

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-77

Anonymous Referee #1

Referee comment on "Rapidly increasing sulfate concentration: a hidden promoter of eutrophication in shallow lakes" by Chuanqiao Zhou et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-77-RC1>, 2022

In this manuscript, authors focused on the widespread increase of SO_4^{2-} concentrations in eutrophic lakes, and they explored the driving mechanism on why increased sulfate concentration was a hidden promoter of eutrophication. Authors arranged a series of microcosms and measured chemicals including sulfate, ΣS^{2-} , AVS, Fe^{2+} , Fe^{3+} , TP and SRB in overlying water and sediments, which was comprehensive. This work provided new insight into the effects of sulfate reduction on the promotion of iron reduction and the release of endogenous phosphorus in freshwater lakes. Overall, I feel that the manuscript is easy to follow, and it is also interesting. However, several issues that need to be modified in this manuscript.

- In this study, the sulfate concentration up to 150 mg/L was selected in the microcosms, however, such high sulfate might not occur in lakes. Authors need to add field data to prove this possibility.
- Line 85 "30mg/L to 100mg/L" lacks of space and the first mg/L need to be deleted. Please check throughout the manuscript.
- Line 141 "0.11g if cyanobacteria powder were added into each bottle" What is the purpose of using cyanobacteria powder instead of fresh cyanobacteria? They have completely different ecological effects.
- Line 141 "200 ml of water", water from Lake Taihu or prepared water in laboratory? How did you deal with it? Please explain it clear.
- Lines 147-148 "Since the sampling method of the experiment is destructive sampling" what was "destructive sampling"? After sampling, how can you guarantee the stable anaerobic environment?
- Tab.1 and Tab.2: Why use the sampling data at 7 and 38 d? Why not the whole incubation? Please provide the reasons.
- Line 311 "When the sulfate reduction process mediates the iron reduction process..." How can we confirm the occurrence of iron reduction or sulfate reduction? Authors need to explain the process and make it clear.
- A thorough byproducts investigation might be required to show the change and shift of oxidation-reduction processes.
- Sulfate addition would affect the microbial diversity and cause the increase in SRB. SRB

played an important role of sulfate reduction. However, there are no data to report these results.

- What is the minimum TOC for the occurrence of sulfate reduction and iron reduction for TP release? According to the discussion, lines 279-280, "Cyanobacteria released large amounts of organic matter during their decay and decomposition", the TOC might come from the cyanobacteria bloom. This indicates that some other carbon and nutrient sources are required to simulate the cyanobacteria bloom. Please clarify this description to prove your point "sulfate concentration increased was a hidden promoter of cyanobacteria bloom. "