Response to Reviewer 4 Comments

**Point 1:** Authors should avoid abbreviations in the title. Authors should add a list of abbreviations before the references.

**Response 1:** Thanks for the kind reminder. We agree with this suggestion. The abbreviations in the title have been deleted. Besides, a list of abbreviations has been added before the references.

**Point 2:** Please avoid repeating the full name and abbreviation throughout the manuscript if you used the first-time abbreviation.

**Response 2:** Thanks to the reviewer for the patient comment. The above mistakes have been revised.

**Point 3:** Line 46-52: & line 84-85 “Ultrafiltration (UF) as an emerging alternative technology to conventional water treatment processes, has been widely used to remove pollutants such as particles, colloids, bacteria, and viruses, thus reducing the risk of water-borne diseases [10]. Size exclusion is considered the primary removal mechanism for the UF. However, in the case of the PPCPs with a small molecular weight (typically < 600 Da), UF membranes also cannot effectively reject these PPCPs, but nanofiltration and reverse osmosis are able to remove these PPCPs based on the thin-film composite”. Sorry, but I don't see why UF can reject viruses and bacteria but not PPCPs. Is it true that the molecular weight of viruses and bacteria is more than that of PPCPs? Please elaborate.

**Response 3:** Thanks to this reviewer for the comment. Common waterborne viruses include Shigella, Vibrio cholerae, Poliovirus, adenovirus, and coxsackie virus, with sizes of 26 nm, 27 nm, 30 nm, 90 nm, and 30 nm, respectively [1-5]. The molecular weights of PPCPs are generally less than 1000 Da (about 1-2 nm), obviously smaller than the virus. The molecular weight cut off of UF membranes was an average 100 000 Da in this work, which was similar to the virus but larger than the PPCPs molecules.

1. Karthik K, Dhanuskodi S, Gobinath C, et al. Multifunctional properties of microwave assisted CdO–NiO–ZnO mixed metal oxide nanocomposite: enhanced photocatalytic and antibacterial activities [J]. Journal of Materials Science: Materials in Electronics, 2018, 29(7): 5459-71.
2. Song S, Liu Z, Zhou J, et al. An adjuvant compound that enhances immunogenicity at fractional doses of the Sabin-inactivated poliovirus vaccine (sIPV) with a long duration of protection in a rat model [J]. Journal of Medical Virology, 2019, 91(1): 14-21.
3. Kim K, Choi J-W, Ma K, et al. Nanoisland-Based Random Activation of Fluorescence for Visualizing Endocytotic Internalization of Adenovirus [J]. Small, 2010, 6(12): 1293-9.
4. Dourmashkin R R, Mccall S A, Dourmashkin N, et al. Virus-like particles and enterovirus antigen found in the brainstem neurons of Parkinson's disease [J]. F1000Res, 2018, 7: 302-.
5. Tamano K, Aizawa S-I, Katayama E, et al. Supramolecular structure of the Shigella type III secretion machinery: the needle part is changeable in length and essential for delivery of effectors [J]. The EMBO Journal, 2000, 19(15): 3876-87.

**Point 4:** The authors should include some information regarding the biological degradation of PPCPs by microorganisms in the introduction section.

**Response 4:** Thanks for the kind reminder. The information regarding the biological degradation of PPCPs has been added in the introduction. The revised sentences are shown below:

In the BAC biofilters, the biotransformation and adsorption both contributed to the PPCPs removal. The activated carbon adsorbed PPCPs to the surface and interior, where microorganisms were suitable for growth. Under the long-term effect of high-concentration PPCPs, the dominant microorganisms in the biofilter were selected to survive. These microorganisms mostly transformed PPCPs into many segments and even directly mineralized them to CO2 [3, 14].

**Point 5:** Line 53-55: “The combined process with ultrafiltration may be another promising choice, featuring a comparable removing performance as the nanofiltration and low operational cost”. Have the authors compared the BAC-UF performance to that of nanofiltration?

**Response 5:** Thanks for the kind reminder. “The combined process with ultrafiltration may be another promising choice, featuring a comparable removing performance as the nanofiltration and low operational cost”. This claim is not supported by our research. To avoid misunderstandings for readers, we changed the claim and revised the sentence. The revised version is as follows:

The combined process with UF may be another promising choice as an alternative to nanofiltration for removing PPCPs in rural areas. It can be seen in lines 54-55.

**Point 6:** I strongly suggest that the authors explain how they performed the t-tests. Please include the sample size (n) or degree of freedom (df).

**Response 6:** Thanks very much for this comment. The method of the t-tests has been explained in section 2.4 (lines 157-158) in the revised manuscript. The sample size (n) has also been added in Table 1 and Table 2.

**Point 7:** Please show the t-value and p-value in a scientific view (e.g., 2.79E-4 would be P <.001).

**Response 7:** Thank you very much for your kind reminder. The values have been modified in the revised manuscript in yellow highlight.

**Point 8:** Line 161-176: Please delete the name of medicinal compounds not used for this study.

**Response 8:** Thanks for the kind reminder. All the names of medicinal compounds not used have been deleted, including Sulfaquinoxaline (SQX), Sulfathiazole (STZ), Doxycycline (DOX), Roxithromycin (ROX), Penicillin-G (PEN-G), Clarithromycin (CAM), Norfloxacin (NOR), Oxociprofloxacin (OFL), Enrofloxacin (EFL), Flumequine (FQ), Acetaminophen (APAP), Diclofenac sodium (DCF), Naproxen (NAP), Indomethacin (IND), Metoprolol (METO), Propranolol (PRO), Atenolol (ATL), Primidone (PRM), Carbamazepine (CMZ), Sulpiride (SP), Sulfapyridine (SPN), Sulfamonomethoxine (SMM), Tetracycline (TC), Amoxicillin (AM), Dimetridazole (DMZ), Oxytetracycline (OTC) and DEET.

**Point 9:** Point 6: Why the same trend of increase or decrease in graphs (Fig. 1) was observed in Fig. 1(c). Why is the DO concentration of BAC-effluent sometimes higher than the Raw water. Please explain it in the manuscript. The reviewer suggests statistical analysis using a t-test (Raw water- BAC-Effluent and Raw water – BAC/UF-effluent).

Response 6: Thanks very much for this comment. The same trend (Figure 2) was mainly due to the stable removal ability of BAC and UF for organics, causing the removal restriction. The periodic backwash (7days) of BAC caused sometimes the dissolved oxygen concentration of BAC-effluent higher than that of raw water. After the gas scrubbing and the hydraulic backwashing, the dissolved oxygen detection of the effluent was carried out, resulting in the above results for dissolved oxygen. Besides, the t-test was used and proved the significant difference between BAC-Effluent and BAC/UF-effluent.

Thanks for the response. Please include it in the manuscript.

**Response 9:** Thanks very much for this comment. The results and discussion has been supplemented in section 3.1. Please see lines 180-185 in the revised manuscript.

**Point 10:** What is the utility or deterioration of PPCPs sludge after removing it from river water? If possible, please add at least one paragraph.

**Response 10:** Thanks very much for this comment. With a turbulent current and dozens of kilometers in length, this river is located in the mountains of Foshan city. The PPCPs sludge at the bottom of the river never executes removal. Thanks for the suggestion from the reviewer. We will further precipitate the PPCPs sludge before the water treatment plant or excavate the PPCPs sludge from the river and study the effects on drinking water quality. The relevant results will be published in another paper in the future.