

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2022-725

Anonymous Referee #1

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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-RC1>, 2022

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The manuscript investigated total Fe, dissolved Fe and Fe solubility for coarse ( $>1 \mu\text{m}$ ) and fine ( $<1 \mu\text{m}$ ) particles in four different seasons at Xi'an, China impacted by anthropogenic emissions and desert dust, combining with the relative humidity and aerosol pH. This work is very useful to realize the importance of RH and aerosol acidity in regulating Fe solubility in atmospheric particles. I would therefore consider the publication of this article once the authors have addressed the following comments.

### Major concerns:

- I think in introduction there are wrong mentions. For example, the organic complexations in L. 74 are not analyzed in following results and discussions. The seasonal variation of Fe solubility, on another hand, has only been explored by a few previous studies as shown in the introduction. Again, you investigated seasonal variations of total Fe, dissolved Fe and Fe solubility in this article. So is it a repetitive work? Please go through the words logically.
- Combining with the Fig. 4, 8 and 9, as well as table A1, the aerosol Fe solubility in this field observation is lower than some previous studies based on field data on regions influenced by anthropogenic emission and pyrogenic iron source. Please give the reasons for the relative low Fe solubility in the article. If possible, the authors should cite more literatures and field data at sampling sites, summarizing in forms of table to show total Fe and Fe solubility in next revised manuscript.

### Minor concerns:

- 49: "primary production" to "primary productions".

- 50: The authors need to clarify the chemical mechanisms as dissolved iron contributing to *ROS* formations in aerosols. It is not enough only listing the references. I think Fenton reaction is a good standpoint.
- 59: "a number of studies have been conducted in the last 2-3 decades." But authors only cite some references in recent years (2018 to 2021) and should replenish more studies in former years than 2010.
- 66: "contribution" to "contributions".
- 74: Irrelevant statement in introduction. From view of this manuscript, the authors aim to study the effect of aerosol acidification on aerosol Fe solubility, rather than organic complexation, as yet it is not shown in entire paper. Please revise it.
- 112: "W41 filter used for aerosol sampling were acid-washed to reduce background levels." I am little confused by the acid-wash and you should explain the pretreatment. Or sampling cut-offs and sampler were acid-washed?
- 119, This sentence could be revised as "Each filter was equally halved."
- 122, this again confusing. Why did the authors fill Teflon jar with 20 mL HNO<sub>3</sub> after acid digestion? Whether the results were same if replacement with ultrapure waters?
- Figure 3 and Figure 7: These plots missed the color legends labeling as the coarse or fine particles.
- 369: Misspelling, please revise "Ass shown in Figure S11" to "As shown".
- 405: "Both Shi et al. (2020) and we suggested that high RH could promote Fe dissolution via acid processing." Only relationship between RH and Fe fractional solubility is not persuasively in favour of it. If possible, the writer can add the soluble ion balance ( $I = 2[\text{SO}_4] + [\text{NO}_3] + [\text{Cl}] - 2[\text{Ca}] - [\text{NH}_4] - [\text{Na}] - 2[\text{Mg}] - [\text{K}]$ ), a proxy of the acidification of the aerosol aqueous phase, in Fig. 8 to see if they correlate. When  $I > 0$ , excess H<sup>+</sup> is required in the associated aqueous phase to neutralize the excess anions.
- 426: Did the lower aerosol pH exist in summer and autumn? Several studies have shown the formations of secondary inorganic aerosols during heavy haze episodes frequently in winter dominate the higher aerosol acidity in cities, so is conflicting with your findings? Can you give an interpretation for it?
- "the observed higher Fe solubility in summer and autumn" at L. 429 is completely contrary to the wordings at L. 443-444 as "dissolved Fe concentrations were lowest in spring and summer". Please revise this.