

Reviewer comments/suggestions are in *italics* font and our responses are in **bold**:

Comments of Reviewer #2:

This study shows the dependency of PAH fraction on particle size. The authors try to explain the sorption mechanism and the aging in the atmosphere and evaluate the cancer risk through inhaling. Furthermore they study the source of PAHs related to particle size.

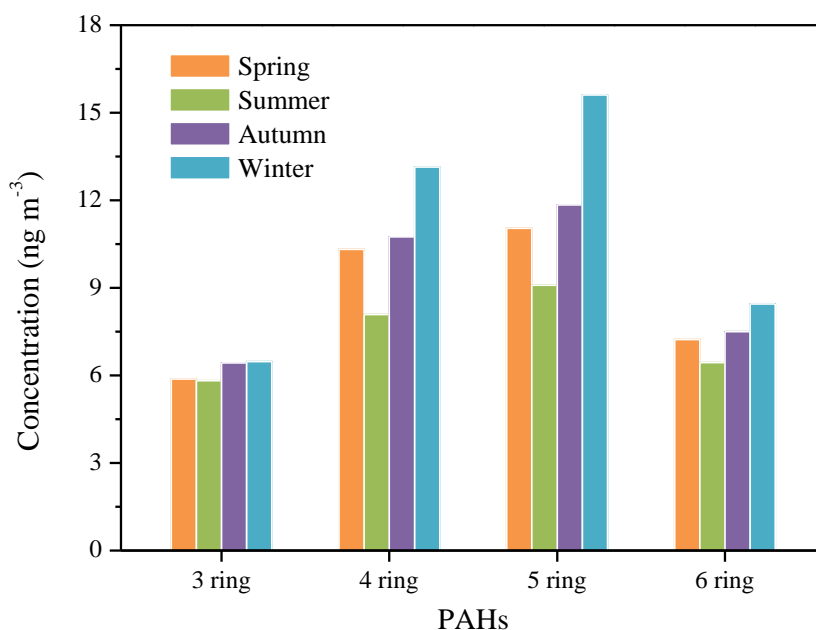
Overall message: the topic is very interesting, but the article should be edited. The issues need to be explained in a more understandable way.

They show clearly that PAHs mainly adsorb on smaller particles, which will penetrate deeper into the respiratory system and might cause cancer.

R: The authors appreciate the reviewer’s comments and the paper has been revised accordingly.

The seasonal variations, they describe and show in fig. 2, seem not to be crucial. If they are significant, maybe they can plot it in a different, more clear way.

R: We agree with the reviewer’s suggestion and changed Fig. 2 accordingly.



(New) **Fig. 2.** Seasonal variation of 3 to 6 ring PAHs.

What do you want to show/tell with fig. 4? Is it just PAH/PM decrease with bigger particles? Because this message is already shown in fig. 3.

R: This issue is no longer relevant in new revision. We have removed the original “Fig. 4”.

I don't understand the link between decreasing PAH/PM and BaA/CHR with size and aging process. (page 20823, line 13-15 "This indicates that: : :") You don't know (or at least you don't write it) the initial ratios at the source so you don't know the changes. In general, like you write, the aging process results in decreasing ratios, but that would mean that the ratio for smaller particles decrease faster than for bigger, as smaller particles have a longer lifetime and are transported longer, so there is more time to be aged.

R: We are not quite sure how to respond to this statement because we think that the "time scale" are related. If we have "time scale" data, it will be easy to explain the particle aging. However, the "time scale" data are difficult to be obtained from the normal field observation. When no time scale data are available, most researchers describe particle aging through other indirect methods. PAH/PM and BaA/CHR employed to evaluate aging process are based on published papers on the particulate PAHs of field experiment (*Atmos. Res.*, 2005, 78, 190-203; *Atmos. Environ.*, 2007, 41, 2061-2072.). In our paper, the values of PAH/PM and BaA/CHR exhibited a similar variation, indicating PAH species are indeed involved in the particle distributing and aging process at a certain extent.

Fig 6 shows clearly that many mechanisms are involved at the sorption process.

R: Thank you.

The analysis done within the statistics is unclear. Which parameters are used to predict PAHs? Physical and chemical properties? The measured and the predicted values match each other well, but what is the conclusion?

R: The authors appreciate the reviewer's concern on the statistics analysis. We offer the following explanation, PLS model can show the predicted particle size distribution of PAHs based on the observed (measured) ones. These predictions are not de novo predictions, since all the data are part of the observed set. Nevertheless, these predicted results do validate the model effectiveness and the measured data reliability based on the values of R^2 and Q^2 .

What is the benefit of section 3.4? Why is it important to know the sources of PAH in different particle sizes (fig 10)?

R: Section 3.4 aimed at source apportionment of PAHs in different particle sizes. Through the description of section 3.4, we can obtain the source factor contributions to size-resolved particles, and further understand which source has considerable influence on respiratory deposition.

You should explain the meaning of the value of LCR. (6.3 people out of 10000000 people get cancer or how to read it???)

R: Certainly. If the LCR value is 2×10^{-6} , it means 2 people out of 1000000 people get cancer.

Language/spelling/grammar

What do you mean with less- and more-ring PAHs? Better describe it with the ring number, or molecular weight – less ring e.g. 2-4(?) -ring, : : :

R: Revised as suggested.

Page 20816, line 11: Aitken (not aitken) Fig. 4: Aitken mode (not Akiten)

R: Revised as suggested.