.0308	0.0091	695	0.0004	-0.0010
420	0.0300	0.0083	700	0.0000	0.0000
425	0.0290	0.0081			
430	0.0278	0.0078			
435	0.0266	0.0068			
440	0.0254	0.0061			
445	0.0239	0.0051			
450	0.0225	0.0045			
455	0.0213	0.0045			
460	0.0199	0.0042			
465	0.0184	0.0035			
470	0.0171	0.0028			
475	0.0159	0.0029			
480	0.0148	0.0024			
485	0.0137	0.0015			
490	0.0127	0.0014			
495	0.0121	0.0014			
500	0.0115	0.0009			
505	0.0107	0.0008			
510	0.0103	0.0009			
515	0.0099	0.0009			
520	0.0096	0.0012			
525	0.0092	0.0007			
530	0.0088	0.0004			
535	0.0084	0.0006			
540	0.0080	0.0005			
545	0.0079	0.0006			
550	0.0077	0.0005			
555	0.0075	-0.0001			
560	0.0074	-0.0006			
565	0.0072	-0.0003			
570	0.0068	-0.0001			
575	0.0065	-0.0004			

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