

[Response to reviewer comment 1 | Egusphere 2024-2101](#)

This manuscript submitted by Altitser et al. for publication in the journal SOIL present a very clear and convincing study that uses geophysics to look at and better understand oxidation processes of an organic pollutant. The authors use a state-of-the-art experimental set-up to measure the Spectral Induced Polarization (SIP) signature of this process in well-controlled laboratory conditions. Their experimental results are clear and unambiguous, showing that SIP shows strong potential to non-intrusively monitor this oxidation process. I have a couple of minor comments on the manuscript that I develop in the list below. However, after these small changes, I will be happy to recommend the publication of this manuscript in SOIL.

*We sincerely thank the reviewer for the constructive feedback. We have carefully considered all the comments and will revise the manuscript accordingly. Below, we provide detailed responses to each point raised:*

General comment: The resolution of the figures on the pdf is rather poor, I guess it is a conversion issue but it would be good to enhance their resolution (especially for the pictures on Fig. 6).

*The resolution issue arose due to file size constraints during the PDF conversion process. We will address this by ensuring that all images, particularly those in Fig. 6, are submitted in high resolution for the final version to maintain clarity.*

Detailed comments:

Line 46-48: Given the context, I suggest to cite Kessouri et al. (2019). Also, note that Revil et al. (2021) is dedicated to the use of SIP on soils.

*We have added the suggested citations of Kessouri et al. (2019) and Revil et al. (2021).*

Line 53: Note that Binley and Slater (2020) is more recent book reference.

*Thank you for noticing. We have added Binley and Slater (2020) as a citation in the relevant section to reflect the most recent reference.*

Subsection 2.1: Since, sand technically refer to a grain size, it would be more complete to provide the mineral constituting sand and silt grains.

*In our study, we use 'Sandy soil' to describe the soil texture, which is a common practice in soil science to indicate the predominant particle size. We provided the percentage of sand (97%), silt (3%), organic matter (OM)(2.5%), and CaCO<sub>3</sub>(4%) to give additional context about the soil composition.*

Section 3: In the text, it could help the reader to illustrate more explicitly the chemical reactions.

*Thank you for the suggestion, we added the following chemical reaction equation to Figure 2.*

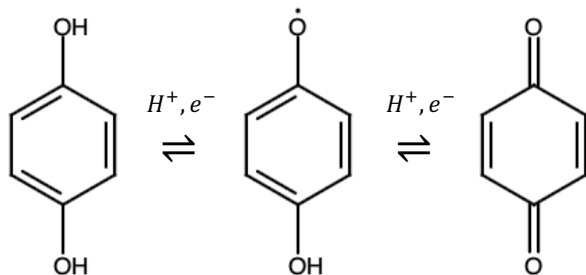


Figure 3: the author should homogenize their notation, here the units on the two y-axes could be written following the same convention (later the authors use “cm<sup>-1</sup>” rather than “/cm”, I suggest to keep it everywhere).

*Thank you for noticing. We ensured that the notation is homogenized, using “cm<sup>-1</sup>” consistently throughout the manuscript.*

Line 172: Reference problem.

*The reference issue at Line 172 has been fixed.*

Line 189: Note that a concentration increase of one ion does not always induce an increase of electrical conductivity. Indeed, as shown by Rembert et al. (2021) replacing the very mobile H<sup>+</sup> ions with the “heavier” hydrated Ca<sup>2+</sup> ions tends to decrease the water electrical conductivity during calcite dissolution (their Fig. 4 and discussion). Hence, it is rather the complete reaction that can explain this change than only its product.

*We appreciate the reviewer's insightful comment and the reference to Rembert et al. (2021). We agree that the relationship between ion concentrations and electrical conductivity is complex and that replacing highly mobile ions (like H<sup>+</sup>) with less mobile ones (like Ca<sup>2+</sup>) can sometimes decrease conductivity, as shown in their study.*

*In our specific case, however, we believe the concentration effects dominate due to the following reasons:*

1. The  $H^+$  concentration in our system ranges from  $10^{-8}$  to  $10^{-12}$  M, while  $Ca^{2+}$  and  $Mn^{2+}$  concentrations are in the  $10^{-3}$  M range. This significant difference in concentration (5-9 orders of magnitude) means that changes in the major ion concentrations have a more substantial effect on conductivity than  $H^+$  replacement.
2. The mobilities of  $Ca^{2+}$  and  $Mn^{2+}$  are relatively similar ( $Ca^{2+}$ :  $6.17 \times 10^{-8} \text{ m}^2 \text{ Vs}^{-1}$ ,  $Mn^{2+}$ :  $5.5 \times 10^{-8} \text{ m}^2 \text{ Vs}^{-1}$  at  $25^\circ\text{C}$ ), so replacing one with the other doesn't significantly affect overall mobility. While  $H^+$  ions are indeed much more mobile ( $36.23 \times 10^{-8} \text{ m}^2 \text{ Vs}^{-1}$  at  $25^\circ\text{C}$ ), their extremely low concentration in our system means their contribution to overall conductivity is limited.

Given these conditions, an increase in the concentration of one of the major ions ( $Ca^{2+}$  or  $Mn^{2+}$ ) is expected to increase the in-phase conductivity in our system. However, we acknowledge that in systems with different ionic compositions or concentration ranges, the interplay between ion replacement and conductivity could be more complex, as demonstrated by Rembert et al. (2021).

Figure 5: On 5a and b, the unit should be written with a capital "S". Also why not using the same unit as for the previous figures (i.e.,  $\mu\text{S cm}^{-1}$ )?

*Thank you for noticing. We corrected the unit notation to use a capital "S" and ensure consistency by using the unit  $\mu\text{S cm}^{-1}$ , as in the previous figures.*