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Comment on acp-2021-712

Anonymous Referee #2

Referee comment on "Sources and processes of iron aerosols in a megacity in Eastern China" by Yanhong Zhu et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2021-712-RC1>, 2021

Title: Sources and processes of iron aerosols in a megacity of Eastern China

by: Yanhong Zhu et al.

General Comments: This paper deals with the Fe aerosol particles reactivity in an urban environment, according to variable weather conditions.

I would like to commend the authors for their work : it is a very relevant study, dealing with an essential issue in Fe atmospheric chemistry for four main reasons :

- Soluble Fe plays an important role in many environmental processes, including in ocean biogeochemistry and thereby the global carbon cycle
- Fe-bearing particles may have adverse health effects
- Anthropogenic Fe particles have been the subject of increased interest in recent years due to their significant solubility
- Very few atmospheric Fe solubilities inferred from urban field studies have been reported in the literature

I cannot however recommend the publication of this study in a high ranked journal as Atmospheric Chemistry and Physics in its present form. Please find below some suggestions, as an attempt to improve the manuscript before resubmission.

- Section 3.1 (Pollution Levels) : This section only gives an overview of the air pollution in the study area, without the results being directly related to the rest of the study, i.e. the evolution of the solubility of particulate iron as a function of the ambient meteorological conditions. I therefore suggest that the authors place the detailed discussion of the results of this section in the "Supplementary Information" section and keep only a summary in the main body of the text.
- Section 3.2 (Fe content and solubility) : At the end of this section the authors compare their results (PM 2.5) with those of Shi et al. (2020) for TSP and state that it is not surprising that the solubilities reported in the present study are consistently higher than those reported by Shi et al. This statement seems premature to me because, to my knowledge, Shi et al. do not provide any indication of what the coarse fraction of the aerosol (> 2.5 microns) in their samples represents. In my opinion, the end of section 3.2 should be deleted as it does not add anything to the authors' statements.
- Section 4. Summary and atmospheric implications : It is surprising that the authors can state that the majority of the iron particles observed in TEM-EDS contain, in addition to sulfates, nitrate ions, because nitrogen is extremely difficult to detect in individual analysis by this technique, unless a cryogenic system is available. Moreover, no nitrogen signal is visible on the spectra of Figure 4. What is the basis for the authors' assertion that iron is associated with nitrates in the collected aerosol?

Specific Comments

- Section 2.2 : Sample collection : When collecting aerosol samples during rain or fog days, there is a risk that the surface of the filter will be washed away and that leaching of the particles will occur. Thus the soluble fraction of the aerosol will be carried into the air pumping system. What precautions do the authors take to avoid this leaching?

- Section 3.3.2 : Atmospheric acidification processing, lines 293-294 : The authors state that the fact that a significant proportion of dissolved iron is associated with secondary sources is evidence of the important contribution of atmospheric processing to soluble iron production. I am absolutely convinced of the importance of atmospheric processes in the production of soluble iron. However, examination of Figure 3 indicates that industrial type 2 sources contribute equally to soluble iron production regardless of weather conditions (38.9 to 42.6%, except for dusty days). This demonstrates to me that the chemical composition of particulate matter emitted by industry is as important as atmospheric processes in the production of soluble iron. I would therefore suggest that the authors be careful when they insist on the influence of atmospheric processes in the production of soluble iron.