We would like to thank both reviewers for their constructive suggestions, which have significantly contributed to improve the quality and clarity of our manuscript. We carefully considered each comment and have made the necessary modifications accordingly. Specific responses to the reviewers' comments, along with the corresponding changes in the manuscript, are provided below in red text.

Reviewer 2

The paper describes a newly designed marine aerosol tank used to generate simulated sea spray aerosol in laboratory settings. The authors give a comprehensive overview of other aerosol tanks in the introduction and carefully describe their results in the context of other tank studies. The tank setup is described in detail, including a clear figure. The tank was tested using both artificial seawater and seawater gathered from the Gulf of Mexico. The analysis of experimental results is given, including both chemical and physical characterization of the aerosol generated from the waters. While results are described in the context of other aerosol reference tank studies, the results from this study are not described in clear detail. More quantification should be given, and the authors should be careful to avoid vague language such as stating that "a better correlation" was found rather than giving exact values. With revision, this paper represents an interesting addition to lab-based sea spray aerosol methods.

> A/ We sincerely appreciate the reviewer's detailed and constructive feedback. The revised manuscript provides clearer and a more precise descriptions of our results, including exact values where applicable.

L403: "likely due to the decomposition of organic matter" – without a measurement of the organic content in water at the time of measurement, this cannot be stated definitively, as turbidity could also be due to suspension of inorganic particulate matter.

> A/ We agree with the reviewer. Given that we were unable to measure the organic content, we cannot rule out other possibilities. Considering your suggestion, the following text was added to the revised manuscript:
>
> **Lines 461-462:** "This could be attributed to a combination of organic matter decomposition and suspended inorganic particulate matter"

L443: it needs to be considered in the analysis that water samples sat at room temperature for fourteen days prior to analysis. This will have a major effect on water chemistry since only organisms >50 µm were filtered out. This would essentially remove all grazers and zooplankton from the system while leaving phytoplankton and bacteria to live on the collected nutrients for fourteen days and cannot be considered truly representative of natural water composition. Nitrate, ammonia, and other nutrients will be metabolized by phytoplankton as the water sits, artificially lowering the concentration.

> A/ We thank the reviewer for her/his comment that helps to clarify the context of the samples' treatment. While we acknowledge that the biological activity may have been significantly altered during the transport/storage period, the goal of our study was not to specifically investigate these effects. Our intention was to evaluate the impact of transportation (and storage) from the collection of samples to the time of the actual

SSA generation experiments. We did this because Mexico City (and our laboratory) is far away from the coast, and therefore, most of the seawater samples need to be transported to Mexico City, unless we go with our setup to each sampling spot. Unfortunately, the latter option is very expensive and not completely feasible.

Therefore, the scope of our study was not to quantitatively assess how transportation and storage influenced the chemical and biological composition of the samples. However, we recognize that this as a limitation in our study. To acknowledge this important point, the following text was added to the revised manuscript:

Line 291: "The sample was transported and stored at room temperature".

Lines 464-473: "Several factors, including nutrient availability, temperature, oxygen levels, light, and predation, determine the survival of microorganisms. The applied filtration may have removed grazers and other zooplanktonic organism, which could have influenced the development of microbial communities and, consequently, affected the aerosol concentrations. However, some studies suggest that certain species can withstand adverse conditions e.g., metabolic activity can slow down at lower temperatures or certain phytoplankton and bacteria species may persist in the absence of many predators (Chakraborty et al., 2012; Kennedy et al., 2019). Although it was not the scope of the present study, it is important to monitor how the evolution or degradation of biological species present in the seawater samples impact aerosol properties."

L535: Missing a word between the two phytoplankton species

A/ Thank you. Corrected.

Line 556: "*Thalassiosira weissflogii* and *Synechococcus"*

L541: It may also be that the samples used in this study contain a greater proportion of decomposed or dying material than the two studies listed. While this is addressed later in the paper, it should also be considered here.

A/ Thank you for the suggestion. To provide a better discussion, the following text was added to the revised manuscript.

Lines 570-572: "Another possible explanation for the observed differences between the present and former studies is that our samples likely contain a greater proportion of decomposed or dying material due to their transportation from the coast to the laboratory (Section 4.5)".

L557: Please give actual correlation values and discuss statistical significance of given values

A/ Thank you for the suggestion. We have now included the actual Spearman's correlation coefficients and their respective p-values in the revised manuscript. Additionally, a discussion of the non-statistically significant values has been included.

Lines 586-595: "A better correlation was observed in the BoSM samples (Na^+ [ρ = 0.94, p = 0.02], Cl^- [ρ = 0.88, p = 0.03], Mg^{2+} [ρ = 0.83, p = 0.06], Ca^{2+} [ρ = 0.20, p

= 0.71], and NO_3^- [ρ = -0.08, p = 0.92]) from April 9 and Na^+ [ρ = 0.84, p = 0.04], Ca^{2+} [ρ = 0.84, p = 0.04], Mg^{2+} [ρ = 0.81, p = 0.07], NO_3^- [ρ = -0.84, p = 0.04], and Cl^- [ρ = -0.08, p = 0.87] from April 25) than in the PoV sample (Na^+ [ρ = 0.58, p = 0.24], NO_3^- [ρ = 0.55, p = 0.27], Mg^{2+} [ρ = 0.46, p = 0.37], Cl^- [ρ = 0.46, p = 0.37], and Ca^{2+} [ρ = -0.03, p = 0.98]). While Mg^{2+} showed a relatively high correlation in the BoSM samples, it did not reach the threshold for statistical significance ($p < 0.05$). This suggests that, while Mg^{2+} may be present in SSA, its role in ice nucleation remains uncertain. Therefore, further research is needed to determine if Mg^{2+} is a key driver in ice formation in marine environments".

L565-582: This should be considered earlier in the paper as impacts are likely to impact all results given.

A/ Thank you for your suggestion. Although this was clearly stated in Section 2.4 in the original manuscript, for clarity this acknowledge in **Lines 570-572** in revised manuscript.

References

Chakraborty, S., Bhattacharya, S., Feudel, U., and Chattopadhyay, J.: The role of avoidance by zooplankton for survival and dominance of toxic phytoplankton, Ecol. Complex., 11, 144–153, https://doi.org/10.1016/j.ecocom.2012.05.006, 2012.

Kennedy, F., Martin, A., Bowman, J. P., Wilson, R., and McMinn, A.: Dark metabolism: a molecular insight into how the Antarctic sea-ice diatom Fragilariopsis cylindrus survives long-term darkness, New Phytol., 223, 675–691, https://doi.org/10.1111/nph.15843, 2019.