EGUsphere, referee comment RC2
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Comment on egusphere-2022-462

Anonymous Referee #2

Referee 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-RC2, 2022

General comments.

A. It is unclear what the purpose of the research presented was: whether the purpose of the manuscript is to present a novel way to sample the magnetic fraction or whether the purpose of the manuscript is to thoroughly characterize the magnetic fraction of dust found in the urban atmosphere. In the first case, the manuscript needs to be supplemented at least with a detailed description of the device's design and, finally, with an evaluation of its performance based on a comparison of the results with those from other methods as well as a recommendation for further research. Otherwise, it should be justified that this single sampling site is representative of the content and composition of magnetic fraction in the air.

The purpose of the work should be defined in the last paragraph of Introduction section, which is missing here.

B. Introduction

The Introduction lacks a final paragraph stating the goals/objectives of the work. Also, the Introduction lacks a paragraph discussing potential sources of magnetic particles (which is discussed in the Results section, among others).

I suggest rewriting the Introduction section providing the information in the following order: characteristics of magnetic fraction in air dust, known sources, known health effects, known environmental effect, various methods of sampling, and then the “last paragraph of Introduction”.

C. Conclusions

Please comment on the novelty of the sampling method proposed. Would you suggest wide application of this design and methodology? What are pros and cons?

D. The characterization and discussion of the results is strongly biased toward spherical particles. Please acknowledge the presence of angular particles derived simply from rust. The word "rust" is not even used in the text. Rust is probably the main source of Fe-rich particles in urban environment. What is their relation to the magnetic fraction? Are you sure no hematite or goethite particles accompany the magnetic fraction? Please supplement the text with relevant observations, comments, and literature data.

Specific comments:

- Line 49 – chemical formula of SO2 needs correction

Line 57:

Magnetic fraction collection

- please expand and rephrase the description by stating, among other things, what size the individual magnets were, how many of them, what the total collecting area was, why the sampler was placed in such a way (vertically, at a height of 1.5-1. 7m), why the sampler was placed in such a location (whether the location was chosen deliberately because of existing knowledge of air pollution in the city or because of convenience), why collection lasted 9 month, which part of the year (seasons), whether the surface was protected from precipitation from above, whether the direction of the vertical collecting surface was directed in the direction of the most common wind direction, how far the grass-covered ground surface reached, whether there are potential sources of magnetic particles in the area, how far away were potential close-range sources (e.g. streets,

streetcar lines) and long-range sources, etc. Is it possible to show a photo of the sampler or installation?

- The information provided in Figure 1 is not discussed or explained in the text. Why were magnetic field measurements and simulations performed, how do they compare, what is their relevance to the predicted performance of the sampler design, how do these measurements and simulations support the predicted performance of the sampler, to what extent was this confirmed by the observed distribution of magnetic particles on the PVC film (Fig. 1 D and E), etc.?

Line 83

The powdered samples were placed on single-crystalline silicon no-background holders.

Does this mean that the sample was ground before analysis, or was it analyzed as is?

Lines 85 – 87

This separation process, for obtaining a laboratory concentrate of the magnetic fraction, is no different from obtaining the magnetic fraction from dust samples collected with classical samplers. Please include such a comment in the text, here or in Conclusions, so that it is clear that for this analytical method the proposed way of sampling atmospheric dust did not give positive effect.

Line 87

The collected diffraction patterns were analysed in terms of the Rietveld method using the FullProf Suite Package (Rodríguez-Carvajal, 1993).

What does it mean: phase identification or quantitative analysis, or both? Please add in

the text.

What was the resolution of the collected diffraction pattern? Was it sufficient for proper analysis by the Rietveld method? Please add in the text.

Lines 90 – 96

Please provide the following information in the text:

Did you use a separate subsample of the material collected on the PVC film, different from the sample used for XRD? How did you split the sample to ensure its representativeness? Did you use a method of concentrating the magnetic fraction similar to that used in XRD measurements? What was the size/mass of the sample used for magnetization measurements? Was it sufficient to make the measurement? Was it a separate subsample, or material previously used for other measurements? Please provide this information in the text.

Line 99

What was the total mass of material collected over a period of 9 months on the ... mm^2 of the sampler?

Line 104

Instead for:

The results of the XRD studies (Fig. 2) suggest that the separated fraction

There should be:

The XRD results (Fig. 2) suggest that the magnetic fraction separated from the collected sample

Lines 106 - 107

Precise analysis of the profile of magnetite reflexions in the XRD pattern suggest the distribution of various elements at the Fe-sites (e.g. Cr, Mn, Co, Zn) as typical of naturally abundant ferrites (Fig. 2).

Please elaborate, it is not clear from this sentence which part of the curve and which observation or which part of Fig. 2 leads to this conclusion.

Lines 112 – 114

Please move this part of the text (discussion of SEM results, grain size and morphology) to line 103, so that SEM results are together, followed by XRD results.

Line 215

Instead for

Fe- rich particle

It should be

Fe- rich particles

Line 236

Domains with the magnetite ordering reach the size of 10 nm (Fig. 5G, H).

Please elaborate and explain what information relevant to the topic of this study was gained from HRTEM analysis and results presented in Fig. 5H? magnetite was identified already using several other methods.

Please move Figure 5 to a place below the text discussing its content.