Dear Editors and Reviewers:

Thank you for your letter and for the reviewers’ comments concerning our manuscript entitled “Relationship between Instant Sampling and Daily Average Values of COD for Urban Wastewater Treatment Plants in China”. Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. The main corrections in the paper and the responds to the reviewer’s comments are as following:

Comments:

1. p.3 L. 101 I required the author to show the statistical explanation to verify the log-normal distribution for COD measurement. As authors response, their data was hard to be conducted in statistical test, and instead of the test, they used log-normal plot and show the linearity by correlation coefficient. I could not understand this response because the data which could be controlled to be plotted in log-normal should also be controlled for statistical test for example, Shapiro-Wilk etc. In addition, the assumption that COD measurement follows the log-normal distribution is the key of this paper.

   The authors said also that according to previous reliable papers, COD can be assumed to follows log-normal distribution. However, almost previous papers came from USA. Then the situation may be different in China. The authors must show the concrete and statistically verified evidence explaining the log-normal distribution assumption in their data.

2. p.5 L.181~L190 I pointed out that the explanation of this paper is not so kind to be understood for readers in first peer review. This part is typical example.

   How can the daily average limit be decided. It must be different from instant sampling limit. The ratio of the daily average and instant sampling limits was defined as K value (eq. (5)). This K was decided by the data of each WWTP, not in general. Why can you conclude that the daily average (= average of instant sampling) exceeded the daily average limit which should be decided according to each WWTPs data when CORmin was larger than assumption value of 0.222.

   If instant sampling limit is 4.5 times daily average limit (= K value should be 4.5), I can understand that the daily average must exceed daily average limit always in this condition.

3. p.8 L.238 The K value is defined as the ratio of VF (variability factor) of instant sampling and daily average, not values of instant sampling and daily average. It results in some conflict.

Response:

1. Thank you for the good advice. We conducted Kolmogorov-Smirnov test of the logarithm of COD data of 1738 WWTPs in China, the result verified the log-normal distribution with the P-value>0.05 for 84% of the WWTPs while some WWTPs did not pass the test actually. But the WWTPs which didn’t pass also presented the approximately log-normal distribution with the correlation coefficient of the fitting linear of the logarithm of COD concentrations against the normal probabilities greater than 0.8. We hoped that the log-normal distribution can be used to further study on COD data of WWTPs like other references.

2. We are very sorry for the unclear explanation in the paper.
We defined the COR by Eq.(8) to relate the average of concentration (e.g. daily average) to the limit (e.g. instant sampling limit). Meanwhile, the COR changed with coefficient of variation shown in Eq. (16) and Figure 1 presenting that there is a CORmin under certain Reliability.

According to the above, when one of the instant sampling values exceeded the instant sampling limit (24h Reliability=75%), the CORmin=0.797 which means (the daily average/the instant sampling limit)min=0.797 showing that the daily average definitely greater than 0.797 times of the instant sampling limit. And if we set the daily average limit as 0.797 or less times of the instant sampling limit (the instant sampling limit is 1.254 times or greater of daily average limit), the daily average definitely exceeded the daily average limit. The following equations may further explain it:

\[
COR = \frac{\mu_x}{C_s} \geq 0.797 \\
\mu_x \geq 0.797 \times C_s
\]

Where:

\( \mu_x \)——average of the measured discharge concentration (daily average)

\( C_s \)——discharge limit concentration (instant sampling limit for 24h)

If \( C_{sd} = 0.7973C_s \) or less, then

\[ \mu_x \geq C_{sd} \]

Where:

\( C_{sd} \)——daily average discharge limit.

In this part, we only discuss the relation between \( \mu_x, C_s \) and \( C_{sd} \) theoretically, we haven’t defined the K values and decided the daily average limit or instant sampling limit for WWTPs in China which will be discussed in 3.2 of the paper. We hope it can be understand and we have modified some descriptions in the paper using the equations above for better understanding.

Some further explanations will be in following Response 3.

3. We are very sorry for the unclear explanation in the paper.

The K value is defined as the ratio of the instant sampling limit to the daily average limit. As the “limit” is defined and calculated by LTA×VF (Eq.(1)), so the “limit” here is not the limit we have already set, but the value calculated to reflect the real discharge level, and can be used to decide the discharge limit. We hope it can be understood.

Because LTA of instant sampling and that of daily average is the same, the K value can be calculated by the ratio of VF of instant sampling and daily average. We have modified the Eq.(5) for better understanding.

The comment 2 mentioned that K was decided by the data of each WWTP, not in general, how the daily average can be decided to exceed the daily average limit which should be decided according to each WWTPs data. We studied the K values for 1738 WWTPs in China, and concluded that 99% of the WWTPs were less than 1.3, which meant that the instant sampling limit can be set by 1.3 times of the daily average limit, and can be accepted by 99% WWTPs in China. Then if \( C_s = 1.3C_{sd} \) (means: \( C_{sd} = 0.7692C_s \)), and 6 of the instant sampling values exceeded the instant sampling limit (24h Reliability=75%), we can get \( \mu_x \) would definitely exceed the \( C_{sd} \), because the minimum of \( \mu_x \) is 0.797\( C_s \) according to the COR reasoning mentioned in Response 2 above. As to the WWTPs with K<1.3, the daily average would always conform to daily average limit when no more than 5 of instant sampling values exceeding the instant sampling limit.
In this paper, we didn’t discuss how to decide the instant sampling limit or daily average limit for WWTPs in China, but we just discussed the relation between the two, which would be helpful for limit setting and treatment control of WWTPs.

We hope the explanations above would helpful for understanding, and we have modified some descriptions in the paper.

Special thanks to you for your good comments.

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