

Comment on acp-2022-725

Anonymous Referee #2

Referee comment on "Seasonal variation of aerosol iron solubility in coarse and fine particles at an inland city in northwestern China" by Huanhuan Zhang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-725-RC2>, 2022

This study by Zhang et al., investigated the seasonal variation of aerosol Fe solubility for coarse and fine particles at Xi'an. Overall, the manuscript is well organized and the results are clearly presented with comprehensive discussion. The topic of this study is of great interest in the community. The results of this study are interesting and important for the understanding the role of Fe in atmosphere, especially for the biogeochemical cycle of Fe. I am very pleased to recommend this manuscript for publication after a minor revision. My comments are shown as below.

- Line 140: Gaseous compounds were not considered when calculating aerosol acidity. Clarify if this will affect the trend of aerosol acidity. This is important for the discussion on aerosol acidity. Generally, omission of gaseous compounds will lead systematically underestimation of pH (over estimation of acidity). I believe that the trend of aerosol acidity would not be affected significantly; therefore, the discussion on aerosol acidity is still valid. But a clarification is needed here.
- Line 146: If the arrival time is 8 am of each day, the number of trajectories should be same as the samples. But the number of trajectories is much more than that of samples. Please verify the accuracy of the description.
- It is stated that "...suggesting desert dust always as the dominant source of total aerosol Fe at Xi'an, regardless of particle size range and seasons." (Line 206-207). But in line 202-204, the authors also mentioned anthropogenic emissions as an important factor. The authors need to clarify how they are consistent.
- Line 229-230: Authors indicated that dissolved Fe concentration in winter for Xi'an is higher than that for Qingdao. It may be resulted from the differences of total Fe concentrations in the two cities. Authors can add one sentence here to make an explanation.
- Line 255-268: When investigating the source of soluble Fe, the authors talked about the correlation of soluble Fe with elements like K⁺, Pb and Al, which is valid. However, the authors started the discussion from K⁺ without any justifications. The correlation with all elements has been actually listed in Table S3. I suggest the authors to have an overall description of the correlation with all elements before mentioned K⁺ (with the highest correlation).
- Line 261-262: Any literature to support that biomass burning emission is important for

autumn and winter in Xi'an?

- Line 264: "anthropogenic emission" is a vague description. Please specify it or list some possible anthropogenic sources.
- Section 4.1: Authors may need to compare the Fe solubilities in winter between Qingdao and Xi'an, as the comparisons for total and dissolved Fe between these two cities.
- Line 308-310: This sentence does not provide sufficient information. To my understanding, the reverse relationship actually reflects the different source (or affecting factor) of total Fe and water-soluble Fe. The authors can try to explain the mechanism or just state that the mechanism needs to be further investigated.
- Line 383: I am not sure if the description of "Secondary formation of dissolved aerosol Fe" is accurate. I understand that secondary process may promote the dissolve of Fe but this description may be misleading.
- Line 409-410: Authors stated that Fe solubility continuously decreased with increasing aerosol pH (from <2 to >5) for fine particles, this trend is generally right. But if we see Figure 9, Fe solubility slightly increased with pH from <3 to >3 for fine particles, so please make your description be more conservative.
- Authors indicated that desert dust was not the main source of dissolved Fe, and chemical aging showed a small impact on Fe solubility for fine particles. It may imply that anthropogenic emission is the dominant source of dissolved Fe in fine particles. Authors can add some sentences in section 6 to illustrate it and make your conclusions be more specific.

Some other minor issues as listed below:

1) The title of section 3.1 may be more suitable with "Meteorological conditions and particulate matter concentrations" since particulate matter concentrations are also discussed in this section.

2) Line 109: Please delete the second word of "and" in "Coarse (>1 μm) and fine (<1 μm) and aerosol particles".

3) Line 110: Specify the time is am or pm.

4) Line 124: Specify the model of the ICP-MS and the MDL.

5) Line 144: Verify the time resolution is 3 or 6 hours.

6) Line 185 and line 229: Please replace the Chinese character in parentheses with "and".

7) Line 213: Correct the typo "deust".

8) Line 356: Space should be added between the parentheses and word.

9) Line 405: Change "we" to "the current study".

10) Line 425: The values of Fe solubility for coarse particles in parentheses were wrong. Please follow Table A1 and revise them.