

General comments

The manuscript titled “Product Ion Distributions using H_3O^+ PTR-ToF-MS: Mechanisms, Transmission Effects, and Instrument-to-Instrument Variability” by Link et al. explores how ion-molecule reactor conditions, ion transmission effects from quadrupole and ion optical tuning, and inlet capillary configuration influence the measured product ion distributions in H_3O^+ PTR-ToF-MS. Their manuscript establishes a library of H_3O^+ product ion distributions for nearly 100 VOCs and provides several practical recommendations to improve the interpretability of PTR-MS data. The research goal is novel and holds significant application relevance for the mass spectrometry community. I recommend its publication in AMT after addressing several minor comments.

Minor comments

1. Abstract Conciseness: The abstract is overly lengthy, some of the introductory content regarding PTR-MS could be moved to the introduction. Please condense the abstract.
2. Line 203-206: The earlier description has already clearly outlined the advantages of GC separation. Therefore, the statement “Though all the PIDs we present here were determined from GC-PTR-ToF-MS measurements, PIDs can be determined without pre-separation from single component calibration sources. Without pre-separation, multicomponent VOC sources may create product ions that can interfere with quantification of the PIDs from a given VOC.” appears redundant.
3. In Section 3.1, the authors illustrate the influence of instrument configuration on PIDs using examples such as pentanoic acid, ethanol, and toluene. Have the authors considered whether the PIDs of different functional group types exhibit consistent responses to instrument parameters, or do the responses vary uniquely for different species?
4. In Section 3.2, the authors discuss the uncertainties in PIDs resulting from variations across different laboratories and over time. It would be beneficial to provide an overall uncertainty estimate to enhance the applicability of the H_3O^+ PID Library.

5. Humidity may affect PIDs. Were all samples measured under the same humidity conditions? Has the potential impact of humidity been considered?
6. In the H_3O^+ _PID_Library: In lab1b, the $\text{C}_{10}\text{H}_{17}^+$ for linalool should perhaps be $[\text{M}-\text{H}_2\text{O}]^+$ rather than listed in column F1. Please carefully review the table to avoid similar errors.