

Response to reviewer's comments

The paper has been improved significantly, now I see that the story is mainly about nucleated particles which can grow into accumulation mode and contribute to PM_{2.5} mass concentration. Regarding this, there are still a few things I'm not sure I have understood well.

Response: We appreciate the reviewer for reviewing our manuscript and for the valuable suggestions, which we will address point by point in the following.

1. You mentioned in the abstract that CS declined during LCD period, while accumulation mode particle number and PM_{2.5} concentration have both increased. This is not very usual, could you provide some information. Is it due to very low concentration of Aitken mode particles?

Response: The mean size distribution of CS was calculated and it showed the CS was mainly contributed by the accumulation mode particles (100-1000 nm). The accumulated particles can contribute to approximately 85% to the total CS in sub-micron size. Although the Aitken mode had larger number concentration, the contribution to CS and PM_{2.5} mass concentration was minor as the small particle size.

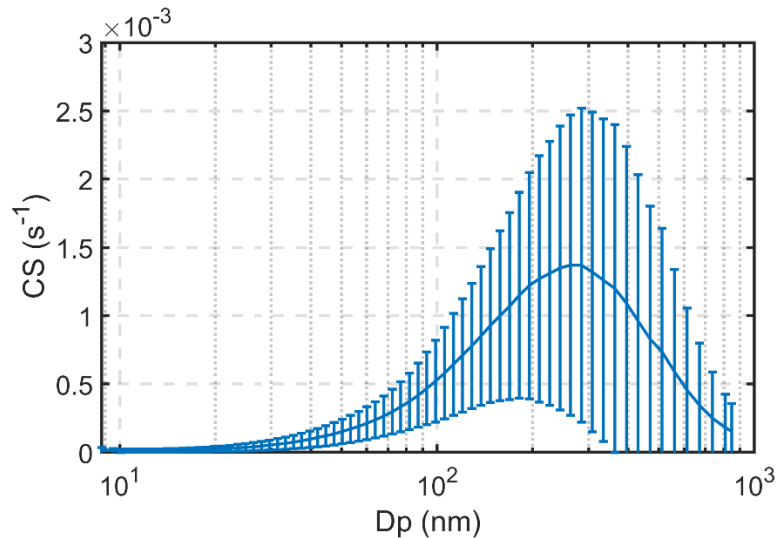


Fig. 1. The size distribution of condensation sink (CS) during the measurement. The solid line and error bars represent the mean value and standard deviation.

2. You are referring to Guo et al.,2014, where they first came up to the idea that nucleated particles could contribute substantially to PM_{2.5} concentration in polluted area. However, is it still valid in this case? As already mentioned in question 1, Aitken mode particles have decreased. Why do nucleation mode increase and grew, but skipped the Aitken mode and entered accumulation directly? Maybe it would be worthy to focus on a single cases, since statistics on 2 months could result in misleading numbers.

Response: A specific case occurred on Feb 4th-14th was analyzed to discuss the influence of NPF event on the elevated PM_{2.5} mass concentration. For this case, the Aitken mode particles on Feb 4th-6th increased due to the NPF event, and then decreased as the particles grow into the accumulation mode. As mentioned above, the accumulation mode was the major contributor to the PM_{2.5} mass concentration. It was also reported by Kulmala et al (2021) that 65% of haze particles on hazy days were resulted from NPF based on one-year dataset in Beijing. However,

as the reviewer questioned, more robust confidence and quantitative evaluation of the NPF influence on the air pollution should be conducted by model work and long-term measurement in the future work. In the abstract, we addressed that the specific pollution case related with the NPF event could occur under the unfavorable meteorological conditions.

Ref:

Kulmala, M., Dada, L., Daellenbach, K. R., Yan, C., Stolzenburg, D., Kontkanen, J., Ezhova, E., Hakala, S., Tuovinen, S., Kokkonen, T. V., Kurppa, M., Cai, R., Zhou, Y., Yin, R., Baalbaki, R., Chan, T., Chu, B., Deng, C., Fu, Y., Ge, M., He, H., Heikkinen, L., Junninen, H., Liu, Y., Lu, Y., Nie, W., Rusanen, A., Vakkari, V., Wang, Y., Yang, G., Yao, L., Zheng, J., Kujansuu, J., Kangasluoma, J., Petaja, T., Paasonen, P., Jarvi, L., Worsnop, D., Ding, A., Liu, Y., Wang, L., Jiang, J., Bianchi, F. and Kerminen, V. M.: Is reducing new particle formation a plausible solution to mitigate particulate air pollution in Beijing and other Chinese megacities?, *Faraday Discuss*, 226: 334-347, DOI: 10.1039/d0fd00078g, 2021.

Minor comments:

The group of organics called organics was even still not discovered by the Atkinson paper. I would suggest to cite the Ehn et al.(2012) and Bianchi et al.(2019) paper when you include HOMs, but what I would prefer is to delete all terms called HOMs and change them to oxidized VOCs or oxidized organics, since that is more exactly what is discussed here.

Response: The terms "HOMs" in the manuscript have been replaced by "oxidized VOCs" as reviewer recommend. The sentence has been revised to "The major pathways of oxidized VOCs formation are the oxidation by O₃, OH and NO₃ radicals (Ehn et al., 2012)".

Writing has also improved, but please continue to check typos like "adpotted" and correct them.

Response: The spelling and grammar have been checked and corrected all through the manuscript.