Response to reviewers

Spatial distribution characteristics and potential risk assessment of heavy metals in sludge of Shanghai sewage Treatment Plant: A Case Study

Feb 7th, 2023

Dear Associated Editor and Reviewers,

Thank you very much for taking the time to review this paper and for your valuable comments and suggestions, which are much helpful to improve our paper. We have studied all the comments and suggestions carefully.

If you have any further questions or concerns about the revised manuscript, please do not hesitate to contact us. We sincerely hope that this revised paper will have a positive outcome, and thank you again for your time and help. Best wishes to all of you!

All the authors

Reviewer#3, This manuscript contains important results regarding the heavy metals in sewage from a series of water treatment plant in Shanghai/China. Although the results are important, the presentation of data should be revised before publication, since in the present form there are a few paragraphs that are nothing else than some enumeration of values.

Answers to the reviewer#3

Dear reviewer, Thanks very much for taking your time to review this manuscript. I really appreciate all your comments and suggestion! We have seriously and carefully revised our manuscript according to your constructive suggestions and remarks. We sincerely hope that the revised manuscript meets your requirements.

Concern#1. **Abstract:**

- lines 9-13: please reorganize this paragraph, it is not clear;
- line 15: what is "nemeluo"?
- line 23: replace the expression "do a good job" with something more scientific;
- the whole Abstract should be revised. There are too many oversized and unclear phrases.

Author response: Thank you for your suggestion! We have revised the abstract of the manuscript.

Author action:

The revised part correspondingly as follows:

Sewage treatment is an important indicator of urban environment and an important way of sustainable development. In this paper, the spatial distribution characteristics of 8 heavy metals in sewage sludge from 44 sewage treatment plants in Shanghai were analyzed. The pollution degree and potential ecological risk of heavy metals in sludge were evaluated by Nemerow comprehensive pollution index and Hakanson potential ecological risk index. First, the single factor pollution index of heavy metals was ranked. TheNemero comprehensive pollution index showed that five sewage treatment plants in Nanxiang, Dongqu, Liantang, Songjiang west and Xinhe were heavily polluted. Secondly, the single factor potential ecological risk index of each heavy metal was analyzed. Finally, it is concluded that in the monitoring and control of sewage treatment, Shanghai should pay attention to the sewage treatment plants with high potential ecological risks, and gain excellent performance in emission reduction of pollution sources, so as to improve environmental quality and reduce potential ecological risks. This paper provides the basis for studying the characteristics of heavy metal pollution of sewage sludge.

Concern#2. **Keywords:**

- "heavy metal sludge"? maybe "heavy metal containing sludge".

Author response: We have changed keyword "heavy metal sludge" to "heavy metal containing sludge".

Concern#3. **Introduction:**

- lines 37-40: please revise.

Author response: Thank you for reviewing our manuscript and for the constructive comments, we have revised the original text and marked it.

Concern#4. **Research data background:**
- table 1: I think the second column should be for “Minimum”, not “Maximum”;

Author response: We have changed “Maximum” to “Minimum”.

Concern#5. **Research methods:**
- line 127: “heavy metal mine”?

Author response: We have changed it to “heavy metal”.

Concern#6. **Simulation and results analysis:**
- line 177: what is meant by “radioactive”?
- figures 1-3: the legends data should be made clearer and fully translated in English;
- figure 2: I think “treatment plants” or “treatment plant system” would be better than “treatment plant”;
- lines 210-232: these two paragraphs might be rewritten in such a manner as not to be presented as an enumeration of data;
- lines 237-245: idem;
- lines 250-261: idem;
- lines 270-278: idem.

Author response: Thank you for your advice! In response to your comments, we have revised the original text and marked it.

Concern#7. **Conclusions:**
- lines 284-292: idem;
- some future research perspectives might be mentioned.

Author response: Thank you for your advice! We have revised the conclusion of the manuscript.
Author action:
The revised part correspondingly as follows:

The sewage sludge of Shanghai sewage treatment plant mainly contains 8 heavy metal elements including Ni, Cu, Zn, Pb, Cr, Cd, Hg and As, and presents diversified spatial distribution characteristics. In this paper, the spatial distribution characteristics of 8 heavy metals in sewage sludge from 44 sewage treatment plants in Shanghai were analyzed. The pollution degree and potential ecological risk of heavy metals in sludge were evaluated by Nemerow comprehensive pollution index and Hakanson potential ecological risk index. The following conclusions can be drawn: 1. The pollution of heavy metals As, Cd and Hg in sewage treatment plant sludge in Shanghai is the most serious; 2. Cu, Zn, Ni pollution in the

middle degree; Cr, Pb pollution is low. According to the Nemero comprehensive pollution index, 10 sewage treatment plants belong to the safety level, 8 to the warning level, 13 to light pollution, 8 to moderate pollution, 5 to severe pollution, among which the Nanxiang sewage treatment plant index is the highest. 2. The single potential ecological risk analysis of heavy metals in sludge shows that the potential ecological risk degree of Hg and Cd is very high, the potential ecological risk degree of Cu and As is high, and the potential ecological risk degree of Ni, Pb, Zn and Cr is low. In Fengxian east sewage treatment plants, which has a high potential ecological risk, in addition to adopting curing and thermal desorption technologies, electric remediation can also be considered to remove Cr elements from the soil. Since the soil of the cave entrance also contains high Cr and Hg, the above-mentioned techniques are also recommended for soil remediation.

We are deeply sorry for your inconvenience caused by us. If you have any further questions or concerns about the revised manuscript, please do not hesitate to contact us. We sincerely hope that this revised version will have a positive outcome and thank you again for your time and help. Best wishes to all of you!