

Reviewer 3:

This manuscript introduced a story on the driving process and mechanism of the rapidly rising SO_4^{2-} concentrations as a crucial contributor to the eutrophication in shallow lakes. Authors successively demonstrated the massive production of ΣS^{2-} and the enhancement of iron reduction under the condition of rapid increase of SO_4^{2-} . The Fe^{2+} released from the iron reduction process was captured by ΣS^{2-} , and the combination of iron and P was reduced, promoting the release of endogenous phosphorus. This experiment is relatively complete and novel, only some formatting issues need to be adjusted.

1.The introduction provided few quantitative data. For example, L76-79, “ SO_4^{2-} concentration in seawater reaching 28mM” was mentioned to support the SO_4^{2-} concentration was the important influence factor of sulfate, what is threshold and why not make a comparison? And how is it related to SO_4^{2-} concentration in eutrophic lakes.

Response:

Thanks for your very professional comments here. It has been reported that the intensity of sulfate reduction is high in freshwater lakes^[1], which is affected by many factors, including the increased of sulfate concentration, and the rapid reoxidation of sulfur^[2]. We will continue to explore the threshold of the sulfate reduction in next experiments. In eutrophic lakes, the degree of the eutrophication shows a positive correlation between the SO_4^{2-} concentration and the degree of eutrophication^[3].

[1] Sandfeld, T., Marzocchi, U., Petro, C., Schramm, A., Risgaard-Petersen, N. Electrogenic sulfide oxidation mediated by cable bacteria stimulates sulfate reduction in freshwater sediments. *The ISME Journal*, 2020, 14(5): 1233-1246.

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

[3] 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.

2.L85 "the SO_4^{2-} concentration in Lake Taihu has increased from 30mg/L to 100mg/L"
L146 " Φ 75mm, length 180mm, volume 500ml"

Kindly add a space between number and unit except % in the whole manuscript.

Response:

We are very sorry for the incorrect writing. We will add a space between number and unit throughout the manuscript.

3.L129 "a fine-mesh plankton (250 meshes)"Inaccurate units, "es" should be deleted.

Response:

Thanks for your careful remind. We will delete the "es" in Line 129.

4.L224 "the highest ΣS^{2-} concentrations at 7 d were 0.14, 0.61, 1.14, 1.55, 2.15, and 3.15 mg/L, respectively." There is one more punctuation mark before "and".

Response:

We are grateful to the reviewer for pointing out this error. We will modify the sentence according to the reviewer's suggestion.

5. Table 1, Table 2 and Figure 2 "0 mg/L SO₄²⁻" Kindly add a space between unit and "SO₄²⁻"

Response:

Thanks for your careful review. We will add a space between number and unit in Table 1, Table 2 and Figure 2.

6. Figure 6, Part of the text is obscured.

Response:

Thank you so much for your valuable suggestions. With your valuable suggestions, we will revise the Fig. 6.