Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2020-250-RC1, 2020

Biogeosciences Discussions

Interactive comment on "Biotic and abiotic transformation of amino acids in cloud water: Experimental studies and atmospheric implications" *by* Saly Jaber et al.

Anonymous Referee #1

Received and published: 24 August 2020

The authors present a very interesting work, measuring biotic and abiotic transformation rates of amino acids under cloud water conditions. The topic is very relevant, the approach is innovative and the results are promising. The manuscript is written in an understandable way and reads very well. Some improvements on the Figures are needed. This work is suitable for the journal; however, some comments and questions should be addressed.

I have some questions and comments about the analytical method: A concentration of 1 μmol of each amino acid was applied for the experiments. How does this concentration compare to ambient amino acid concentrations? And, even more important:

how are typical compositions of amino acids in the ambient atmosphere? Is a uniform concentration of 1 μmol for each amino acid realistic? This might strongly influence the different degradation pathways. Please comment on that and I'd recommend to include such discussions in the manuscript.

Concerning the analytical method; the authors used ESI. It is known that ESI is prone the matrix effects (ion suppression) especially in ambient samples containing salt. Therefore, a sample preparation method is often applied, to eliminate disturbing matrix compounds. Did the authors test such effects, as ion suppression for the individual amino acids, for example by comparison of the external calibration to standard addition?

The LOQs seem quite high. How do they compare to other analytical methods used for amino acid analytics? It seems that the LOQ are close to the applied concentration of 1 μmol, so did this cause problems in the analytical accuracy? How was the precision (e.g. standard deviation) of the analytical method? As the authors introduce the analytical method as a new approach and an improved technique, some further method validation would be necessary in my opinion.

How about contaminations? Did you measure blanks and if so, were they considered? Finally; would you analytical method (without pre-concentration and sample preparation) be applicable for measuring amino acids in ambient marine samples?

Chapter 2.1.: The authors explained that the strains were chosen because they are the most abundant and active bacteria in cloud water. Are there more information on these strains available, that might be used to explain their different behaviour towards the individual amino acids?

Chapter 3.1.1: Interestingly, the efficiencies of the different strains are very variable among each other and concerning the different amino acids. The authors mentioned that all amino acids were mixed together in the experiment. I was wondering if you also performed these experiments with single amino acids? This might be interesting

especially regarding the net production of GLY that is certainly a product from the degradation of other amino acids.

Chapter 3.1.2.: The manuscript often refers to the Figures S3 and S4 which seem to be crucial for following and understanding the text. As the manuscript does not contain many Figures, maybe transfer them to the main part? An alternative could be to highlight the amino acids that have the same metabolic pathway in Figure 1 (instead of Figure S4). The statement that the "blue box" amino acids exhibit the same behaviour regarding their biodegradation is difficult to see in Figure S4 and a "zoom in" would be required. Actually, it seems that GLY shows quite a different behaviour, not in line with the other "blue box" amino acids. Also the "green box" amino acids are difficult to see (Fig. S4). For the "purple box" amino acids; the mentioned strong similarities are not obvious from Fig. S4. The 23b-28 strain seems to be much stronger for ASN compared to ALA. Please re-think the way of showing the similarities and maybe find a clearer way to present similarities and differences for the metabolomic-groups amino acids and their response to the different strains.

Chapter 3.1.3 Are there any more detailed explanation theories why these different strains exhibit such different behaviours? To what properties could that be related? On page 9, line 24 the authors mention that the AA biodegradation could be linked to the phylogeny of the bacterial strains. Could you give some more explanation (to non-biologists) about this?

Chapter 3.3.1: I wonder how relevant singlet oxygen is for diluted systems. (lifetime?) Is the sink for singlet oxygen considered in the rates (Fig 3)?

Figure 2 shows that degradation and formation happens for the individual amino acids. As a general question and also related to Fig. 2: Can any mechanisms for the formation/degradation of the individual amino acids be derived from that?

Chapter 3.3.2 and Figure 4: This chapter deals with the comparison of the biotic and the abiotic pathway. They are shown in Fig.3. While some exemplary comparisons are

made between both pathways (Page 11, Line 30 - Page 12 Line 6) I miss some real conclusions here. In addition, Figure 3 is difficult to understand and not well discussed; some more details might be helpful to understand the outcome of Fig. 3.

Chapter 4: The conclusions are well written. The authors summarize that the so far only degradation (losses) of amino acids but not production (transformation into each other) was considered. However, I was struggling with the following sentence: "Our study qualitatively suggests that the sources and distribution of amino acids in the atmospheric particle and aqueous phases can be modified by metabolic and chemical transformation pathways." -> Could the authors derive more precise conclusions here? I understood it was the aim to show HOW the two pathways (biotic, abiotic) contribute. I was wondering if the authors could finally comment on the relative importance of the biotic and the abiotic pathway e.g. which seems to be the more important way?

Small comments: There are several typos e.g. page 2 line 11 (C.L-1), sometimes the chemicals / amino acids are written with capital letter, sometimes with small letters (e.g. Table S4).

Empty spaces are missing and the formulas in eq. 2-4 are not represented right. In addition, the reference style needs revisions (e.g. page 16, line 44-45, page 17, line 11, page 19, line 25.

Table S3: There are missing references (for GLU, GLY, SER. . .). At what temperature was the rate constant obtained?

Concerning the Data availability I'd strongly recommend to upload the data in a public database such as PANGAEA or similar.

Author contributions: I was surprised that "SJ", as the first author, did not "write the manuscript"?

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2020-250, 2020.