General comments:

1) Please improve the structure of the abstract. Abstracts should have fewer than 250 words. Also, authors focus more on the approach and results/observations, but it is not clear to me about the status of research, research gap, the importance and implications of the results.

Abstract was improved.

2) In this study, you studied the Norpinonic acid anionic fragmentation pathway in the gas phase. But in the Introduction section, you mentioned more analytical techniques that used for OA products (Lines 44-47). This might be confusing. I suggest that you should focus more on the gaseous measurements.

Both aspects are important, and because the analytical techniques are the most popular tools in which the fragmentation technique is used to identify SOA molecules we decided to focus more on this matter in the introduction giving just a signal that the degradation/fragmentation process is of interest in gaseous environment. As the Reviewer suggested the gas-phase measurements are the other site of moon, as much important but there is a lack of direct chamber or field experiments that we could refer to in the case of fragmentation SOA phenomena. Taking above we opt to address this results mainly to the analytic chemists giving them a deep insight on how the structure identification of fragment ions can be accompanied by reaction energy analysis.

3) Lines 52-53: "to the proper identification of OA components, mentioned MS/MS measurements should be made very accurately", I suggest that you could add more descriptions/discussions about the MS/MS technique here.

The appropriate references to MS/MS type of analytical technique has been added to the text, giving access to more detailed method descriptions elsewhere.

4) Line 156: why do you apply three different DFT methods in this study?

We added this information to SI section 4. Computed data for norpinonic acid:

Because density functional methods are best regarded as approximations to the resolving for the electron density in a molecular system and the exact exchange correlation function is not known, comparative analysis of different DFT models in terms of performance is an important part of computational chemistry. Quite often, one particular set of functionals and functional bases works very well for a particular application, so for the study of structures not precisely described by quantum chemistry, calculations should be carried out with various functionals to get closer to experimental results.

5) Lines 160-161: For the comparison, please state the specific difference or improvement between these three methods here.

The computational method that most closely matched the experimental results was chosen on the basis of the correlation plots of the results. The correlation coefficient for the ωB97XD method was R2 = 0.76 (Fig. 6) while that for the other two was 0.75 and 0.53 (PBE1PBE and B3LYP, respectively, Fig. S63, S64).

6) Section 3.1: Is this the first research that emphasize fragmentation pathways of norpinonic acid? Are there any other comparable studies, please add more discussion in this Section.

To our best knowledge there is no literature examples in which the energy-resolved fragmentation patterns have been recorded for other atmospheric relevant compounds. There is no information about the energetics of fragmentation or bond breaking process for other acids. The MS/MS mass spectra can be only compared while registered in the same conditions (collision gas pressure and kinetic energy). We are aware, that mass spectrometry has been widely used in analytical atmospheric chemistry and fragmentation spectra has been recorded for various of other air-present acids. This suggestion is very valuable, but we do not plan to expand current paper by this data because it requires a detailed analysis and will make it unacceptable long. In parallel, we are currently working on a very similar project where series of acids and their fragmentation patterns, together with detailed energetics will be compared by using highly advanced statistical methods.

7) Lines 129, 161, 248, 286, 292: It is hard for readers to connect the main text with the SI, here you do not provide the relevant parts in the SI.

Appropriate references have been made.

8) Line 29: should be: "Primary organic aerosols are emitted to the atmosphere…"

Corrected.

Technical corrections:

Line 8: "athmospheric".

Corrected.

Line 11: please provide the full title of m/z.

The appropriate reference to the definition of m/z abbreviation has been added. The IUPAC description of mass to charge ration, should help the readers to understand the proper meaning as unified and commonly acceptable description.

Link: https://goldbook.iupac.org/terms/view/M03752

Line 13: Is "CIE" right?

Corrected. It should be Energy-Resolved Collision Induced Dissociation (ER-CID) technique.

Line 21: please provide the full title of ER-CID when it occurs at the first time

Corrected.

Line 119, Line 128: superscript: "10-4".

Corrected.

Line 257: "fragmentat"

Corrected.