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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Fine particle characterization in a coastal city in China: composition, sources, and impacts of industrial emissions" *by* Lu Lei et al.

Anonymous Referee #1

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Review of "Fine particle characterization in a coastal city in China: composition, sources, and impacts of industrial emissions" by Lei et al.

Lei et al. presented time-of-flight aerosol chemical speciation monitor (ToF-ACSM) measurements of fine particles in a coastal city in China that is affected by two large steel plants. The instrument was equipped with the newly developed PM2.5 size cut and capture vaporizer. From data sets in spring and fall, differences in mass concentration and species concentration were discussed with both diurnal pattern analysis and positive matrix factorization (PMF). Potential source analysis using bivariate polar plots revealed impacts from the steel plants. Specifically, six plumes were analyzed in

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detail, and results suggest that ammonium sulfate, NOx/CO ratio, and NOx/SO2 ratio could be used to evaluate the impacts from steel plant emissions.

The measurements are new in that 1) a focus on the effects of industrial plumes; and 2) with newly developed PM2.5 size cut and capture vaporizer. The analysis is rigorous for standard aerosol mass spectrometric (AMS) practice and PMF analysis, but lacks in verification of certain potential differences between the capture vaporizer (CV) and standard vaporizer (SV), as indicated in Major Comment #1 below. The manuscript is fairly well written, but has some room for improvement. Minor Comments below list a few examples for the authors to consider changing. Overall, I have concerns in the assertions that certain inorganic and gaseous species can be used as diagnostics for steel plant emissions (see Major Comments below). Therefore, I suggest Major Revision, for the authors to lean the discussion more on other major conclusions (which are by themselves quite useful), instead of focusing too much on using these diagnostic indicators that might not be specific to steel plant emissions.

Major Comments:

1. P11, L14. The authors suggested that there were two plumes in which ammonium bisulfate accounted for 70-80% of PM mass. I suppose the conclusion that the "sulfate" detected by the ToF-ACSM was bisulfate is from the observation that "sulfate" measured was much higher than the ammonium measured on an equivalent basis. If so, the authors should specify that in the manuscript. Another concern I have is whether that was partly due to the usage of CV as compared to the commonly found nearly "neutral" NR-PM in previous AMS studies using SV. There might be difference in both RIE and fragmentation patterns for CV compared to SV, as indicate by Hu et al. (AMT, 2017 and AST, 2017). The authors need to clarify whether these would affect quantification of sulfate using the ToF-ACSM that comes with a CV.

2. P12, L5-8. The authors suggested that the NOx/SO2 and NOx/CO ratios can be used as diagnostics for impacts of steel plant emissions. First, it is ok for NOx/SO2 ratio

with both ug/m3 as the mass concentration unit, and end up in a dimensionless ratio. But CO has a unit of mg/m3. Should the NOx/CO ratio be the number stated * 10^-3? Second, the low ratios observed in plumes in this study do not exclude possibilities of similar low ratios from other plumes (such as traffic emissions, power plants, and biomass burning). Can the authors summarize literature values for other typical primary sources before making such a statement that low ratios of these gaseous species can be indicators of steel plant emissions?

3. P13, L4. The statement that ammonium sulfate can be used to evaluate and quantify the impacts of steel plant emissions is even less convincing. There would be ubiquitously existence of ammonium sulfate in most environments, many of which with ammonium sulfate as the dominating NR-PM species. If the authors can justify Major Comment #1 above, then it makes a little bit more sense to say that ammonium bisulfate (typo?) can be used for this purpose. Still, other sources (e.g., power plants) can emit (directly or indirectly) large amounts of ammonium bisulfate too. Please clarify.

Minor Comments:

1. P1, L13: a new sentence should start after “China”.

2. P1, L14: change “have” to “present”.

3. P1, L16: no need to use “seasons”. Spring and fall contain the meaning of “season”. There are a number of similar cases later. Please check.

4. P1, L21: put a “,” after “seasons”.

5. P2, L12: change “important one” to “important sources”.

6. P2, L16: add “concentrations of” before “toxic”.

7. P3, L1: change “contributions” to “effects”.

8. P3, L22: add “a” before “capture vaporizer”.

9. P4, L9: change “new” to “newly”. There are some similar cases later too. Please check.

10. P4, L10: delete “those,”?

11. P4, L15: I would suggest either using “SO4” as the shorthand notation or using the right ionic formula.

12. P5, L9: delete “for”.

13. P7, L2: delete “was” before “decreased”.

14. P7, L5: change “small, less than 2%” to “small at less than 2%”?

15, P8, L4: I would suggest using the right ion formula for the alkyl ion series.

16, P8, L17: a new sentence should start before “for example”.

17, P11, L8: change “nearby” to “near”.

18, P12, L17: add “a” before “higher contribution”.

19, P12, L18: which one is higher? Daytime or nighttime? It seems contradictory to what was said previously.

20, P13, L4: change “steel plants emissions” to “steel plant emissions”.

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