Reviewer 2

The article presents a detailed investigation into the potential effect of glutamic acid (Glu)-iron complexes on Fenton and photo-Fenton reactions in cloud water and on the hydroxyl radical yield. Using Glu as a model amino acid, the study offers compelling insights into how these organic compounds may interfere with iron (photo)chemistry leading to an impact on the oxidative potential of cloud water. Overall, this study makes a valuable contribution to our understanding of aqueous-phase atmospheric chemistry. I have just few comments.

- It would be interesting to compare the results with other well-known iron complexes with organic ligands that might be relevant for cloud water (for example Fe-oxalate)

Response

We fully agree that comparing our results with well-known iron-organic complexes relevant to cloud water, such as Fe-oxalate, is important. Accordingly, we have revised the manuscript to include a discussion on this aspect to enhance the environmental relevance of our study. The modification was given at **lines 271-276**.

- It would be good to further discuss the potential of forming the Glu-iron complexes in real cloud water. Are there other compounds that may complex strongly the iron? Since the Glu is only a model for AAs, I think the work is relevant because other AA-iron complexes may behaviour in the same way.

Response

The new discussion of iron-Glu complexes in real cloud water was provided and reported in **lines 510-518**. Indeed, other compounds commonly present in cloud water, such as various amino acids and low-molecular-weight carboxylic acids, are known to form stable complexes with iron and may undergo similar (photo)-Fenton reactions as observed with glutamic acid. The corresponding modifications can be found in the revised manuscript at **lines 532-535.**

- In section 2.2.1 please add the concentration of H2O2 used in the experiments (line 131).

Response

The H_2O_2 concentration was added in the section 2.2.1, shown at **lines 140-142**.

- In Figure 1 the letters (a, b, c and d) referred to the different plots are not very visible, probably it would be good to put them outside the plots.

Response

To maintain a consistent figure style throughout the manuscript, we did not move the panel labels (a, b, c, d) outside the plots. However, we increased their font size to enhance visibility and ensure they are clearly distinguishable. This modification can be found at **line 285** in the revised manuscript.

- From Figure 3 and Figure MS6 the degradation of Glu with and without H2O2 seems very similar, please report also the data about the irradiation of Glu alone.

Response

The similar degradation of Glu with and without 1 mM H_2O_2 is due to the low light absorption of H_2O_2 and limited •OH generation. We also tested Glu under irradiation alone, and the rate constant was k = $(1.90 \pm 0.22) \times 10^{-5}$ s^{-1}, indicating negligible degradation. This is expected, as Glu does not absorb solar light. The data have been added to the revised manuscript (**lines 347-350**)

- In the figure caption for Figure 3 is described only the left panel and not the right panel, please add it.

Response

Thank you for very careful review. The description for the right panel is added as shown in **lines 360-363.**

- Page 19, lines 389-391, please add the reactivity constant between formic acid and hydroxyl radical.

Response

The reactivity constant between formic and OH radical was added and shown **on page 20 at line 409**.

- I suggest to change the colours of the lines in the figure 4a, to avoid confusion with the other part of the figures (Figure4b,c,d) where for each colour indicates a specific carboxylic acid.

Response

Thank you for your suggestion. We have changed the colors of the lines in the figures 4a. The modification can be found at **line 414**.

- In page 22 you discuss the TOC results, have you also performed IC (inorganic carbon) analysis? From that you could also directly measure the mineralization of the Glu. If you have these data, please add them in the manuscript (or in the SI).

Response

We provided measurement of total carbon (TC) and inorganic carbon (IC) and calculated the total organic carbon (TOC) accordingly. However, since the reaction system is open and acidic, a significant portion of the CO_2 produced during glutamate mineralization escapes from the solution, leading to an underestimation of the actual mineralization degree when using IC data. For this reason, we did not include the IC results in the manuscript. We will clarify this point in the revised SI (SM5) to avoid misunderstanding.

- Page 23, lines 456-457, please add a reference for the deamination process as you did for the other reaction involved in the overall mechanism.

Response

A new reference was added, the modification can be found at **lines 476-477.**