EGUsphere, author comment AC1
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Reply on RC1

Jan M. Michalik et al.

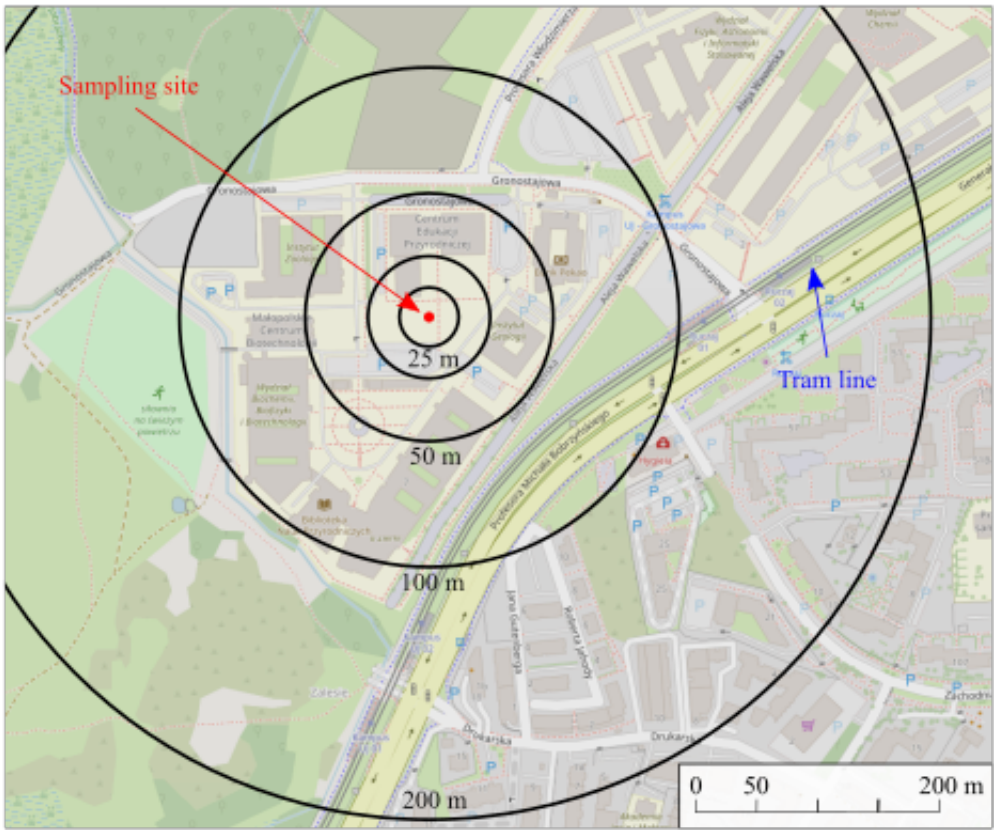
Author comment on "Magnetic fraction of the atmospheric dust in Kraków – physicochemical characteristics and possible environmental impact" by Jan M. Michalik et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-462-AC1, 2022

Authors are very grateful for his/her work on reviewing our submission and for his/her positive report. The changes suggested by the Reviewer as "technical comments" are being included in the revised version of the manuscript. Below we present our response to points raised by the Reviewer as "Specific comments".

1) More details in the Method section would be valuable, e.g.:

1a) [Lines 58-63] More info re sampling site. Is it next to a busy street? How far from the street curb? How busy this street is? How many lanes? What is the traffic volume? Etc.

According to Google Maps distances (straight lines) to places related to personal/public transport are as follows:
I. 125 m to the nearest tram lane (separated by at least 5 m tall noise barrier and 3 storey buildings with 35 m wide gap between them);
II. 142 m to the nearest two lane street (separated by at least 5 m tall noise barrier and 3 storey buildings with 35 m wide gap between them);
III. 35 m to the car park (12 parking spots approximately)
IV. 40 m to the car park (30 parking spots approximately; mostly hidden on the other side of the 1,5 storey building)
V. 60 m to the car park (20 parking spots approximately)
VI. 25 to the closest car park (20 parking spots @ 25 m distance, 20 parking spots @ 35 m, 20 parking spots @ 45 m approximately)
VII. 50 m to the car park (20 car parking spots and 8 bus parking spots approximately)
VIII. 50m to the car park (30 parking spots approximately)
We have decided to add a figure with a situation map (attached) and not a list like the one above, but we are opened for suggestions.



1b) [Lines 70-80] It is unclear how the samples were collected and dispersed in isopropanol. Was the PVC foil ultrasonicated in isopropanol? For how long?

Outer layer of the PVC foil was carefully cut through one of the edges. As the material was mostly stuck to its surface (importantly the vast majority of thin blackish phase was so) is was sonicated for 15 minutes in IPA, then carefully washed with IPA keeping the volume of the liquid as low as possible in order to control the sample in easier way.

1c) [Lines 82-88] What kind of powdered samples? Were they collected separately from these collected with magnets and PVC foil?

The sentences could have been misleading. First (82) refers to the fact that these were powder - ground in order to make them homogenous in terms of gran sizes samples. As this fact shall be obvious the sentence can be removed. Starting form (85) it refers to the fact that the samples have been milled in order to separate Fe (magnetic) containing phase form surrounding matrices.

2) Some discussion on advantages and disadvantages of this kind of sampler would be interesting. There are obvious benefits of such a system (e.g. simplicity, low workload required, etc.) but also some drawbacks (e.g. very poor temporal resolution, dependence on the weather, etc.). From a practical side, how big is the system? How much material (mass? volume?) was collected in the 9 months of sampling? This kind of discussion would be interesting regarding the potential use of such passive sampler instead of 'active'

vacuum-based PM10/PM2.5 samplers.

We agree with the following issues raised by the referee: the temporal resolution is very poor. In fact 9 months of collection can cover up some seasonal variations. However particles we are tracing are formed in high temperature industrial processes and winter/summer differences are not that straightforward as in the case of soot just to give an example. Then we designed the sampler in the way it is not affected by rain/snowfall (at least it "active" part).
Practical aspects
- Size: 50 x 100 mm (for the "collecting area", but that would depend on the single magnet size. Given the results I would say that keeping the magnets as small as possible in order to have better "single magnet edge" to "single magnet surface" ratio and thus better field gradients shall lead to better results. However with smaller magnets mechanical stability (bending for example) would be poor so the overall surface shall be smaller. Then the rest of the design can be adapted to the needs.
- The volume of the material is really small. In fact part of the material was used for chemical analysis and magnetic measurements so was either lost in process or partially lost in holders. It was also far to small quantity for easy sample preparation for Mossbauer spectroscopy (filler was needed to add volume). Also SEM/EDX analysis require the material to be used just for that purpose. For next study / as a suggestion I would propose somehow bigger active area.

3) [Lines 179-198] Interesting discussion on the sources of the magnetic particles. It is indeed challenging to unambiguously determine the source of these particles (it is most probably a mixture of several sources). High concentration of Cu and Zn in some of the particles might suggest the non-exhaust vehicle sources (brake- and tyre-wear). Was Ba analysed? Its presence would also suggest the brake-wear as the source.

We are currently working on the follow-up study related to the brake-wear particles, coal combustion etc. Certainly it is a challenging task but we believe that based on the data presented in the manuscript under consideration, large scale ongoing and planned studies, recent results and available published data we can elaborate conclusions regarding the magnetic micro- and nanoparticles. Also I would like to comment that the manuscript under revision may serve as an invitation for collaboration for groups studying similar problems but having more specific experience (e.g. metallurgy, road transportation, rail transportation, aerosols in general, etc.)
The presence of Ba is mentioned in line 223. It is usually accompanied by S and it can suggest that it is related to coal combustion. The highest measured Ba content was 4.82wt%; usually is lower.

3a) [Lines 199-205] Well, high concentrations of Fe oxides can be also derived from vehicular brake systems, as shown in several recent studies so it would be also worth considering this potential source as the concentrations of magnetite (and other Fe-rich minerals) in brake-wear PM can be even an order of magnitude higher than in emissions from industrial processes! Also, more details on the sampling site location would provide more information on this topic (cf. comment 1 on the Method section).
The possibility of the emission of Fe-rich particles from brake-wear is mentioned in line 197. Without detail results of chemical and morphological analysis of brake-wear origin particles we withheld the discussion.

We would also like to add tha table with EDX analyses results (.pdf file attached) as a Supplementary Information.

Please also note the supplement to this comment:
https://egusphere.copernicus.org/preprints/2022/egusphere-2022-462/egusphere-2022-462-AC1-supplement.pdf