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Comment on acp-2022-13

Anonymous Referee #2

Referee comment on "Formation of organic sulfur compounds through SO_2-initiated photochemistry of PAHs and dimethylsulfoxide at the air-water interface" by Haoyu Jiang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-13-RC2, 2022

In this work, the authors investigated the formation of compounds including orgaosulfur compounds through SO2 initiated photochemistry of PAHs and DMSO. Mass spectrometric data and reaction mechanims supported by theorteical calcultions are given to support the formation of observed products in the gas and aqueous phase. The results of this work provide greater insight into the sources of atmoshperic sulfur compounds formed through light induced heterogeneous processesing of SO2 with PAHs/DMSO at air/water interface. I support the publication of this work with a few minor comments below.

Line 145, "The applied mixing ratio of 800 ppb would probably amplify the intensity of the detected product compounds, but the formation profiles would still remain the same as in the case of smaller SO2 mixing ratios." In addition to the reaction pathways, can the authors further elaborate if the formation and volatilation of reaction products (e.g. the detection of the gas phase products) would be affected by the high concentrations of the reactants applied in the study?

Line 221, " we tentatively identified a number of unsaturated multifunctional molecules and OSs released in the gas phase from the reaction of SO2 with either DMSO or PAHs/DMSO, which are summarized in Table S5." Again, will the detection of gas-phase products be affected by the choice of the reactant concentrations?

Line 234, Figure 1, please check the resolutions of the figures and the reaction scheme.

Line 239, "In this study, we observed rapid formation of MSA, MSIA, MSM, EMS, MSAOH, and ESAOH (Figure 2 and Figure S2)." What are the concentrations of these gas-phase products (e.g. ppb or ppm) and their aqueous phase concentrations?

Line 261, " Here, we show that during daytime the reactions of light-excited SO2 and aqueous DMSO or DMSO/PAHs could represent an important source of gaseous MSA in the atmosphere near the water (ocean, lake and river) surface" What are the yields of the gasoues MSA in different systems?

Line 271, "The intensities of the product compounds (Figure 2 and Figure S2) decrease after one hour most probably due to their reaction with SO2 and/or their photodegradation" Please elobarate or show these reactions. What are the kinetics or rates of these reactions?

Line 284, "Numerous unsaturated multifunctional molecules and OSs were identified in the liquid phase during the reaction of SO2 with either DMSO or PAHs/DMSO by using FT-ICR-MS. The number of detected product compounds in the aqueous phase was significantly higher compared to those detected in the gas phase, due to very high sensitivity of FT-ICR-MS." What are the concentrations of these aqueous-phase products detected by the FT-ICR-MS? Are they volatile or non-voltiles in the reaction systems?

Line 398, "3.5. Reaction Mechanism of the Gaseous Compounds" As mentioned above, will there be other volatile and gaseous compounds that want to be considered?

Line 416, "These observations highlight the importance of the SO2 oxidation reactions of DMSO and/or PAHs/DMSO at the freshwater and sea surface, or in the liquid films of the aerosol particles, which would represent important source of OSs." What would be the formation yields of these products through SO2 oxidation reactions of DMSO and/or PAHs/DMSO?