Response to Prof. Szabolcs Nagy's opinion on the PhD dissertation entitled "Ecotoxicological profiling of PM generated by urban heating and transport"

First, I would like to thank Prof Szabolcs Nagy for taking time to evaluate my PhD dissertation and giving his comments, suggestions and questions related to it.

Response to the comments:

1. **General comments**

I am really sorry for typing and grammar errors.

- **The Abstract ends with unclear statements, which sound rather unfinished: "Based on analytical measurement and Vibrio test outputs, indoor PM in each non-smoking household appears and elevated risk to inhabitants.**

I have made a grammar mistake, the sentence was meant to read as follows: Based on analytical measurements and Vibrio test outputs, indoor PM in each non-smoking household appears to pose elevated risk to inhabitants.

- **The results of the dissertation reveal that the whole-aerosol had excellent discriminative power in different environments." – a last round of proofreading was missing here.**

This sentence was meant to summarise the final outcome of the PhD work and its correct form is: The results of the dissertation reveal that the whole-aerosol test had excellent discriminative power in different environments.

- **In my previous review I criticized the quality of the figures. Although the Candidate did try to make his figures similar, the dissertation still contains several figure styles, including unnecessary 3D (fig.22.). Figure 15. shows three data points only, in my previous review I suggested that these should be presented in the text only (in the previous version these data were shown on a figure and presented in the text as well – I criticized the double presentation). The Candidate decided to keep the figure and erase the text – the opposite of my suggestion.**

Figure 22 was published in *Sainnokhoi et al. 2022. Characteristics of particle-bound polycyclic aromatic hydrocarbons (PAHs) in indoor PM2. 5 of households in the Southwest part of Ulaanbaatar capital, Mongolia. Environ. Monit. Assess. 194 (9), 1–21.*

https://doi.org/10.1007/s10661-022-10297- 0). In the dissertation I used the published format. Considering Figure 15, I agree that it does provide only redundant information.

- **Subchapter 6.5.1 contains strange units of measure (μg m_3) – what does that mean?**

I apologize for the typing error, it should be μg m^{-3}.

Response to question(s)

- My question is – considering the highly toxic nature of the indoor air samples collected in rural Mongolia, is there any possibility to improve the quality of life of those who live under such conditions? If yes, what kind of actions should or could be carried out?

Two technological/technical solutions have been suggested by the government. In order to reduce indoor air pollution and to improve life quality of ger inhabitants, top-lit-updraft design (TLUD) stove models (generally referred to as 'improved' stoves) were introduced through the Energy and Environment Project, partially subsidized by the Asian Development Bank. At this moment we are analyzing indoor samples collected in the so-called Ger (yurt) district of Ulaanbaatar where app. 98% of households consume solid fossil fuel (mainly coal). Unfortunately, our preliminary results indicate that PAH emissions of improved stoves are not significantly better. This corresponds with the findings of Lim et al. (2018).

The use of raw coal is also prohibited. Comparative studies reported in the literature, however, suggest that PAHs emissions from honeycomb briquette might be higher than emissions generated during combustion of raw coal chunks (e.g. Wang et al. 2016). In our recent study households investigated used briquette but we detected extremely high PAHs emissions in some cases, with the prevalence of highly toxic and mutagenic 5-6 ring PAHs.

The problem is aggravated by the fact that since 2000, large number of Mongolians has moved from the rural areas to the city in order to have access to quality education for families, a healthcare system, and to seek for better job opportunities. Many newcomers to Ulaanbaatar's capital are herders who lost their livestock in the harsh winter climate. As such, app. 60% of the population of Ulaanbaatar live in yurts in the so-called Ger districts of Ulaanbaatar.

- *Lim, M., Myagmarchuluun, S., Ban, H., Hwang, Y., Ochir, C., Lodoisamba, D., & Lee, K. (2018). Characteristics of Indoor PM2.5 Concentration in Gers using Coal Stoves in Ulaanbaatar, Mongolia. In. J. Environ. Res. Public Health, 15(11), 2524.*
- *Wang, Y., Xu, Y., Chen, Y., Tian, C., Feng, Y., Chen, T., & Zhang, G. (2016). Influence of different types of coals and stoves on the emissions of parent and oxygenated PAHs from residential coal combustion in China. Environmental Pollution, 212, 1-8.*

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