The manuscript by Zhou et al. investigated the effects of different levels of sulfate concentrations and sulfate reduction on P mobility and release subjected to cyanobacteria decomposition. This work is interesting and the authors found a new contributing pathway of eutrophication in lakes. However, there are several problems still need to be revised especially in the experimental design and discussion sections.

1.The accumulation and decay of cyanobacteria in eutrophic lakes might change the physical and chemical environments of water body and form anaerobic reduction conditions. However, cyanobacteria decomposition also released a large amount of phosphorus. This has implications for determining how much phosphorus was released from the sediments, how does the authors solve this problem.

Response:

Thanks for the reviewer's good problem. In this study, the cyanobacteria powder biomass remained equal at the initial stage in all anaerobic bottles. During the incubation, the phosphorus concentration in the overlying water showed positive correlation with the initial sulfate concentration. The phosphorus concentration in the sediment showed the negative correlation with the initial sulfate concentration. These results indicated that sulfate concentration promoted the endogenous phosphorus released from sediment to overlying water.

2.Microorganisms play an important role in the biogeochemical cycle of lakes. The increased of sulfate concentrations will affect the abundance and activities of microorganisms. More data are needed to report these results in the discussion section.

Response:

Thanks for the reviewer's suggestion. 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 data about the abundance and activities of microorganisms in the discussion section.

3.The authors set up a series of sulfate concentrations from 0 to 180mg/L. However, some concentrations of sulfate were too high, therefore, some background data of sulfate concentration can be added in eutrophic lakes and to explain the role of sulfate concentration gradients in microsystems.

Response:

Thanks for the reviewer's kind remind. In recent studies, the sulfate concentration increases significantly in the freshwater lakes around the world [1]. Particularly for Lake Taihu, the sulfate concentration increased from 30 mg/L to 100 mg/L from 1960 to 2010 [2]. In addition, it has been reported that the sulfate concentration will continue to increase in the future [3]. We will add more background data of sulfate concentration to explain the role of sulfate concentration gradients in microsystems.

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

[2] Yu, T., Zhang Y., Wu, F.C., et al. Six-decade change in water chemistry of large

freshwater lake Taihu, China. Environmental Science & Technology, 47(16): 9093-9101.

[3] Chen, M., Li, X.H., He, Y.H., et al. Increasing sulfate concentrations result in higher sulfide production an phosphorous mobilization in a shallow eutrophic freshwater lake. Water Research, 2016, 96: 94-104.

4.Why use cyanobacteria powder instead of fresh cyanobacteria? What is the meaning of cyanobacteria powder? The cyanobacteria powder and fresh cyanobacteria may have different ecological effects.

Response:

Thanks for your professional questions. In this study, we only considered the decomposition process of cyanobacteria, not the decay process. Therefore, we used the cyanobacteria powder instead of fresh cyanobacteria.

5.Please explain destructive sampling's definition and the reason for choosing this method. Authors need to explain how to keep anaerobic environment during incubation.

Response:

Thanks for the reviewer's 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. Only one group needs to be taken out in each sampling period, therefore, the anaerobic state of other anaerobic bottles will not be destroyed.

6.Line 40, Line 128 "cyanobacteria bloom" please keep the form of the full manuscript consistent. Line 116 "cyanobacteria outbreak", Line 367-368 "outbreak of cyanobacteria". Please keep the form of the full manuscript consistent.

Response:

We are sorry for these mistakes. We will adjust the format to ensure the unity throughout the manuscript.

7.Fig.1, the coordinate of iron concentration should be consistent in different groups for comparison and observation.

Response:

Thank you so much for your valuable suggestions. In this manuscript, we maintained consistent iron concentration coordinates for the treatments with initial sulfate concentration of 30, 60, 90, 120, 150 and 180 mg/L in Fig.1. In the treatment with 0 mg/L sulfate, the iron concentration in overlying water was higher than other treatments. We will unify the coordinate of iron concentration for comparison and observation.