Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-13

Anonymous Referee #1

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-RC1, 2022

This is an interesting and new submission investigating the formation of organic sulfur compounds through the SO2 initiated (photo)chemistry of PAHs and DMSO at the air-water interface. A series of advanced analytical tools are employed to identify the products of these chemical interactions. This study is in line with previous investigations of the same group.

The fact that SO2 and/or PAHs could trigger photochemistry at the air/water interface is a topic that certainly falls with the scope of ACP, this is why I would certainly recommend the publication of this manuscript once the authors have dealt with the comments below.

While the title stresses the photochemical aspects of the chemistry presented, the actual text is a bit vague about the importance or not of the dark chemistry during the experiments (some figures in the SI points towards some active dark chemistry as well which is finally quite surprising for the poly-aromatic compounds). The same comment applies to the relative importance of the photochemistry of SO2 and PAHs. The text mentions that the SO2 dominates but pathway B stresses another possibility. It would be helpful if the authors could elaborate more on the relative importance of each pathway to avoid any confusion for the reader.

If excited SO2 would create some OH radicals in the liquid phase it would certainly be scavenged by DMSO due to its very high concentration (it is used as cosolvent), with little interplay with the PAH photochemistry. In other, is there any synergy between PAH and SO2 or are the experiments looking at the PAH/DMSO and SO2/DMSO chemistry with finally no interaction.

The chemical scheme involving PAH is not fully clear to the reviewer, as it seems that S(IV) is oxidized to S(VI) without any real explanation.

Also, section 3.2 mixes some discussion on the actual results and the atmospheric context of the study. Some reediting here would certainly help the reader.

Finally, while this reviewer recognizes the need to perform such experiment at high concentrations. The observations made here cannot directly be used for realistic outdoors conditions. Therefore, some discussions on how to extrapolate these finding to authentic atmospheric conditions would beneficial for the manuscript.