Response on RC1 (Round 2)

about manuscript:

"Measurement Report: Seasonal trends and chemical speciation of chromium(III/VI) in different fractions of urban particulate matter – a case study of Radom, Poland" Monika Łożyńska, Marzena Trojanowska, Artur Molik, Ryszard Świetlik.

Thank you very much for the suggestions and comments contained in the review. All suggested changes have been included in the manuscript. Answers to the comments are presented below:

Specific Comments:

Abstract

- Line 18: Change "varied a lot…" to "varied from a low in summer (…) to a high in winter (…).". Consider adding a sentence to the end of the abstract highlighting the importance of this measurement report.

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 16-17): The Cr(VI) share in PM in the particular seasons varied from a low in summer (9.1% of Crtot) to a high in winter (40% of Crtot). A concluding sentence has also been added. Current version (lines 21-22): The studies presented in manuscript fill the research gap of chromium and hexavalent chromium measurements in particulate matter of different sizes in the air of a medium-sized city in central Poland.

Introduction

- Line 36: Add the word "mostly" after the parenthetical to say PM2.5 "mostly comes from anthropogenic processes".

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 30-32): The particulate matter's coarse fraction (2.5-10 μm) is assumed to be of natural origin, while the fine fraction (0.1–2.5 μm, especially the particles of less than 1 μm) mostly comes from anthropogenic processes (Nocoń et al., 2018).

- Lines 65 – 66: Delete the first sentence of this paragraph, as the second sentence regarding average atmospheric concentrations of Cr is more specific and relevant.

Authors' response:

At the reviewer's suggestion, the sentence has been removed.

- Line 71: After "Cr(VI)" add the words "concentrations in the United States" for clarity.

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 62-63): According the US EPA National Air Toxics Assessment in 2017, the median, mean, and maximum Cr(VI) concentrations in the United States were 0.03 ng/m3, 0.1 ng/m3 and 3.18 ng/m3, respectively (Proctor et al., 2021).

- Line 78: Change "unavailable" to "limited".

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 67-69): Although chromium occurrence in urban air has been extensively studied and a range of publications have appeared recently (Catrambone et al., 2013; Widziewicz et al., 2016; Nocoń et al., 2018), investigations of total Cr occurrence and its valence speciation in particulate matter of different particle sizes are still limited.

Experimental

- Line 93: Consider adding tanneries to this list, as mentioned at the end of the introduction.

Authors' response:

Thank you for your comment. Tanneries have been added to the list. Current version (lines 82-83): The local sources of chromium emissions are: road traffic, coal burning in homes, coal-fired municipal heating plants, tanneries and multiple metalworks.

- Line 100: It is very helpful to see the weather data separated by sampling week. However, precipitation is still missing from Table S2. This is important to include as it informs the reader how much chromium might have been lost due to wet deposition over that sampling period.

Authors' response:

Following the reviewer's suggestion and the comment in 'General Comments', Table S2 has been supplemented.

- Line 104: Per the author's "Reply on RC2", this air rate should be changed to state "The sampling rate was maintained at approximately 6 m3/h."

Authors' response:

Thanks for your comment. The flow rate data has been changed. Current version (line 94): The sampling rate was maintained at approximately 6 m^3/h.

- Line 105: Change the word "weight" to "precision" for clarity of the instrument used.

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 95-96): The filters were weighed before and after sampling, the precision was 0.01 mg (Microbalance MX5 Mettler Toledo) in a temperature and relative humidity controlled environment (20±3°C and 50±10%, respectively).

- Line 145: Per the author's "Reply on RC2", revise or add an additional sentence that since "the recovery is high enough (Cr - 95.2% and Cr(VI) - 99.3%) and our results are not related to" enforcement," the data presented in this report are uncorrected for sample recovery efficiency. If only presented here, it should be clear that the claim refers to both Crtot and Cr(VI).

Authors' response:

At the reviewer's suggestion, sentence has been added. Current version (lines 134-136): The recovery is high enough (Cr - 95.2% and Cr(VI) - 99.3%) and our results are not related to the enforcement analysis, which is why the data presented in this report are uncorrected for sample recovery efficiency.

Results

- Line 187 – 194: This new section is very helpful, but would be better suited to be added as a final paragraph to the preceding section (3.1) since it refers to all PM, not just Cr. The authors could add a sentence in this paragraph in Section 3.2 that suggests Cr levels in PM are decreasing due to the same reasons that PM is decreasing, as well as the role of their current sampling location. This is already

mentioned in lines 208 – 210, though, so an additional statement in Lines 187 – 194 may be unnecessary. (Comment from the "Technical Corrections")

Authors' response:

Thanks for your comment. The paragraph "It should be..." has been moved to section 3.1. In section 3.2 (lines 171-177), an appropriate explanatory sentence has been added (lines 184-186): In Poland, the concentrations of Cr in the PM, similar to the particulate matter concentrations, decrease every year thanks to the use of state-of-the-art, efficient and environmentally friendly technological solutions.

- Lines 304 – 305: This change mentions "is likely to cause carcinogenic effects in the future from lifetime exposure" which should be changed to "poses a substantial risk of carcinogenic effects from lifetime exposure".

Authors' response:

As suggested by the reviewer, the sentences have been corrected. Current version (lines 286-289): A carcinogenic risk value above the upper limit (1·10-4) suggests that chromium(VI) in atmospheric particulate matter poses a substantial risk of carcinogenic effects in the future from lifetime exposure, while values below the lower limit (1·10-6) do not pose a significant risk. HQ below one suggests no significant risk of non-carcinogenic effects.

- Lines 311 – 313: The sentence "The World Health Organization…" should be deleted here as it is a repeat of the sentence on Lines 258 – 260.

Authors' response:

At the reviewer's suggestion, the sentence has been removed.

Technical corrections:

Thank you so much for all your suggestions. The authors agree with all the reviewer's comments in the "Technical Corrections" section. All suggested changes are incorporated into the manuscript.

With gratitude

Monika Łożyńska