Biogeosciences Discussions

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Reply on RC4

Chuanqiao Zhou et al.

Author 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-AC5, 2022

Reviewer 4:

The manuscript submitted by Zhou and colleagues explored the effect of sulfate reduction on phosphorus release from sediment. The authors constructed a series of microecosystems with different initial concentration of SO42-, and explained the mechanism of promoting the release of endogenous phosphorus according to the changes of sulfur, iron and phosphorus during the cyanobacteria decomposition. This study proposed that the release of endogenous phosphorus was an important reason for maintaining lake eutrophication, which provided a new insight for lake management. While the topic is interesting and relevant for the journal, there are also some questions about the whole story that the author needs to answer and modify.

1.The authors described carefully the collection of samples required for experiments and the set-up of incubation microcosms in the section of "2. Materials and Methods". However, some photos of sample sites and schematic diagrams of experimental groups will be more convincing and straightforward.

Response:

Thanks for the reviewer's good suggestion. We will add the photos of sample sites and schematic diagrams of experimental groups in this manuscript.

2.L157-167. The chemical analytical methods involved in the manuscript need further introduced. Authors need to add further detail to describe the index test method involved in manuscript.

Response:

Thanks for the reviewer's valuable suggestion. From Line 157 to Line 167, we showed the chemical analytical methods in this study, and we will add more detail to describe the

index test method according to the reviewer's suggestion.

3.During sampling of incubation microcosms, how to control the anaerobic and air pressure changes in the gas extraction process?

Response:

Thanks for your professional questions. In this study, we used the method of destructive sampling. At the beginning of the experiment, we set up a time series microcosms including 1, 2, 3, 4, 5, 6, 7, 9, 11, 14, 18, 23, 28, 33, 38, 43 and 48 d. At each time point of sampling, only one group needs to be taken out in each sampling period, therefore, the anaerobic environment of other anaerobic bottles will not be destroyed.

4.This study has been conducted for 48 days. The source of reference for this time should be indicated. Is it any value to assume that the experiment lasts longer?

Response:

Special thanks to the reviewer for your high perspicacity. Before the formal experiment, we did a preliminary experiment. We combined with the results of the preliminary experiment and the contents reported in the publications [1], and determined that the experiment lasted for 48 days. We will add the source of reference for this time in the manuscript. The experiment lasting longer is meaningful but unnecessary for this study. The cyanobacteria powder was decomposed completely at 48 days, and the environment in the anaerobic bottles were in a relatively stable state. In addition, we observed that the phosphorus concentration kept stable.

[1] Yan, X.C., Xu, X.G., Wang, M.Y., Wang, G.X., Wu, S.J., Li, Z.C., Sun, H., Shi, A., Yang, YH. Climate warming and cyaobacteria blooms: Looks at their relationshiops from a new perspective. Water Reseaech. 2017, 125, 449-457.

5.Figure 1: It seems complicated. I suggest highlighting the main line of the article and adding some easy-to-understand symbols.

Response:

Thanks for your professional suggestions. We showed the dynamic changes of the iron concentration (Fe^{2+}, Fe^{3+}) in Figure 1. We will highlight the main line of the article and add some easy-to-understand symbols according to the review's suggestions.

6.L262. "During the decomposition of cyanobacteria, SRB abundance significantly changed."

Please show the result by statistical results.

Response:

Special thanks to reviewer for your high perspicacity. We will show the result by statistical

results in Line 262.

7.This study discussed that expect for climate warming and external input, the release of endogenous phosphorus is also an important reason of eutrophic lake. Why didn't the authors determine its proportion of contribution and discuss the contribution rate of endogenous nutrients in a more detailed way in the manuscript?

Response:

Thanks for the reviewer's professional suggestion. To determine the proportion of contribution for endogenous phosphorus is out of the purpose of this study. In future experiments, we will consider the isotope tracer method to determine the contribution of endogenous phosphorus.

8.L279-281. "Cyanobacteria released large amounts of organic matter during their decay and decomposition, which promoted microbial growth and ultimately promoted anaerobic reduction of sulfur and iron (Holmer et al., 2001)." The authors obtained this result based on the results and references. But a detailed explanation of the biochemical process followed this sentence. Since the anaerobic reduction of sulfur and iron is quite complex, I suggest that more attention should be paid to the logic of the discussion here. Putting this sentence after the biochemical explanation will make the discussion clearer.

Response:

Thanks for the reviewer's questions. Cyanobacteria decomposition released a large amount of organic matter and formed the anaerobic environment which promoted the sulfate reduction [1]. We will modify the logic of this paragraph and add more discussion about the biochemical explanation.

[1] Holmer, M., Storkholm, P. Sulphate reduction and sulphur cycling in lake sediments: a review. Freshwater Biology, 2001, 46:431-451.

9.In this manuscript, the results and discussion of microorganisms are insufficient. I suggest that the author can supplement more data to make the study more comprehensive.

Response:

Thanks for your comments. The increase of sulfate concentration promoted the increase of abundance and activity of SRB. In this study, we have showed the dynamic changes of the SRB abundance in Table 1. We will add more discussion about abundance and activities of microorganisms in the discussion section according to other studies.

10.This study indicated that the sulfate reduction promoted the release of endogenous phosphorus in eutrophic lakes. The authors may be able to compare this study with the non-trophic lakes in the middle and lower reaches of the Yangtze River.

Response:

Thanks for the reviewer's kind remind. It has been reported that the sulfate concentration in eutrophic lakes has a stronger reduction potential than that in non-eutrophic lakes, since the availability of organic matter is one of the important factors limiting the occurrence of sulfate reduction. We will compare this study with the non-trophic lakes in the middle and lower reaches of the Yangtze River and add more discussion.

11.Some of the outdated references should be replace with more recent one.

Response:

Thanks for the reviewer's valuable suggestion. We will replace the outdated references.

Please also note the supplement to this comment:
https://bg.copernicus.org/preprints/bg-2022-77/bg-2022-77-AC5-supplement.pdf