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Comparison of primary aerosol emission and secondary aerosol formation from gasoline direct injection and port fuel injection vehicles

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Data correction

Wall-loss correction as well as particle and gas dilution corrections were considered in this study. The details of wall-loss correction are introduced by Du et al. (2017). The real-time instruments sampled from the chamber during the whole photo-oxidation experiment, and zero air was added to maintain a constant pressure inside the chamber. This led to particle dilution that the sampled particles would not be included in the subsequent measurement, and gas dilution that the sampled gas would not participate in the subsequent photo-oxidation reaction and SOA formation. The particle dilution corrected mass concentration $C_{corr,n+1}$ could be calculated as:

$$C_{corr,n+1} = C_{n+1} + \sum_{i=1}^{n}(k_{wall} \times C_i) + \sum_{i=1}^{n}(k_{dilu,i} \times C_i) \quad (1)$$

where C_{n+1} was the measured particle mass concentration at time n+1, k_{wall} was the wall loss decay constant and $k_{dilu,i}$ was dilution ratio at time i.

Then the gas dilution was taken into consideration. The final particle mass concentration $C_{final,n+1}$ could be calculated as:

$$C_{final,n+1} = C_{corr,n+1} - C_1 + \sum_{i=1}^{n}\left(\sum_{i=1}^{n+1} k_{dilu,i}\right) \times (C_{corr,n+1} - C_{corr,n}) \quad (2)$$

References

Du, Z., Hu, M., Peng, J., Guo, S., Zheng, R., Zheng, J., Shang, D., Qin, Y., Niu, H., Li, M., Yang, Y., Lu, S., Wu, Y., Shao, M., and Shuai, S.: Potential of secondary aerosol formation from Chinese gasoline engine exhaust, Journal of environmental sciences, in press.

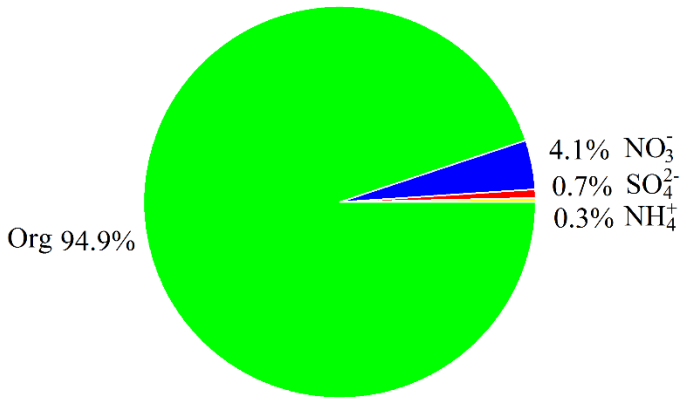

Figure S1. Chemical composition of secondary aerosol formed in the chamber experiment (Experiment GDI-1).

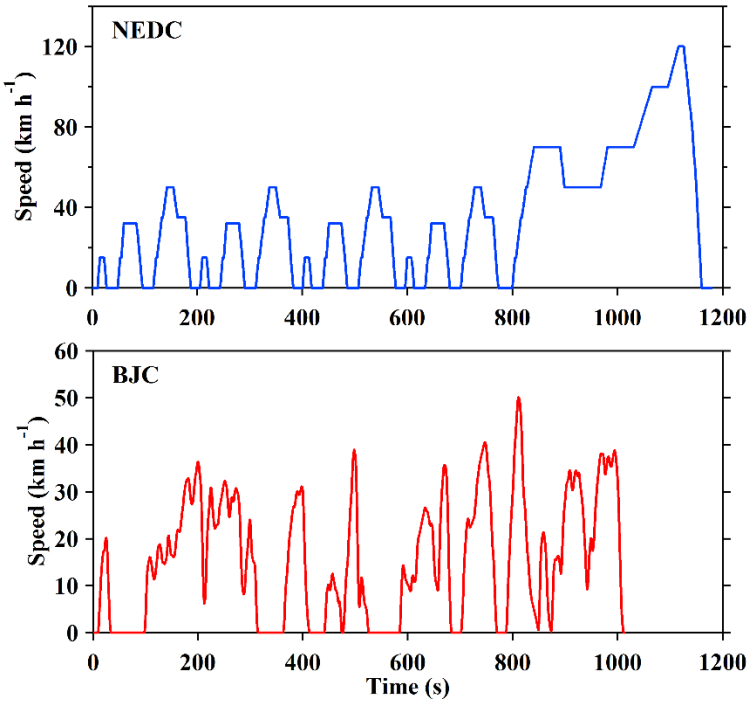

Figure S2. Speed profiles of NEDC and BJC driving cycle.

Table S1 Details of the fuel used in the experiments.

Specifications	Fuel
Density (g mL^{-1})	0.7
Rvp (kPa)	55.4
Aromatics (% v/v)	36.7
Olefin (% v/v)	15.4
Ethanol (% v/v)	0.01
Oxygen (% m/m)	0.02
Mn (mg kg^{-1})	< 0.1
Sulfur (mg kg^{-1})	6
T10 (℃)	55.4
T50 (℃)	109.9
T90 (℃)	164.3
Fbp (℃)	194.4

Table S2 The EFs of Particulate-phase PAHs from GDI and PFI vehicles.

Compound	Emission factor (ng kg-fuel^{-1})	
	GDI	PFI
Napthalene	0.025	<0.0001
1-Methylnaphthalene	<0.0001	<0.0001
2-Methylnaphthalene	0.012	0.004
2,6-Dimethylnaphthalene	0.006	0.003
Acenaphthylene	0.012	0.009
Acenapthene	<0.0001	0.015
Fluorene	0.003	0.105
Methyl-fluorene	0.083	0.105
Dibenzofuran	0.006	0.039
Retene	0.009	0.011
9-Methylanthracene	<0.0001	0.013
Phenanthrene	0.244	0.069
Anthracene	0.048	0.018
Fluoranthene	0.201	0.034
Pyrene	0.246	0.029
Methyl-fluoranthene	0.004	0.007
Benzo[a]anthracene	0.006	0.036
Chrysene	0.020	0.065
Methyl-chrysene	<0.0001	0.007
Benzo[b]fluoranthene	0.034	0.147
Benzo[k]fluoranthene	0.041	0.129
Benzo[e]pyrene	0.028	0.051
Benzo[a]pyrene	0.012	0.041
Benzo[ghi]flouranthene	0.095	0.027
Cyclopenta[cd]pyrene	<0.0001	0.032
Dibenzo[a,h]anthracene	<0.0001	<0.0001

Picene	<0.0001	<0.0001
Perylene	0.009	<0.0001
Benzo[ghi]perylene	<0.0001	<0.0001
Indeno[1,2,3-cd]pyrene	<0.0001	<0.0001
Coronene	<0.0001	<0.0001
Sum PAHs	1.144	0.994