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#2, This research is a distinguished effort by the work team. But there are some observations. In general I accept the article to publish after see my comments.

Answers to the reviewer#2

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, the main revisions made and new materials are as follows:

I. We have revised the abstract of the manuscript. in the Abstract.

II. We have added keyword "sewage treatment plants" to the manuscript. in the Keywords.

III. Four references have been modified to be replaced into the manuscript. in the References.

IV.

V. We have checked the full manuscript and changed all the abbreviation of the heavy metals; in the text.

VI. We have enhanced resolution of all Figures and translated the label to English. in the text.

VII. The conclusion has been modified. in Conclusion.

VIII. Efforts have been made to improve the language along with the manuscript. A native English speaker has made additional cross-checking. Moreover, other mistakes have been corrected. (all the modifications are highlighted in yellow).

Concern#1. **In Abstract:** the authors used long sentences. It is best for they can do short sentences. Up, I was try to do this and the authors must follow the same at all manuscript.

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. **The keywords:** Not enough.

Author response: Thank you for your suggestion! We have added keyword “sewage treatment plants” to the manuscript.

Author action:
The revised part correspondingly as follows:
Keywords: heavy metal containing sludge.; sewage treatment plants; spatial distribution; pollution index; ecological risk

Concern#3. The authors must update the references, there is no references in 2020, 2021 and 2022.

Author response: Thank you for your advice. Four references have been modified to be replaced into the manuscript.

Author action:
The revised part correspondingly as follows:
[4] Xu Zhe,Zhang Qingrui,Li Xuchun,Huang Xianfeng. A critical review on chemical analysis of heavy metal complexes in water/wastewater and the mechanism of treatment methods [J] . Chemical Engineering Journal . 2022,429.
[7] Geng Yuanmeng, Zhang Chuanbing, Zhang Yong, Huang Doudou, Yan Shuxiao, Sun Tengfei, Cheng Liu, Wang Jing, Mao Yuxiang. Speciation and ecological risk assessment of heavy metal(loid)s in the municipal sewage sludge of China[J]. Environmental Science,2021,42(10):4834-4843.
[9] Song yanyan, Cui Jing, Jiang Xuesong, Qi Hengzhen, Bian Zhiming. Occurrence characterist and ecological risk assessment of organic pollutants in sewage sludge of Zibo city[J].Environmental Monitoring in China, 2022,38(04):155-164.
[21] Ma Tao, Song Jiangmin, Liu Qunqun, Sheng Yanqing. Comparision of ecological risk assessment of heavy metals in dredged sediment treated by different methods [J]. Environmental Engineering,2021,39(02):141-146+152.

On page 11-12.

Concern#4. The authors didn’t compare the obtained results with the other countries.

Author response: Thank you for your opinion, which is very valuable. Considering the privacy protection of sewage plant data in different countries, we are unable to obtain relevant data of other countries for the time being, but we retain your suggestion and consider expanding it in future research.

Concern#5. The authors must use the abbreviation of the heavy metals at all manuscript.

Author response: Thank you for your suggestion! All the abbreviation of the heavy metals in the manuscript has been corrected.

Author action:
We have checked the full manuscript and changed all the abbreviation of the heavy metals. **In the text.**

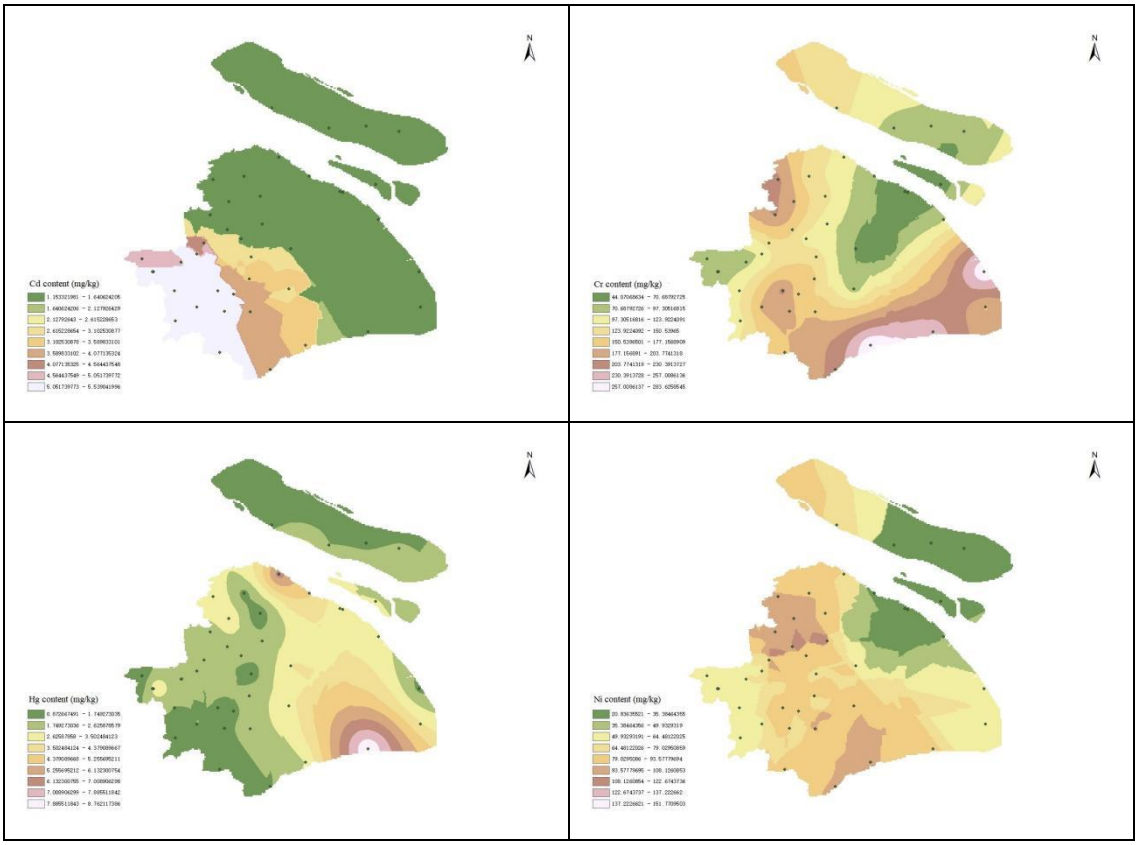
Concern#6. The simulation of the results was very excellent.

Author response: Thank you very much for your kindness comments.

Concern#7. The resolution of Figures must be more enhanced.

Author response: Thank you for your suggestion! We enhanced resolution of all Figures.

Author action:
The revised part correspondingly as follows:



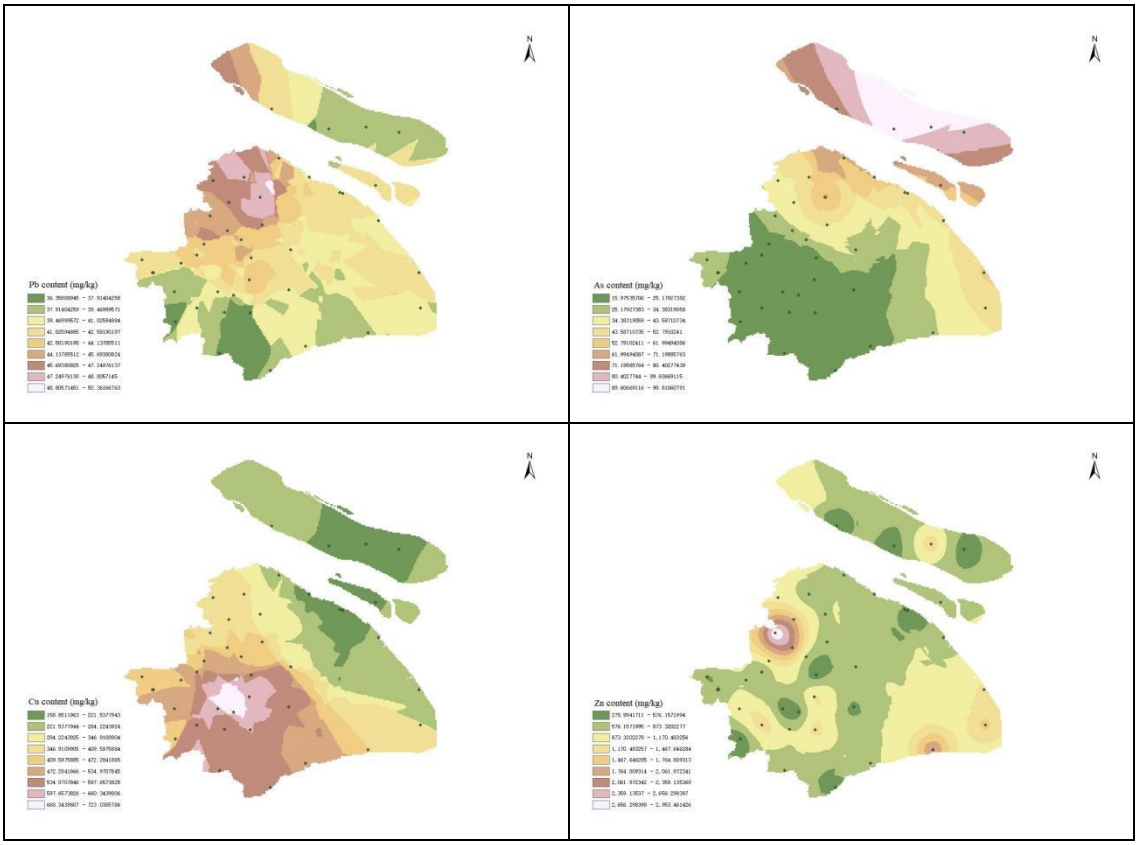


Figure 1. Spatial distribution of heavy metals in sludge using Kriging interpolation.



Figure 2. Overall spatial distribution of heavy metals in sludge of Shanghai sewage treatment plants

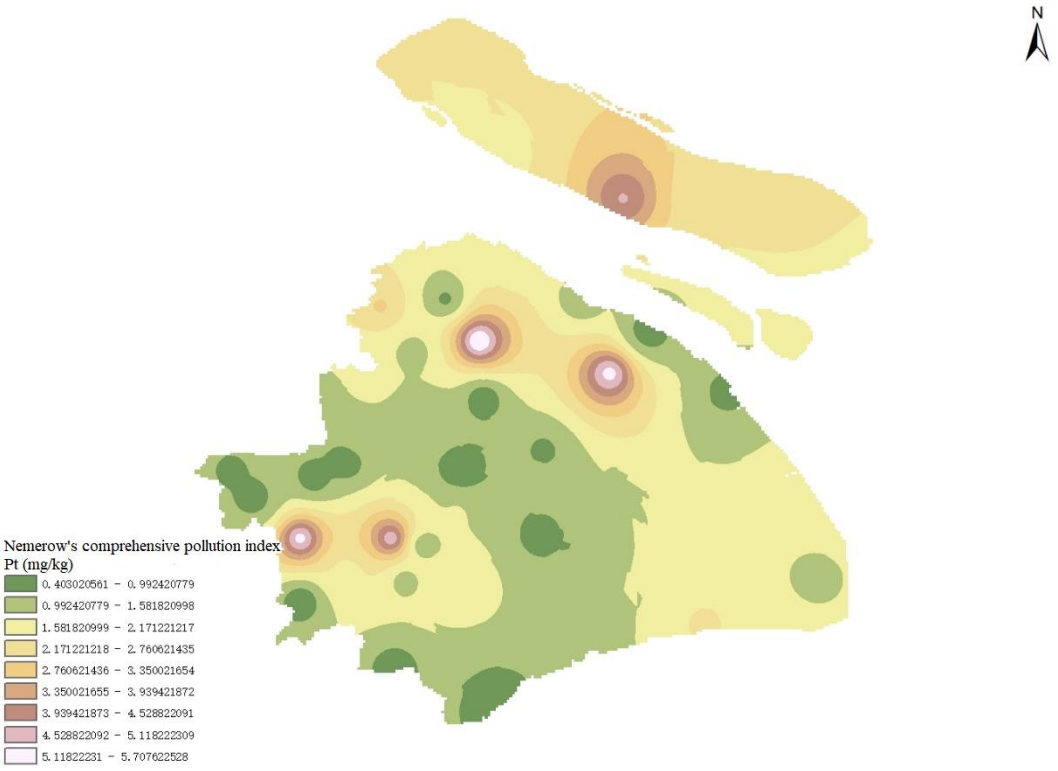


Figure 3. Spatial distribution of heavy metal pollution in sewage treatment plants in Shanghai.

Concern#8. The label in Figures must be translated to English, not all scientific people know Chinese language with all of my regards and respect to their language.

Author response: Thank you for your suggestion! We translated the label in Figures to English.

Author action: The revised part correspondingly be the same as **Concern#7**.

Concern#9. The conclusion was very long must be focused and decreased.

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!