Referee Report:
Non methane hydrocarbon (NMHC) fingerprints of major urban and agricultural emission sources active in South Asia for use in source apportionment studies

Anonymous Referee

1 Overview

Kumar et al. present measurement of 49 NMHCs using GC-FID from samples collected at difference sources (paddy stubble burning, garbage burning, idling vehicular exhaust and evaporative fuel emissions) in northern India. Normalized profiles were calculated based on the measured NMHCs for different sources. The authors identified *i*-pentane as a chemical tracer for petrol vehicular exhaust and evaporative emissions, propane as a chemical tracer for LPG evaporative and LPG vehicular exhaust emissions, and acetylene as a chemical tracer for the biomass fires in flaming conditions.

Instrument analysis is adequate. However the authors need to provide standard gas calibration data for compounds with higher concentrations (> 50 ppbv) to show that the instrument linearity is within tolerance at high mixing ratio level. The sample size for many sources are small (3 or 5 samples), which could introduce large variability and potentially undermine the data quality.

Overall, this study reports the source profiles of NMHCs over an understudied area of the world with complex emission sources. The data should be of interest to the atmospheric science community. This manuscript is within the scope of ACP. I recommend that the manuscript be published in ACP after minor revision.

2 Minor comments

(1) "South Asia" in the title covers a broad area. Please revise the title to reflect the specific sampling area (Mohali, India).

(2) Section 2.2: Please provide a schematic diagram of the instrument setup.

(3) Section 2.2: in peak identification and quantification section, there is no discussion on the peak separation. Are all the target compound peaks well separated? If not, how do you resolve the interference? Please provide a typical chromatogram showing all the target compounds taken during a standard gas calibration experiment. Please also include a typical chromatogram taken during the analysis of a sample collected from each source.

(4) Page 9, Line 9: in Figure S2, most compounds do show good linear association. However, certain compounds, such as *m*-Diethylbenzene, *p*-Diethylbenzene, exhibit larger uncertainties at about 20 ppbv mixing ratio level and larger deviations from the fitted line compared to the rest of the compounds. Please provide correlation coefficient values (with 4 significant figures) for all the target compounds in Figure S2.

(5) Page 9, Line 12: please list all compounds with concentrations > 50 ppbv after dilution.

(6) Page 9, Line 13–14: please provide data (similar to Figure S2) to show the standard gas calibration results for the target compounds with concentrations of up to 200 ppbv. Please also include correlation coefficient values (with 4 significant figures) for all the target compounds.

(7) Page 11, Line 5–7: please provide data to show a comparison of the target compound mixing ratios between before the fire and during the fire. Are the mixing ratios taken just before the fire (deemed as the ambient background level) significantly lower than during the fire? If not, does this bring large uncertainty to the interpretation of the calculated emission profiles?

(8) Page 17, Line 6–12: there is no need to list all the rankings here since the reader can get this information from Figure 3.

(9) Page 18, Line 10: it would be more informative to provide the rate coefficient value range for reactions between C2-C4, C5-C8 alkanes and OH here for comparison purpose instead of just saying "more reactive towards OH radical".

(10) Page 19, Line 3–15: using the fraction of BTEX to assess the health risks may not be the best way since most guidelines use concentration as benchmark. For example, smoldering paddy stubble fire (13%) > diesel evaporative emissions (11%) does not necessarily indicate that the BTEX concentration in diesel evaporative emissions is less than smoldering paddy stubble fire. Please provide the concentration (with uncertainty) here as well to assist the discussion.

(11) Page 33: the sample size for some NMHCs sources (e.g., paddy stubble burning, garbage burning, and traffic) are quite small (3 or 5). Please provide mixing ratios of the target compounds (together with uncertainties) in Figure 1 and Figure 2. If there are large uncertainties in the mixing ratios, please justify that such small sample size is representative of the sampling areas or even feasible to be extrapolated to represent South Asia.

3 Technical corrections

(1) Page 2, Line 13: "PMF": please give the full name of any acronym when it appears for the first time in the manuscript.

(2) Page 2, Line 15: "LPG": please give the full name here.

(3) Page 3, Line 1: "BTEX": please list all the compounds in BTEX.

(4) Page 3, Line 2: "most polluting": please provide data to support this conclusion.

(5) Page 4, Line 1–2: “North West-Indo Gangetic Plain” $\rightarrow$ “North West-Indo Gangetic Plain (NW-IGP)”.

(6) Page 9, Line 21: please define “pAs” here.

(7) Page 16, Line 6: pleaes provide the full name for BSV and BSVI.

References