Supporting information for:

Enhancement of Secondary Organic Aerosol Formation and its Oxidation State by SO₂ during Photooxidation of 2-Methoxyphenol

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Chemicals

Guaiacol (Sigma-Aldrich, >99%), sodium chloride (Sinopharm Chemical Reagent Co., Ltd., >99.8%), and ammonium sulfate (Sinopharm Chemical Reagent Co., Ltd., >99%) were used in the experiments as received. NO (963 ppm) and SO_2 (3000 ppm) were purchased from Beijing Huayuan Gas Chemical Industry Co., Ltd.

Figure S1. Schematic of the RCEES-CAS smog chamber facility.

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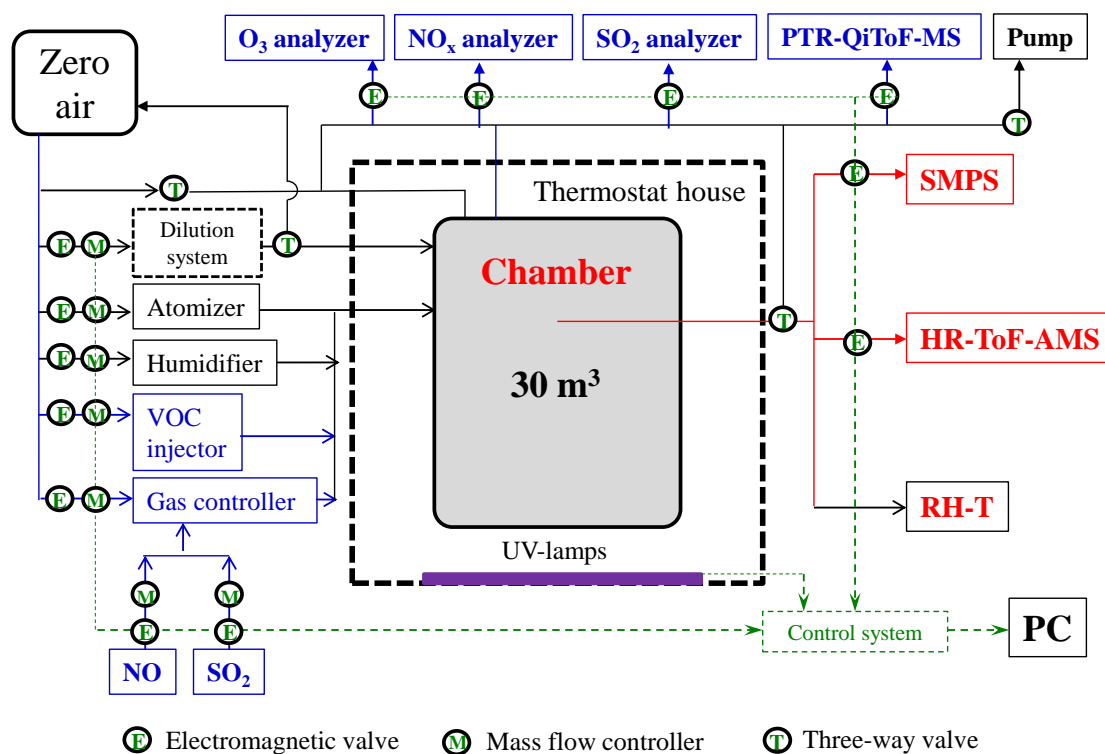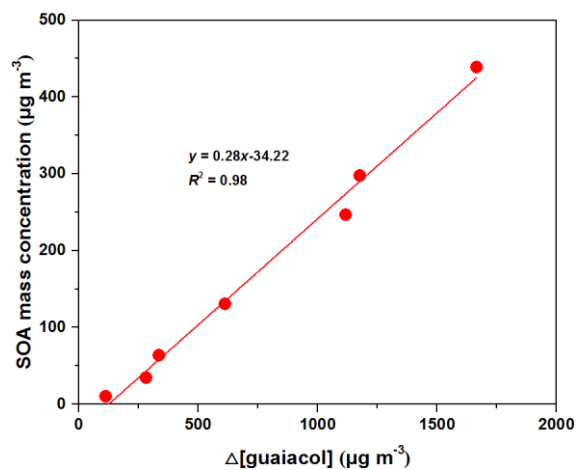
Figure S2. SOA mass concentration (M_0) vs. the consumed guaiacol concentration

($\triangle$[guaiacol]). Each data point represents a separate experiment.

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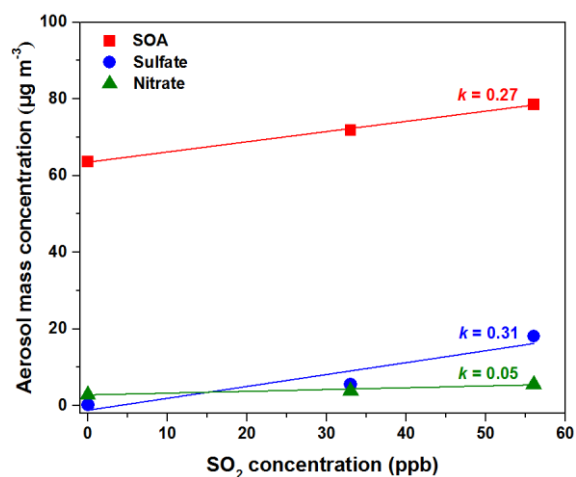
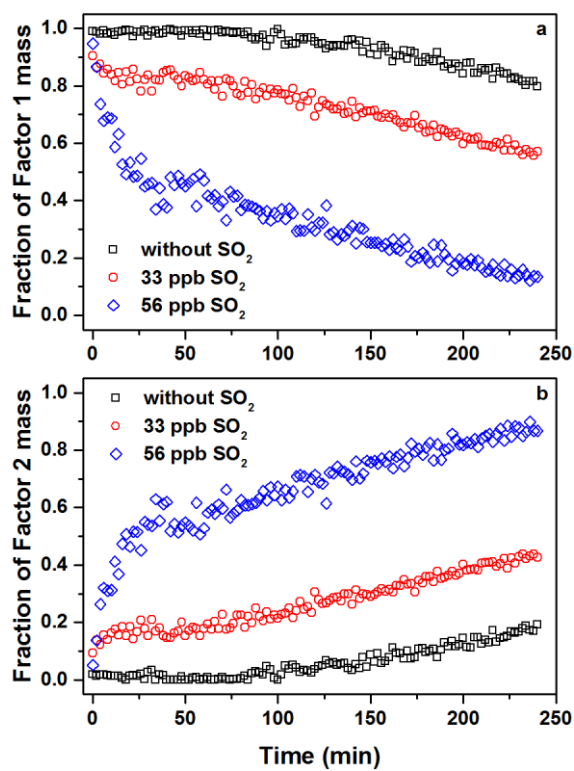


Figure S3. Foramtion of SOA, sulfate, and nitrate as a function of SO_2 concentration

for guaiacol photooxidation. The *k* values are the slopes of the fitted lines for each

species.

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35   **Figure S4.** Time-dependent curves of Factor 1 (a) and Factor 2 (b) at three different

36   SO$_2$ concentrations.

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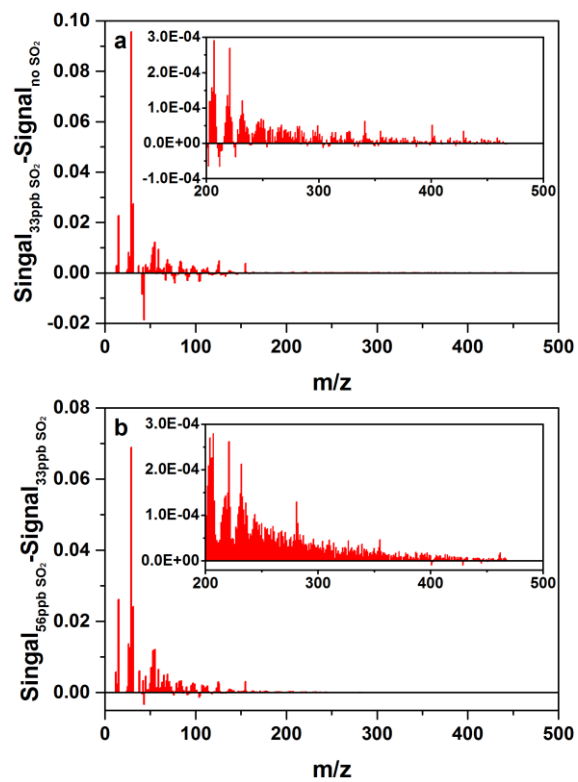
Figure S5. Differences among the normalized mass spectra of SOA formed at different SO_2 concentrations (a: 33 ppb SO_2 – no SO_2; b: 56 ppb SO_2 – 33 ppb SO_2).

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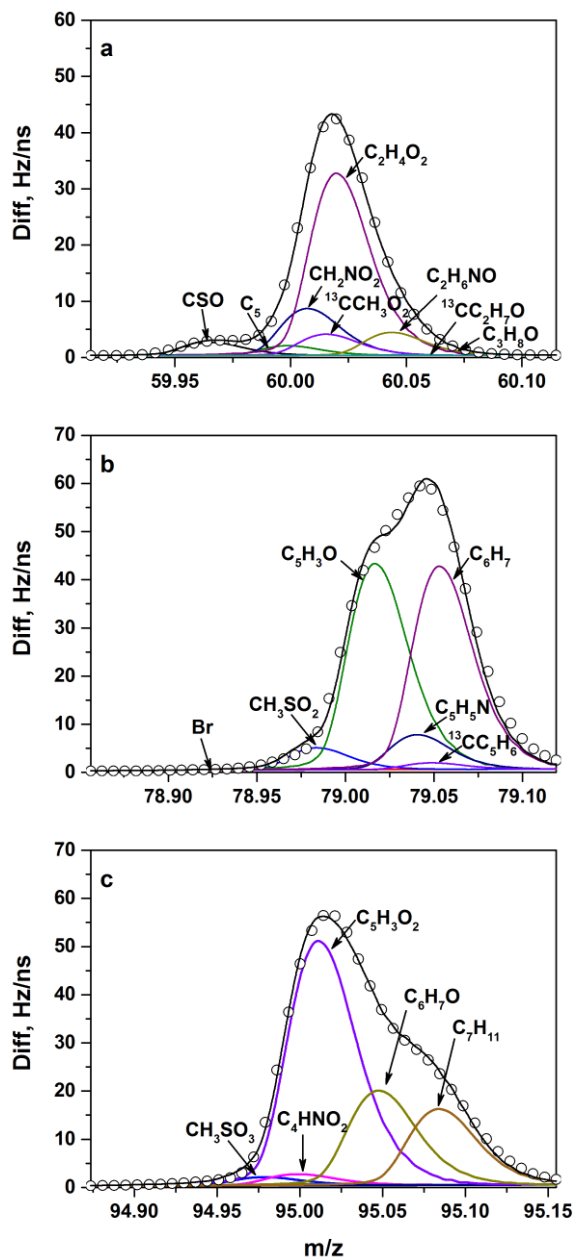
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41 **Figure S6**. Fitted peaks of average W-mode mass spectrum of methyl sulfate obtained

42 at 56 ppb SO_2 without seed particles.

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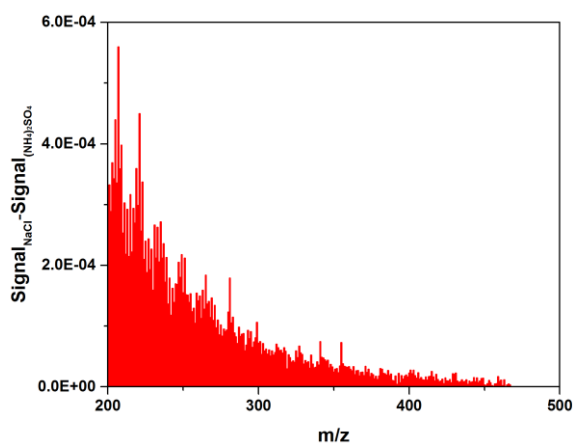
Figure S7. Difference between the normalized mass spectra of SOA formed with

different seeds (NaCl seeded SOA – $(NH_4)_2SO_4$ seeded SOA).

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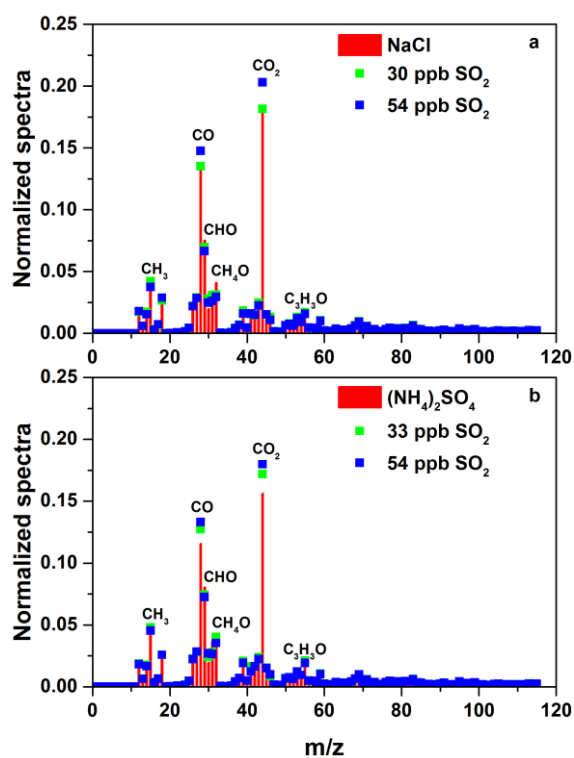
Figure S8. Mass spectra of SOA with NaCl (a) and $(NH_4)_2SO_4$ (b) as seed particles

obtained by HR-ToF-AMS at different SO_2 concentration (red bars: without SO_2; olive

markers: 30 ppb SO_2 for a and 33 ppb SO_2 for b; blue markers: 54 ppb SO_2).

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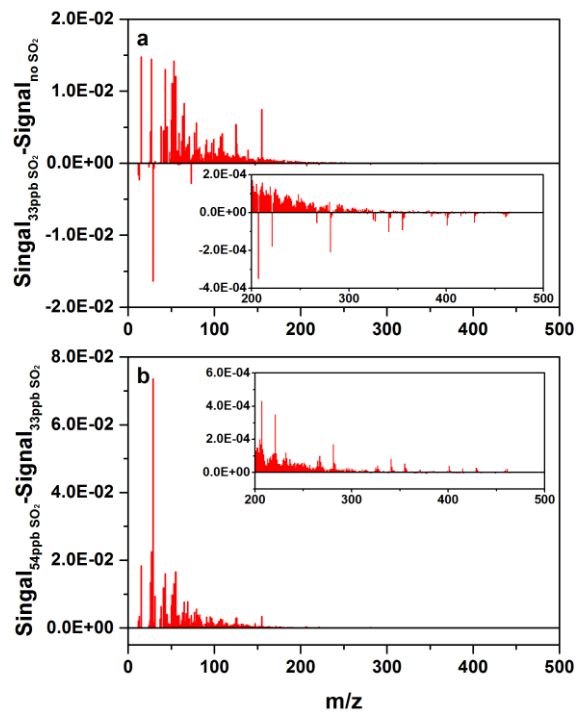
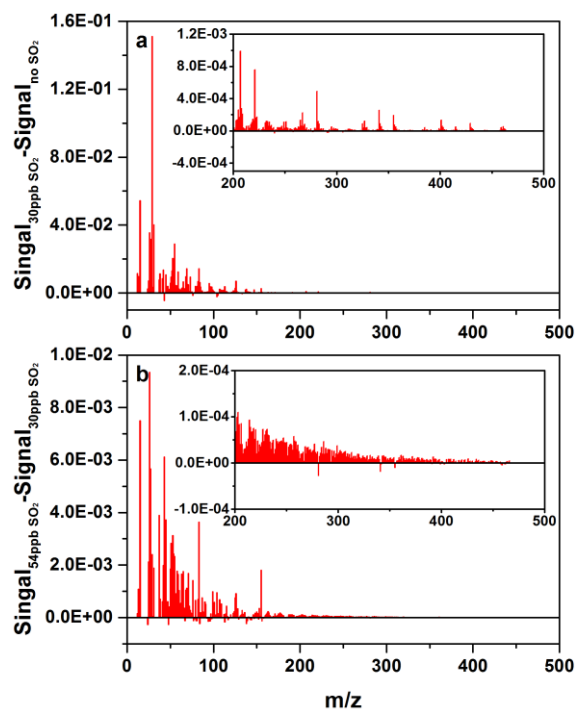


Figure S9. Differences among the normalized mass spectra of SOA formed at different SO_2 concentrations with $(NH_4)_2SO_4$ seed particles (a: 33 ppb SO_2 – no SO_2; b: 54 ppb SO_2 – 33 ppb SO_2).

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55 **Figure S10.** Differences among the normalized mass spectra of SOA formed at

56 different SO_2 concentrations with NaCl seed particles (a: 30 ppb SO_2 – no SO_2; b: 54

57 ppb SO_2 – 30 ppb SO_2).