I. General Comments from Reviewer 2

Zhang et al. measured SOA formation from emissions from a GDI engine and four types of food cooking emissions that were exposed to OH radicals in a Go:PAM. Equivalent atmospheric aging timescales of up to 5 days were studied. The SOA/POA ratio was approximately 100 for the oxidized vehicle exhaust and 2 for the oxidized cooking exhaust. Higher SOA oxidation states were observed for the oxidized vehicle exhaust. AMS spectra of the oxidized emissions were examined and compared to ambient LO-OOA, MO-OOA, and COA factors resolved using PMF. The studies are well motivated. In its current form, there are too many important experimental details that are missing for me to support publication in ACP.

Reply: We appreciate the constructive comments from the reviewer on this manuscript. We have added plenty of parts to method and discussion to enrich the whole article. In the revised manuscript, we have almost rewritten the SI and reprocessed the data of cooking POA and SOA by a new method. Besides, we have answered the reviewer's questions point to point in the following paragraphs (the texts italicized are the comments, the texts indented are the responses, and the texts in blue are revised parts in the new manuscript). In addition, all changes made are marked in the revised manuscript.

II. Detailed comments from Reviewer 2

1.Critical details about the sampling inlets between the source emissions and the OFR (e.g. tubing length, diameter, material, residence time) that could influence the penetration efficiency and/or delays in transmission to the OFR (e.g. Pagonis et al, 2017) are missing. If these conditions vary between vehicular exhaust and cooking exhaust measurements, that is one of several potentially important variables that could complicate direct comparison of results between the two studies.

Thank the reviewer for reminding us to supply necessary details. The sample inlets between the source emissions and the OFR mainly contained a dilutor, sampling lines ,and silicon tubes. Both vehicle and cooking fumes were diluted at a constant ratio by a Dekati Dilutor (e-Diluter, Dekati Ltd.). The dilution air was ambient air (clean period), which was firstly filtered by a particle filter system (including a dryer, a filter ,and an ultrafilter, SMC Inc.) to remove the particles and water. Then the dilution air was filtered by an activated carbon adsorption device to remove the VOCs. Vehicle exhaust from the tailpipe was first diluted by a gradient heated dilution system (6 fold) and then diluted by an unheated dilution system (5 fold). The temperature of sample flow was near indoor temperature after secondary dilution systems. The cooking fumes were collected through the kitchen ventilator. The boiled water can be a background sample influenced by indoor air, iron wok ,and ventilator. Besides, a temperature controller and heat insulation cotton were wrapped around the sampling pipelines to prevent freshly warm gas from condensing on the pipe wall. The sampling lines were composed of stainless steel and black carbon tubes. Silicon tubes were used to dry the emissions before they entered measuring instruments. As the results of blank groups in Table S1, the dilution air and background interference just made a minor influence on the SOA concentration. We have added details in SI and Table S1.

> Revised text “The dilution air was ambient air (clean period), which was firstly filtered by a particle filter system (including a dryer, a filter and an ultrafilter, SMC Inc.) in order to remove the particles and water. Then the dilution air was filtered by an activated carbon adsorption device, in order to remove the VOCs. Vehicle exhaust from tailpipe was first diluted by a gradient heated dilution system (6 fold) and then diluted by a unheated dilution system (5 fold). The temperature of sample flow was near indoor temperature after secondary dilution systems. The cooking fumes was collected through the kitchen ventilator. The boiled water can be a background sample influenced by indoor air, iron wok and ventilator. As the results of blank groups in Table S1, the dilution air and background interference just made minor influence to the SOA concentration.”

Table S1. Comparison of results between blank and experimental groups (Dilution air and boiled water are two kinds of blank groups. The others are experimental groups.).

Experiment	OH Exposure ($\times 10^{10}$ molecules$\cdot$cm$^{-3}\cdot$s)	OA Concentration (μg/m3)	Standard Deviation	Relative Standard Deviation
Dilution Air (cooking)	0	-	-	-
	9.6	0.37	0.04	12%
Boiled Water	0	0.04	0.02	44%
	9.6	0.36	0.12	32%
Deep-fried Chicken	0	12.30	0.49	4%
	9.6	28.29	2.55	9%
Shallow-fried Tofu	0	13.56	0.68	5%
	9.6	21.70	1.08	5%
Stir-fried Cabbage	0	10.75	0.65	6%
	9.6	18.38	1.65	9%
Kung Pao Chicken	0	6.47	0.52	8%
	9.6	11.39	1.25	11%
Dilution Air (vehicle)	0	-	-	-
	7.8	0.52	0.07	13%
GDI 20 km/h	0	0.40	0.01	3%
	7.8	19.68	1.48	8%
GDI 40 km/h	0	0.41	0.01	3%
	7.8	15.24	0.62	4%
GDI 60 km/h	0	0.42	0.02	5%
	7.8	23.23	4.00	17%

The details of Go: PAM have been added to the SI as following:

> As Figure S1 shows, the flow reactor of Go: PAM is made of quartz glass (1) (Raesh GmbH RQ 200), which is 100 cm long and 9.6 cm in diameter. About 84 cm of the flow reactor may be illuminated by either one or two Philips TUV 30 W fluorescent tubes (2), each radiating about 10 W at 254 nm. It is enclosed in a compartment of

aluminum mirrors to reduce the inhomogeneity of the photon field inside the reactor. The fluorescent tubes and quartz tubes are surrounded by a parabolic trough mirror (3), 90 deg. flat mirror (4) and 45-90 deg. flat mirrors (5). The shell of Go: PAM is composed of a sheath metal cover (6) and square tubing support structure (7).

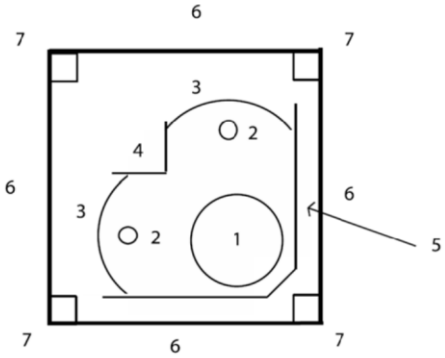

Figure S1. Profile of Go: PAM. (1) 9.6 cm quartz tube (2) fluorescent tube (3) parabolic trough mirror (4)90 deg. flat mirror (5) 45-90 deg. flat mirror (6) sheath metal cover (7) Square tubing support structure

The vehicle exhaust and cooking fume were partly collected from the tailpipe and kitchen ventilator, which means we didn't focus on the total mass of source emission. We focused more on the relative properties and parameters like SOA/POA, elemental ratios and mass spectra which are independent of the total mass of OA.

2.It is not clear to me why different OFR conditions were used in the vehicle exhaust and food cooking experiments. For example, the residence time was 110 s and the RH was 44-49% in the GDI exhaust studies, compared to 55 seconds' residence time and RH = 18-23% in the food cooking studies. This makes it more challenging to directly compare results from the different studies – for example, although there may be overlap in OH exposure between the different experiments, timescales for gas-to-particle condensation and any humidity-dependent heterogenous chemistry are different.

Thanks for the reviewer's careful and patient review. We agree with the reviewer that it is a bit challenging to compare the results from different studies, because many different experiment conditions may make influences on the SOA formation, especially for the gas-to-particle condensation and humidity-heterogenous chemistry. The residence time is influenced by the flow rate of measurement instruments, and the humidity is influenced by the intrinsic property of the vehicle and cooking plumes. We continuously measured several times at each condition, and the standard deviations are shown in the form of error bars in Figure 1-2. The residence time may be long enough for gas-to-particle distribution during each experiment, because their error bars in Figure 1-2 are minor. Assuming that we collect three data groups during one experiment condition, if the residence time is not enough, the last group may leave residual particle or gas phase compounds to the next group, resulting in different measurement results and big standard deviations (large error bars in figures).

Relative humidity can influence the photochemical or aqueous-phase processing of SOA, it is stated that the aerosol liquid water content may show a linear increase as a function of RH (at RH > 60%) during the three seasons in Beijing, indicating the potential impacts of aqueous-phase processing at high RH levels (Xu et al., 2017). Therefore, RH 18-23% or RH 44-49% are both relatively low, and photochemical oxidation may still play the leading role in these two experiments. In the future, we really hope we could strictly control the temperature, RH, and other conditions to deeply investigate how the aerosol ages as a function of equivalent days of atmospheric oxidation, under certain gas-phase and heterogeneous oxidations.

Xu, W., Han, T., Du, W., Wang, Q., Chen, C., Zhao, J., Zhang, Y., Li, J., Fu, P., Wang, Z., Worsnop, D. R., and Sun, Y.: Effects of Aqueous-Phase and Photochemical Processing on Secondary Organic Aerosol Formation and Evolution in Beijing, China, Environmental science & technology, 51, 762-770, 10.1021/acs.est.6b04498, 2017.

3.More detailed information about the gas-phase measurements are necessary to interpret the results. For example, it is not clear to me whether more SOA is formed from aging of vehicle emissions because the VOC concentrations are higher, the SOA yields of those VOCs are larger, or both. Please add table(s) showing the list of VOCs that were measured from each source, their emission factors relative to CO_2, and their OH rate coefficients that were used to calculate the total external OH reactivity.

Thanks for the reviewer's advice. The VOCs are measured at the inlet of Go: PAM in order to determine the OHR. We have divided them into 5 types including alkane, alkene, aromatic, O-VOCs (Oxidized VOCs, mainly included aldehyde and ketone), and X-VOCs (halogenated-VOCs) using the measurement of GC-MS (Gas Chromatography-Mass Spectrometry, GC-7890, MS-5977, Agilent Technologies Inc). The high resolution of gaseous components and their SOA or O_3 yields are not the main focus of this manuscript, and the detailed information of VOCs, S/I VOCs are designed to write another article, so we just list the brief result of VOCs and their K_{OH} in Table S5-S6 here.

Revised text:"The detailed information of gaseous compounds and their KOH can be found in Table S5-S6. The KOH for each specie was taken from the updated Carter research results (http://www.engr.ucr.edu/~carter/reactdat.htm, last access: 24 February 2021)."

Table S4. VOCs measured by GC-MS at the inlet of Go: PAM.

Expriment	TVOCs (ppbV)	Alkane (%)	Alkene (%)	Aromatic (%)	O-VOC (%)	X-VOC (%)
GDI 20 km/h	33	60%	6%	12%	13%	9%
GDI 40 km/h	35	55%	7%	13%	13%	12%
GDI 60 km/h	29	54%	6%	12%	14%	13%
Deep-fried Chicken	139	21%	7%	6%	29%	37%
Shallow-fried Tofu	124	57%	9%	10%	18%	7%
Stir-fried Cabbage	127	48%	8%	14%	21%	10%
Kung Pao Chicken	189	64%	8%	11%	5%	13%

Table S5. K_{OH} of major species in Go: PAM.

Species	**K_{OH} (cm^{-3}·molecules^{-1}·s^{-1})**
Alkanes	
Ethane	2.48E-13
iso-Pentane	3.59E-12
Propane	1.09E-12
n-Butane	2.36E-12
iso-Butane	2.12E-12
n-Pentane	3.79E-12
2,3-Dimethylbutane	5.77E-12
3-Methylpentane	5.19E-12
n-Hexane	5.19E-12
n-Butane	2.36E-12
1,2-Dichloroethane	2.39E-13
2,3-Dimethylpentane	1.50E-12
3-Methylpentane	5.19E-12
Methylcyclopentane	8.60E-12
2-Methylpentane	5.19E-12
2-Methylheptane	7.00E-12
n-Heptane	6.76E-12
Alkenes	
Ethylene	8.52E-12
Isoprene	1.00E-10
Propene	2.62E-11
trans-2-Pentene	6.69E-11
Aromatics	
m/p-Xylene	1.87E-11
Toluene	5.63E-12
1,2,4-Trimethylbenzene	3.25E-11
o-Xylene	1.36E-11
Benzene	1.22E-12
m/p-Xylene	1.87E-11
O-VOCs	
Acetaldehyde	1.50E-11
Acetone	1.70E-13
MTBE	2.93E-12
MethylEthylKetone	1.22E-12
MethylVinylKetone	2.00E-11
n-Hexanal	2.99E-11
Acrolein	2.00E-11
n-Pentanal	2.79E-11
X-VOCs	
Tetrachloroethylene	1.59E-13
MethyleneChloride	1.48E-13
Freon	0.00E+00
Chloroform	1.03E-13
Chloromethane	4.30E-14
Inorganic	
SO_2	9.00E-13
NO_x	1.00E-11

4.L96: A field study at IAP is mentioned here, but it is not clear until much later (L254) that results from this study are (I think) already published in the Li et al. (2020a) paper that is referenced much later in the manuscript.

Thanks for the comments. The field study at IAP is used to compare its ambient OA mass spectra with our laboratory OA mass spectra. It is surely a published result in the Li et al. (2020a), and we used the original data of that published article. It may cause ambiguity, so we have removed the description in the Method section (previous L96) to Discussion section 3.4 (previous L254).

5.L112: Given the presumably large emission factors of unsaturated fatty acids in the cooking emissions, and their corresponding fast reaction rate coefficients with ozone, it would have been useful to conduct control measurements to measure the ozonolysis products of the cooking emissions. Why were those experiments not performed here?

We agree with the reviewer that it would be better to quantify the unsaturated fatty acids and their further influence on SOA formation. However, the AMS, SMPS, or general GC-MS can’t measure the concentration of unsaturated fatty acids emitted from cooking. Unsaturated and saturated fatty acids are important components of cooking emission, but their quantifications are indeed very difficult and time-consuming. Fortunately, in this experiment, online CIMS is operated and we have collected quartz filter for Orbitrap-MS. However, these further analyses need standard materials and complicated MS analysis. We’d like to present these results in other articles in the future.

Whereas, we have done the O_3 oxidation groups during the cooking experiment as Table S7 shows. There is no significant increase in OA mass when we just add O3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). We admit that O_3 itself indeed could influence the formation of SOA, but it is hard to study this topic in this article (we mainly consider O_3 as the material of OH under certain water vapor and UV levels), we hope we can do more comprehensive researches in the future. Besides, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). This estimator could evaluate the potential non-OH reactions in the flow reactor such as the photolysis of VOCs, the reactions with $O(^1D)$, $O(^3P)$, and O_3. Our results showed that non-OH reactions （including direct reaction with O_3） were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. Acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn’t take place during our cooking conditions, and OH reactions still played the dominant role. The revised text in SI is as follows:

Table S7. Comparison of primary (no O3, UV OFF), O_3 oxidation (certain O_3, UV OFF) and OH oxidation (certain O_3, UV ON) results during the cooking experiment.

Experiment	Input O_3 concentration (ppbV)	UV	OH Exposure （$\times 10^{10}$ molecules·cm^{-3}·s)	OA Concentration (μg/m3)	Standard Deviation	Relative Standard Deviation
Dilution Air (cooking)	-	OFF	0	-	-	-
	-	ON	9.6	0.37	0.04	12%
Boiled Water	-	OFF	0	0.04	0.02	44%
	-	ON	9.6	0.36	0.12	32%
Deep-fried Chicken	-	OFF	0	12.30	0.49	4%
	1183	OFF	-	14.50	0.20	1%
	1183	ON	9.6	28.29	2.55	9%
Shallow-fried Tofu	-	OFF	0	13.56	0.68	5%
	1183	OFF	-	14.79	3.25	22%
	1183	ON	9.6	21.70	1.08	5%
Stir-fried Cabbage	-	OFF	0	10.75	0.65	6%
	1183	OFF	-	12.70	0.72	6%
	1183	ON	9.6	18.38	1.65	9%
Kung Pao Chicken	-	OFF	0	6.47	0.52	8%
	1183	OFF	-	/	/	/
	1183	ON	9.6	11.39	1.25	11%

Revised Text:“ Except for the off-line calibration based on the decay of SO_2, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). The OH exposures calculated by both methods showed a good correlation (Figure S1&S2). This estimator could also evaluate the potential non-OH reactions in the flow reactor such as the photolysis of VOCs, the reactions with $O(^1D)$, $O(^3P)$, and O_3. Our results showed that non-OH reactions were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. Acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn’t take place during our cooking conditions, and OH reactions still played the dominant role. Besides, Table S7 shows the comparison of primary (no O_3, UV OFF), O_3 oxidation (certain O_3, UV OFF), and OH oxidation (certain O_3, UV ON) results during cooking experiment. There is no significant increase in OA mass when we just add O_3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). Overall, our Go: PAM could reasonably simulate the OH oxidation process of cooking OA in ambient.”

Peng, Z., Day, D. A., Ortega, A. M., Palm, B. B., Hu, W., Stark, H., Li, R., Tsigaridis, K., Brune, W. H., and Jimenez, J. L.: Non-OH chemistry in oxidation flow reactors for the study of atmospheric chemistry systematically examined by modeling, Atmospheric Chemistry and Physics, 16, 4283-4305, 10.5194/acp-16-4283-2016, 2016.

Ji, Y., Qin, D., Zheng, J., Shi, Q., Wang, J., Lin, Q., Chen, J., Gao, Y., Li, G., and An, T.: Mechanism of the atmospheric chemical transformation of acetylacetone and its implications in night-time second organic aerosol formation, The Science of the total environment, 720, 137610, 10.1016/j.scitotenv.2020.137610, 2020

6.L136: The information in Tables 1-2 indicates that the sample line temperature was 20-25ºC, presumably at or close to room temperature. How did the authors determine that this temperature was sufficient to "prevent freshly warmed gas from condensing on the pipe wall"?

Thanks for the careful review. Vehicle exhaust from tailpipe was first diluted by a gradient heated dilution system (6 fold) and then diluted by a unheated dilution system (5 fold). The temperature of sample flow was near indoor temperature after secondary dilution systems. The cooking fumes was collected through the kitchen ventilator, where the temperature was just a litter higher than that of indoor air. Therefore, it is enough to set the sample line temperature at 20-25℃ in order to prevent freshly warmed gas from condensing on the pipe wall.

7.L137: What are the particle backgrounds when the lamps are turned on with ozone and humidified air flowing through the Go:PAM? Simply flowing dry purified air and ozone through a dark OFR is likely insufficient to clean out the OFR between experiments that employ OH as the oxidant. In this case, the background concentrations are probably significantly underestimated because as soon as the lamps are turned on, there is the potential to generate SOA from the OH oxidation of background contaminants that are not reactive towards O3

We appreciate the reviewer's question. We have done the O_3 oxidation groups during cooking experiment as Table S7 shows. There is no significant increase in OA mass when we just add O3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). We admit that O_3 itself indeed could influence the formation of SOA, but it is hard to study this topic in this article (we mainly consider O_3 as the material of OH under certain water vapor and UV level), we hope we can do more comprehensive researches in the future.

Besides, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). This estimator could evaluate the potential non-OH reactions in flow reactor such as the photolysis of VOCs, the reactions with $O(^1D)$, $O(^3P)$ and O_3. Our results showed that non-OH reactions （including direct reaction with O_3） were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. The acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn't take place during our cooking conditions, and OH reactions still played the dominant role.

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Deep-fried Chicken	-	OFF	0	12.30	0.49	4%
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	1183	OFF	-	14.79	3.25	22%
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Stir-fried Cabbage	-	OFF	0	10.75	0.65	6%
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Revised Text:"Except for the off-line calibration based on the decay of SO_2, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). The OH exposures calculated by both methods showed a good correlation (Figure S1&S2). This estimator could also evaluate the potential non-OH reactions in flow reactor such as the photolysis of VOCs, the reactions with O(^{1}D), O(^{3}P) and O_3. Our results showed that non-OH reactions were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. The acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn't take place during our cooking conditions, and OH reactions still played the dominant role. Besides, Table S7 shows the comparison of primary (no O_3, UV OFF), O_3 oxidation (certain O_3, UV OFF) and OH oxidation (certain O_3, UV ON) results during cooking experiment. There is no significant increase in OA mass when we just add O_3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). Overall, our Go: PAM could reasonably simulate the OH oxidation process of cooking OA in ambient."

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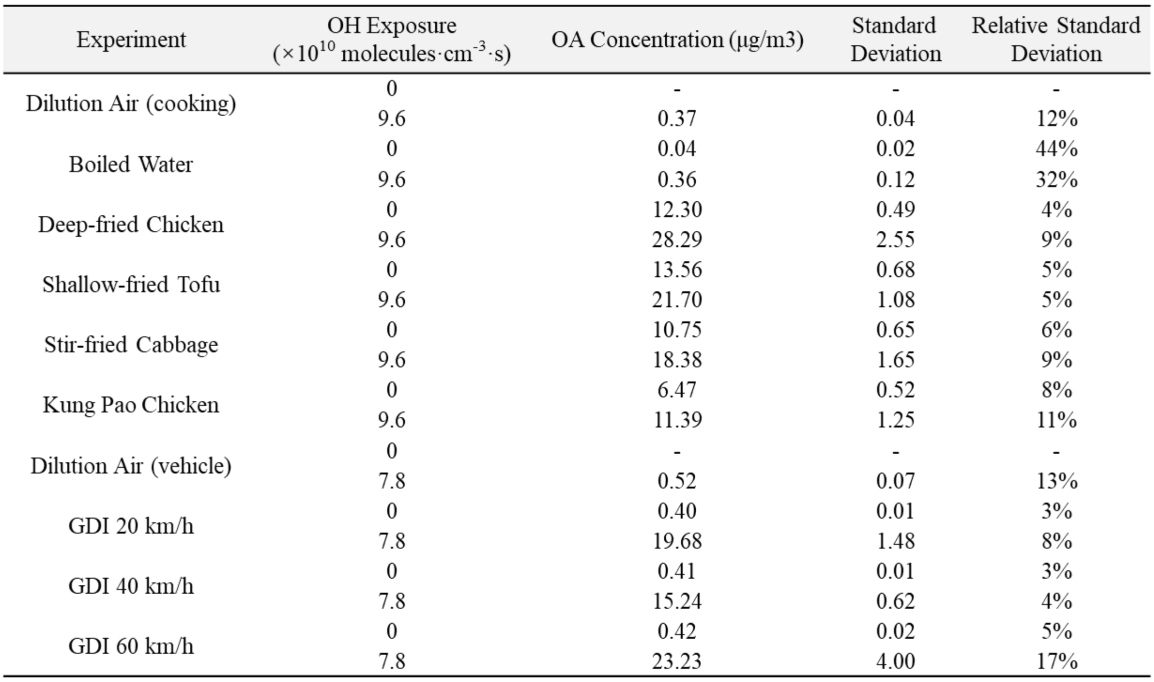
Before each experiment, all pipelines and the Go: PAM chamber were continuously flushed with purified dry air. In order to check our cleaning effect, after the cleaning procedure, we would measure the dilution air results in the Go: PAM, and their results are similar to those dilution air blank results in Table S1, which are far below those of formal experimental groups.

Table S1. Comparison of results between blank and experimental groups (Dilution air and boiled water are two kinds of blank groups. The others are experimental groups.).



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GDI 20 km/h	0	0.40	0.01	3%
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	7.8	15.24	0.62	4%
GDI 60 km/h	0	0.42	0.02	5%
	7.8	23.23	4.00	17%

8.L159: In addition to the OFR conditions that were summarized in Tables 3-4, the actinic flux at 254 nm (or, alternatively, the ratio of O_3 measured before and after photolysis at 254 nm) is also a required input to the OFR254 OH exposure estimator. Please add this information to Tables 3-4 or describe in the text.

As for the vehicle and cooking experiment, the photon flux at 254 nm was 4.5×10^{14} and 2.2×10^{15} photons·cm^{-2}·s^{-1}, respectively. These parameters have been added to SI-section S2.

Revised Text:"As for the vehicle and cooking experiment, the photon flux at 254 nm was 4.5×10^{14} and 2.2×10^{15} photons·cm^{-2}·s^{-1}, respectively."

9.L161-L165: This discussion is confusing and in places incorrect. I don't understand why acetylacetone is mentioned at all if it is not present in the emissions, whereas other specific VOCs that were measured are not discussed here or anywhere else in the paper. Also, I suspect ozone is likely an important oxidant for some species, especially unsaturated fatty acids that are presumably important components of the cooking emissions as discussed in the paper. For example, for oleic acid, at OH and O_3 exposures of 2.7E11 and 5E15 molecules cm^{-3} s (OFR conditions in Line 5 of Table 4), assuming effective OH and O_3 rate coefficients of 3.5E-11 and 2.1E-15 cm^3 molecule^{-1} s^{-1} (Renbaum et al, 2012), the estimated

fractional oxidative loss of oleic acid to O_3 is ~0.55. Thus, O_3 may actually be the major oxidant for several important compounds emitted from the cooking sources.

Thanks for the constructive comments. When it comes to the reason for discussion of “acetylacetone”, because our results showed that non-OH reactions were not significant except for the photolysis of acetylacetone, according to an OFR estimator (Peng et al., 2016). However, there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. The acetylacetone was usually considered as a kind of VOCs emitted from industrial production. Therefore, its potential photolysis wouldn’t take place during our cooking conditions, and OH reactions still played the dominant role.

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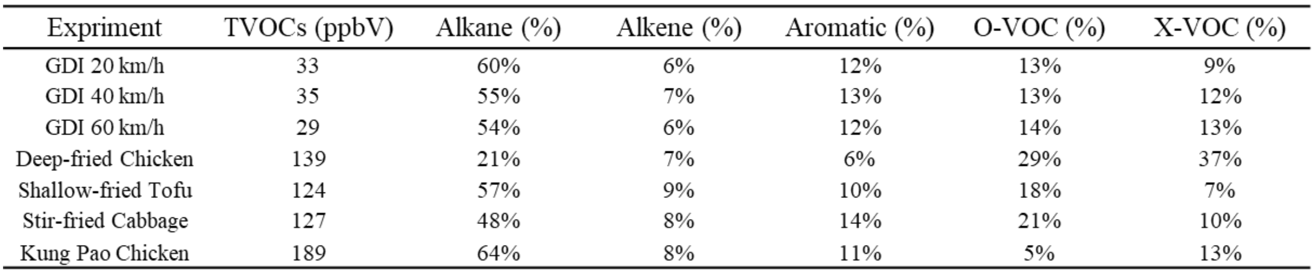
The VOCs are measured at the inlet of Go: PAM in order to determine the OHR. We have divided them into 5 types including alkane, alkene, aromatic, O-VOCs (Oxidized VOCs, mainly included aldehyde and ketone) and X-VOCs (halogenated-VOCs) using the measurement of GC-MS (Gas Chromatography-Mass Spectrometry, GC-7890, MS-5977, Agilent Technologies Inc). The high resolution of gaseous components and their SOA or O_3 yields are not the main focus of this manuscript, and the detailed information of VOCs, S/I VOCs are designed to write another article, so we just list the brief result of VOCs in Table S4 here.

Table S4. VOCs measured by GC-MS at the inlet of Go: PAM.



Expriment	TVOCs (ppbV)	Alkane (%)	Alkene (%)	Aromatic (%)	O-VOC (%)	X-VOC (%)
GDI 20 km/h	33	60%	6%	12%	13%	9%
GDI 40 km/h	35	55%	7%	13%	13%	12%
GDI 60 km/h	29	54%	6%	12%	14%	13%
Deep-fried Chicken	139	21%	7%	6%	29%	37%
Shallow-fried Tofu	124	57%	9%	10%	18%	7%
Stir-fried Cabbage	127	48%	8%	14%	21%	10%
Kung Pao Chicken	189	64%	8%	11%	5%	13%

Fortunately, we have done the O_3 oxidation groups during cooking experiment as Table S7 shows. There is no significant increase in OA mass when we just add O_3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). We admit that O_3 itself indeed could influence the formation of SOA, but it is hard to study this topic in this article (we mainly consider O_3 as the material of OH under certain water vapor and UV level), we hope we can do more comprehensive researches in the future.

Besides, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). The OH exposures calculated by both methods showed a good correlation (Figure S1&S2). This estimator could also evaluate the potential non-OH reactions in flow reactor such as the photolysis of VOCs, the reactions with O(^{1}D), O(^{3}P) and O_3. Our results showed that non-OH reactions（including direct reaction with O_3）were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. The acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn't take place during our cooking conditions, and OH reactions still played the dominant role.

Table S7. Comparison of primary (no O3, UV OFF), O_3 oxidation (certain O_3, UV OFF) and OH oxidation (certain O_3, UV ON) results during cooking experiment.

Experiment	Input O_3 concentration (ppbV)	UV	OH Exposure（$\times 10^{10}$ molecules·cm^{-3}·s)	OA Concentration (μg/m3)	Standard Deviation	Relative Standard Deviation
Dilution Air (cooking)	-	OFF	0	-	-	-
	-	ON	9.6	0.37	0.04	12%
Boiled Water	-	OFF	0	0.04	0.02	44%
	-	ON	9.6	0.36	0.12	32%
Deep-fried Chicken	-	OFF	0	12.30	0.49	4%
	1183	OFF	-	14.50	0.20	1%
	1183	ON	9.6	28.29	2.55	9%
Shallow-fried Tofu	-	OFF	0	13.56	0.68	5%
	1183	OFF	-	14.79	3.25	22%
	1183	ON	9.6	21.70	1.08	5%
Stir-fried Cabbage	-	OFF	0	10.75	0.65	6%
	1183	OFF	-	12.70	0.72	6%
	1183	ON	9.6	18.38	1.65	9%
Kung Pao Chicken	-	OFF	0	6.47	0.52	8%
	1183	OFF	-	/	/	/
	1183	ON	9.6	11.39	1.25	11%

Revised Text:"Except for the off-line calibration based on the decay of SO_2, a flow reactor exposure estimator was also used in this study (Peng et al., 2016). The OH exposures calculated by both methods showed a good correlation (Figure S1&S2). This estimator could also evaluate the potential non-OH reactions in flow reactor such as the photolysis of VOCs, the reactions with O(^{1}D), O(^{3}P) and O_3. Our results showed that non-OH reactions were not significant except for the photolysis of acetylacetone. But there is no acetylacetone from vehicle exhaust or cooking emission according to our measurements and previous studies. The acetylacetone was usually considered as a kind of VOCs emitted from industrial production (Ji et al., 2020). Therefore, its potential photolysis wouldn't take place during our cooking conditions, and OH reactions still played the dominant role. Besides, Table S7 shows the comparison of primary (no O_3, UV OFF), O_3 oxidation (certain O_3, UV OFF) and OH oxidation (certain O_3, UV ON) results during cooking experiment. There is no significant increase in OA mass when we just add O_3 with UV off, comparing to those of OH oxidation groups (input O3 with UV on). Overall, our Go: PAM could reasonably simulate the OH oxidation process of cooking OA in ambient."

Peng, Z., Day, D. A., Ortega, A. M., Palm, B. B., Hu, W., Stark, H., Li, R., Tsigaridis, K., Brune, W. H., and Jimenez, J.

L.: Non-OH chemistry in oxidation flow reactors for the study of atmospheric chemistry systematically examined by modeling, Atmospheric Chemistry and Physics, 16, 4283-4305, 10.5194/acp-16-4283-2016, 2016.

Ji, Y., Qin, D., Zheng, J., Shi, Q., Wang, J., Lin, Q., Chen, J., Gao, Y., Li, G., and An, T.: Mechanism of the atmospheric chemical transformation of acetylacetone and its implications in night-time second organic aerosol formation, The Science of the total environment, 720, 137610, 10.1016/j.scitotenv.2020.137610, 2020

10.L203: The O/C ratio is insufficient by itself to associate the mass spectra of the SOA with ambient PMF factors.

Here, we just make a simple guess in order to introduce the following text, and a direct comparison with ambient PMF factors can be found in Section 3.4.

11.L207 and L227-L228: These statements are too speculative, and references are made to other source characterization studies that are not directly relevant to the sources that were characterized here. Molecular speciated measurements of VOCs were performed with GC-MS as described in L168-L172 that are not discussed in the text. Those measurements should either support (or not) this interpretation of the results. And the fatty acids that are mentioned have high effective OH rate coefficients (e.g. Renbaum et al., 2012), so it is not obvious to me how the statement that "cooking produces more hardly oxidized acids" is justified.

Thanks for the reviewer's comments. The VOCs are measured at the inlet of Go: PAM in order to determine the OHR. We have divided them into 5 types including alkane, alkene, aromatic, O-VOCs (Oxidized VOCs, mainly included aldehyde and ketone) and X-VOCs (halogenated-VOCs) using the measurement of GC-MS (Gas Chromatography-Mass Spectrometry, GC-7890, MS-5977, Agilent Technologies Inc). The high resolution of gaseous components and their SOA or O3 yields are not the main focus of this manuscript, and the detailed information of VOCs, S/I VOCs are designed to write another article, so we just list the brief result of VOCs in Table S4 here.

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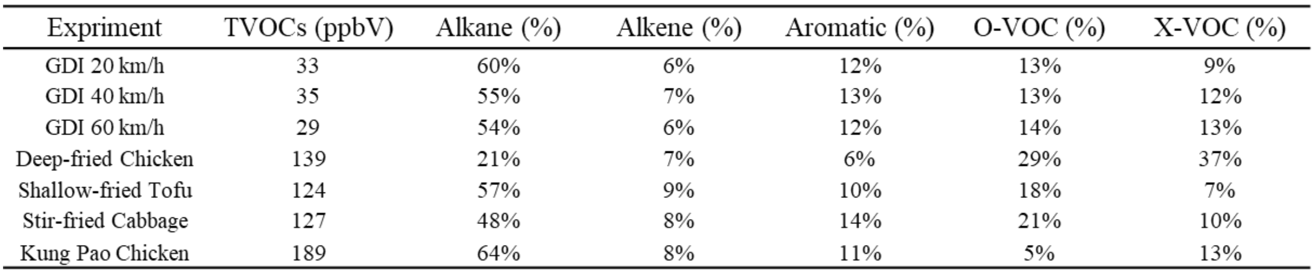

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As the reviewer pointed out, the expression“cooking produces more hardly oxidized acids” is indeed not very appropriate. We found that the cooking SOA had lower SOA mass growth, O/C, and f_{44}, comparing to those of vehicle SOA. However, it is not enough to indicate that“cooking produces more hardly oxidized acids” . Therefore, we have removed this inaccurate expression.

12.L225: Is “souring” a typo? If not, I am not certain what this statement means.

We are sorry that it was a typo. We have replaced “souring” with “increase”.

13.Figures 2-3, 7. I find it confusing/distracting to have two different photochemical age and/or two SOA:POA axis scales on the same figure.

Thanks for the careful review. It is mainly for the beauty of the drawing, so that the data points are distributed as evenly as possible in the center of the picture

14.Figure 6: I think that the numbered symbols represent the integer m/z values of the average vehicular and cooking exhaust AMS spectra, but this should be made clearer in the legend or the caption.

As the reviewer suggested, we have explained them in the caption.

> Revised text“Figure 6. Average mass spectra of OA from two urban lifestyle sources. The numbered symbols represent the m/z values with relatively large fractions. The gray symbols represent the fragments mainly come from hydrocarbon-like fragments and the green symbols represent those mainly come from oxygen-containing fragments.”

References provided by the reviewer

L. Renbaum-Wolff and G. D. Smith, "Virtual Injector" Flow Tube Method for Measuring Relative Rates Kinetics of Gas-Phase and Aerosol Species, J. Phys. Chem. A, 116, 6664−6674, dx.doi.org/10.1021/jp303221w, 2012.

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