

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-711

Anonymous Referee #2

Referee comment on "Measurement report: Underestimated reactive organic gases from residential combustion – insights from a near-complete speciation" by Yaqin Gao et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-711-RC2>, 2022

The manuscript by Gao et al. reported the near-complete speciation of reactive organic gases (ROGs) with 125 species identified to evaluate their emission characteristics from residential combustion. The authors used a Gas Chromatography equipped with a Mass Spectrometer and a Flame Ionization Detector (GC-MS/FID) and $\text{H}_3\text{O}^+/\text{NO}^+$ Proton Transfer Reaction Time-of-Flight Mass Spectrometer (Vocus PTR-ToF-MS) to identify 55 previously un- and under-characterized species. Without considering these "newly identified species", the ROG emissions from residential coal and biomass combustion would be underestimated by $44.3\% \pm 11.8\%$ and $22.7\% \pm 3.9\%$, respectively, which further highlighted the potential underestimation of secondary organic aerosols formation potential (SOAP) and OH reactivity (OHR) of ROG emissions. Overall, this study would be a useful addition to better understanding the detailed speciation of ROGs from residential combustion. However, the novelty of this study should be clearly addressed, especially given that some previous studies also applied these advanced instruments and have identified these "newly identified species" (Figure 2).

Specific issues:

Line 115-116: why only selected peaks (mainly higher alkanes) under NO^+ mode PTR measurements were studied?

Line 151: the loss of acids and alcohols in the canister is larger, and the author attributed this to their functional groups of $-\text{COOH}$ and $-\text{OH}$. Would it be more direct to relate this to

the volatility of compounds? Are there any criteria to exclude these compounds from the analysis?

Line 174 and 324: why is benzene chosen for normalization purposes?

Figure S2 (b): how many compounds were used here, and why were they chosen for comparison but not all the compounds?

Given this study is based on offline analysis that some dynamic changes in emissions from residential combustion may not be reflected. Could this cause a potential bias?

Section 3.2: the SOA formation potential was estimated by using SOA yields from the literature. Are those values obtained at specific conditions? What would be the uncertainties for the estimation?

Section 3.3: The authors cited literature information to get the EFs of anthracite and straw and then applied these values to estimate the ROG emissions of residential coal and straw combustion in mainland China. Are the quantification of EFs from limited sources representative? Is anthracite representative of residential coal combustion in mainland China?