

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-153

Anonymous Referee #2

Referee comment on "Behavior of KCl sorbent traps and KCl trapping solutions used for atmospheric mercury speciation: stability and specificity" by Jan Gačnik et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-153-RC2>, 2021

This manuscript conducted several experiments to study the collections of GOM and GEM by several potential GOM traps (e.g., KCl crystal, KCl impregnated quartz wool, and KCl solution). The results are helpful for better understanding of artifacts of GOM sampling using KCl sorbent traps, which would contribute significantly to the sampling method of GOM in future studies. This manuscript is well written and organized. The use of radioactive tracer (^{197}Hg) is novel. I would suggest a minor revision of this manuscript before the publication in AMT. Some of the comments are listed below.

Line 16-18: the stability test of Hg(II) showed a highest loss of 5.5% (mostly around 1-2%), this is overall small relative to the analytical uncertainty of atmospheric GOM (could be biased by several times). I do not think a correction of such a small loss would improve the analysis of atmospheric GOM. I agree that a much lower loading of Hg(II) (e.g., 5-100 pg) may cause higher loss of Hg(II), but this was not done in this study. Therefore, based on the finding of this study, it is not practicable to draw a conclusion that the GOM measurements should be corrected by the loss of Hg(II) (e.g., 5%).

Line 156: why a KCl solution with a concentration of 1 mol L⁻¹ was used to soak the quartz wool? Have the authors tried other concentrations? Would a higher concentration improve the sampling of GOM or cause a higher retention of GEM?

Line 157-158: these KCl sorbent traps were reused by heating to a temperature of 600 °C. This temperature is relatively higher than the traditional temperature setting (e.g., 500-550 °C) for the desorption of GOM from KCl coated denuders. I think this may change the morphology of KCl, as suggested by the authors.

Line 159-160: the authors used a mixed acid solution to leach the Hg(0) collected on the KCl sorbent traps, I think these treatments would also change the chemical properties of

KCl traps, which may increase the retention of GEM by the sorbent traps.

Line 182-183: The authors should explain why these two experiment would precisely generate HgCl₂ or HgBr₂. Have the authors determined the Hg(II) compounds in these two solutions?

Line 276-280: In my opinion, an over interpretation of the results is not of significant scientific values. As mentioned above, the leaching and reuse processes of the KCl sorbent traps would probably change the morphology of KCl traps (especially for the KCl crystal and KCl crystal +Al₂O₃ catalyst), and they are quite different from the processes for the reuse of KCl denuders.

Line 324-325: A comparison of the absolute losses between the low and high loading of Hg(II) is meaningless.

Line 331-336: I agree with the authors that loss of Hg(II) could occur during the sampling. However, the losses could be associated with many factors, such as quantity of Hg(II) on the sorbent traps, sampling and flushing flow rate, ozone, humidity, etc.. In this study, the loading of Hg(II) is much higher than the real atmospheric conditions, and the air flow was also lower than the GOM sampling flow rate (e.g., 10 LPM) and flushing flow rate during desorption processes (e.g., 1.0 LPM). Therefore, using the loss rate determined from this study to correct GOM measurement is not expected.

Section 3.6: A GOM bias of 3500% for the using the KCl solution trap is extremely higher. The authors should specify that the KCl solution trap should be not relevant for field GOM sampling. Note that KCl solution trap is generally used for the sampling of GOM in flue gas.