

Atmos. Meas. Tech. Discuss., referee comment RC2
<https://doi.org/10.5194/amt-2022-309-RC2>, 2022
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Comment on amt-2022-309

Anonymous Referee #2

Referee comment on "Using tunable infrared laser direct absorption spectroscopy for ambient hydrogen chloride detection: HCl-TILDAS" by John W. Halfacre et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2022-309-RC2>, 2022

Halfacre et al. report the construction and evaluation of a spectrometer for quantification of HCl in the atmosphere. The instrument is thoroughly described and was evaluated in the field as part of the Integrated Research Observation System for Clean Air" (OSCA) campaign in Manchester. The instrument's figures of merit are an improvement over existing technology (Table 1). The paper should be published once my comments below have been addressed.

Title: Please remove the term "Novelty" from the title. Novelty is implied when publishing. Further, TILDAS using astigmatic Herriott cells has been around for at least a quarter century. The main novelty of this work is the extension of known technology (QCL-TILDAS) to a new molecule (HCl).

line 21/301 - "high accuracy". It would help to be more quantitative here and nuanced in the discussion of accuracy. The authors report that the instrument measured 3.6% lower than a commercial HCl cylinder, certified to contain a known concentration within $\pm 5\%$. The certification applies to what the manufacturer added to the cylinder; what comes out can be an entirely different matter (subject to regulator passivation etc.). As such, a comparison to a single cylinder does not suffice to validate a new instrument's accuracy in my opinion.

In this context, are the absorption line strengths well known (and can be used to justify accuracy)?

There is also a zero offset to be considered when discussing accuracy since the instrument reports negative mixing ratios (e.g., Figure 9) which are inaccurate by default. Consider stating a slope uncertainty and a zero offset uncertainty.

Have the authors considered calibrating or comparing against a wet chemistry technique?

line 114 - replace detection with quantification

line 128 - I was wondering about the safety of perfluorobutanesulfonic acid, which is partially discussed on lines 186-188. Consider adding a comment regarding safe handling of this compound.

lines 147 - 154. Please state the line strengths (or cross-sections) used and how those were determined (Hitran?)

line 153 "well-resolved" - please state the FWHM of these lines and add a graph showing the spectrum you are discussing here (at high and low concentration), so the readers can see for themselves.

line 501-514. Please try to be more quantitative in this paragraph - for example, rather than saying 'greatly improve' or 'higher flow inlets' or 'reduce sample air residence time', state by how much or the actual value.

Figure 6 - replace sec with s

Figure 8 - what caused the second hump at 14:10? Please add an explanation to the caption.

Figure 9 panels (a) and (c) - both the HCl and NO₂ data exhibit spikes and negative concentrations, even when averaged. Please add some discussion to the text as to the meaning of this, potential causes, and remedies. Consider adding a horizontal line to show limits of detection or quantification.

Figure 10 panel (a) - change units to pptv to avoid the $\times 10^3$