

Anonymous Referee #1

First, the authors would like to thank the reviewer for taking valuable time to review and for the critical assessment of the paper.

Comment 1:

The paper as presented showed some interesting examples of the use of TOC monitoring but was missing quite a bit. In the abstract it talks about BOD & COD not being useful for process control which is true which was applicable to one of the case studies demonstrated but not to the other two.

Answer 1:

In the cases presented, TOC measurements are leveraged as a direct or as an indirect tool for processes controls and optimization. Case 1 is an example of direct use, case 2 and 3 are indirect:

- Case 2: in this case, online analysis of the organic carbon contributed to understanding source water better and in real-time so smarter decisions could be made to chemical dosages adjustments. Consequences are a help for operators to protect membranes from fouling while generating better effluent quality.
- Case 3: By having TOC analysis on-site and jar testing data with TOC and turbidity, plant operators did not have to wait for third party test results and could make immediate process decisions: Plant operators managed to reduce operational cost expenditures within several steps of plant optimization, including the ability to change pH, coagulant type, or coagulant dosage to obtain optimum results and ensure removal of organics and know when to regenerate granular activated carbon (GAC).

Comment 2:

The paper also seemed overly biased to one particular product in general and seemed more of a marketing paper rather than looking at the benefits of the technique as a whole.

Answer 2:

The structure of the paper was revamped to address that comment. Firstly, a precise definition of each organics measurement technology was provided, together with a brief explanation of pros and cons.

The following sections were added:

2 Discussion of the methods for organics measurements and regulatory frameworks

2.1 The methods for organics measurements in water and wastewater

2.1.1 BOD measurements

2.1.2 COD measurements

2.1.3 TOC measurements

2.2 Regulatory frameworks

2.3 Discussion about the determination of the correlation factor

Secondly, the paper is now quoting the particular product or technology used to conduct the study, with less emphasis on it. It was important to explain the technology used, as TOC analyzers have a wide range of applications and technologies, and not all are applicable to measure TOC in the cases illustrated here. We also had to explain what mode was used (NPOC vs TOC) because it has an influence on the results.

Comment 3:

It was very disappointing that in the references that there was no detailed reference to the work that WEF members have done on using TOC as an alternative to BOD for regulatory purposes as this was a seminal moment for the use of the technique this seems like quite a big thing to be missing in the paper.

Answer 3:

The revised version of the paper includes references to the ITA and WEF work about using TOC as an alternative to COD and BOD, and methodologies to achieve a correlation that can be accepted by national authorities. See especially sections 2.2 and 2.3.

Comment 4:

The paper is also a bit sensationalist digging into the BOD and COD techniques whilst not admitting the drawbacks of TOC (i.e. the cost and complexity of the technique).

Answer 4:

The TOC monitoring technique has been explained in section 2.1.3, and additional wording about drawbacks added:

The value of online analysis is obviously getting real time data to see process changes and make quick process decisions based on the observed fluctuations. Online TOC analyzers typically require maintenance throughout the year and have consumable parts that need to be changed out. Newer TOC analyzers however are designed for ease of use and have minimized maintenance down to once per quarter with calibration every 6-12 months.

The cost of ownership and complexity is more important with TOC than with COD or BOD: TOC test procedures are relatively simple and straight-forward, but are specific to the type of carbon-analyzing instrument utilized. Thus, no “typical” TOC procedure exists. The instrument manufacturer’s procedures should be followed accurately to achieve the best results.

Comment 5:

I do think that the paper provides value which is why i haven’t rejected it outright but I think it needs a major re-write with a big adjustment in the balance of the paper with a little bit more research into the usefulness of the analytical technique in the industry rather than being focused on one particular instrument and its uses.

Answer 5:

The paper was reviewed and amended to take referee’s comments into consideration, to balance the content toward usefulness in the industry:

- Present the benefits of TOC technology as a whole, Focus less on a particular product
- Include section about the drawbacks of TOC technology, such as cost of ownership and complexity of the technique
- Include comparison with other methods from other studies, and add explicit references (+ include them in text)