

# ***Interactive comment on “Organosulfates in atmospheric aerosol: synthesis and quantitative analysis of PM<sub>2.5</sub> from Xi’an, Northwest China” by Ru-Jin Huang et al.***

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The authors thank the referee to review our manuscript and particularly for the valuable comments and suggestions that have significantly improved the manuscript. We have made most of the changes suggested by the referees and have outlined these in detail below.

Anonymous Referee #1

Identification and quantification of organosulfates are essential in assessing their formation pathway and contribution to particulate matter. A significant obstacle in the

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analysis of organosulfates is a lack of commercially available organosulfate standards. Nine organosulfates with different functional groups were synthesized in this study; and analysis of organosulfates on real ambient filters is subsequently conducted. The results are potentially interesting; the paper is very well written and current contribution is a welcome addition to the field.

Major comments:

1. Line 156: Any purification is performed to obtain the organosulfate standards?

Response: The synthesized organosulfate standards were recrystallized in ethanol for purification. We have included this in revised manuscript.

2. Line 160: Are the synthesized organosulfate standards stable? Was there any degradation/decomposition observed during storage?

Response: The synthesized organosulfate standards were stored in refrigerator ( $\sim 4$  oC). No degradation/decomposition was observed after 2 years, which was confirmed by the NMR analysis. We have included this in revised manuscript.

3. Line 163: Readers might be interested in the NMR spectra of the synthesized standards. Please include the information in SI.

Response: Thanks for the suggestion, we have included the NMR spectra in SI.

4. Line 163-174: What is the purity of the obtained standards?

Response: The organosulfate standards were recrystallized in ethanol for purification and purity of these synthesized standards is  $\geq 95\%$ , confirmed by NMR analysis. We have included this in revised manuscript.

5. Line 313: The authors suggest the anthropogenic origin of phenyl sulfate and glycolic acid sulfate. Trend of phenyl sulfate is more similar to that of OC, while glycolic acid sulfate is more similar to inorganic sulfate. Any explanation?

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Response: Phenyl sulfate and glycolic acid sulfate both show a trend similar to OC and sulfate. However, we agree with the referee, there is small difference, which is likely associated with the difference in reaction rates, the abundance of precursors and their emission sources. Glycolic acid sulfate is formed efficiently from glycolic acid relative to glyoxal in the presence of acidic sulfate particles, therefore, sulfate is likely the reaction rate limited factor.

6. Line 316-320: Do the authors suggest that hydroxyacetone sulfate is biogenic origin? If so, why the concentration of hydroxyacetone sulfate is much higher than that of phenyl and benzyl sulfate, which were suggested from anthropogenic origin? I doubt if there is a large biogenic source for hydroxyacetone sulfate in Winter.

Response: We agree with the referee that emissions of biogenic precursors, e.g., isoprene, are not likely abundant in Xi'an in winter. In the manuscript, we discussed that in general hydroxyacetone sulfate has both biogenic and anthropogenic origins. It would depend on the formation rates of biogenic hydroxyacetone sulfate and anthropogenic hydroxyacetone sulfate. We have added more discussion in revised manuscript.

Minor comments:

7. Line 322: Please define “high polluted days” and “low polluted days”.

Response: High polluted days with PM<sub>2.5</sub> of 293.7-314.5  $\mu\text{g m}^{-3}$  (average 300.6  $\mu\text{g m}^{-3}$ ) and low polluted days with PM<sub>2.5</sub> of 94.7-121.2  $\mu\text{g m}^{-3}$  (average 106.4  $\mu\text{g m}^{-3}$ ). We have added these in revised manuscript. We have included this in revised manuscript.

8. Line 615: “chromatogram” should read “chromatograms”

Response: Change made.

9. Line 611: Legends (a), (b), (c), (d) are missing on Figure 2

Response: Change made.

10. Line 620: Figure 4 (a), unit of concentration should be added to the legend.

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Response: Because the unit for organosulfates ( $\text{ng m}^{-3}$ ) is different from that for OC and  $\text{SO}_4^{2-}$  ( $\mu\text{g m}^{-3}$ ), we specify these in the caption.

Please also note the supplement to this comment:

<https://www.atmos-meas-tech-discuss.net/amt-2018-104/amt-2018-104-AC1-supplement.pdf>

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