

***Interactive comment on “Effect of biostimulation on biodegradation of dissolved organic carbon in biological granular activated carbon filters” by K. Tihomirova et al.***

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We thank the Referee for the comments.

1) Specific Comments. For example, it is not clear whether one or more water samples were utilised.

In the study all samples (over the period of about year) were taken from the single site, namely, at the outlet from biofilter at Daugava water treatment plant. This fact will be stressed more in the text in section 2.4.

2) At line 11, page 72, a water sample is referred to in the singular, but earlier it is

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referred to as plural (line 17, page 70).

See answer for Anonymous Referee #1: "The average concentration of BDOC of water sample without addition of LOC was only  $0.49 \pm 0.29$  mg/l (n=14) or 7% of DOC(BAC) in this study".

3) If more than one sample was collected, what was the frequency of the sampling and over what period of time?

In this study the monitoring of the samples was not planned, thus the samples were taken without strict frequency over the period of 1 year.

4) Were different water samples used for each experiment (e.g. for those with added LOC and for those without) and if so did the raw water quality (in terms of DOC and BDOC) differ?

See reply AC C23

5) If only one sample was used, what is the limitation of this?

The reason for choosing the biofilter effluent was the fact the slowly biodegradable BDOC were not removed during the filtration, which was the fraction of BDOC in which enhanced removal we were most interested in.

6) Were experiments repeated and, if not, can the authors comment on the reproducibility of the work?

30 experiments in total were carried out in this study. Relative repeatability of DOC measurements was 2% for each sample. Average reproducibility of experiments was 16%.

7) In the Discussion section at lines 272 and 4 or page 74, the average DOC of both the raw water and of the water post-BAC and the BDOC of the BAC effluent is reported with the error. What does this error represent? It seems relatively large and therefore could impact the results. This should be explained in the manuscript prior to the Discussion

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section.

For given DOC measurement this is variation of DOC measurements in inflow to the column during the experiments, and this is because of natural variation of DOC in the BAC samples. Repeatability of measurements for one samples are much lower (see reply AC C23)

8) Could the authors explain their rationale for sampling post-BAC rather than pre-BAC?

There are two reasons: (i) see comment about slowly BDOC; (ii) in the inflow high residual ozone was present, which can influence negatively the biomass in the columns.

9) How efficient were the full scale BAC filters at biodegrading DOC? If they were operating efficiently, biodegradable DOC could have been significantly decreased upstream of the sampling point, explaining why the BDOC of the water sample was only 7% (as stated on line 11, page 72).

The average results of regular monitoring of DOC and BDOC in WTP tree year period are described by Tihomirova (2011). The BDOC concentration decreased from  $1.47 \pm 1.05$  mg/l in the raw water to  $0.59 \pm 0.51$  mg/l (10 % and 9 % of the DOC, respectively) after rapid filter and increased to  $0.82 \pm 0.38$  mg/l (15 %) after BAC filtration. High error range might be attributed to the fluctuation of raw water and treated water quality. Consequently, biological stability of water samples increased during pre-ozonation, sedimentation and rapid sand filtration and second ozonation, but it decreased again after BAC filters. DOC was higher in the river water than in the drinking water, but the ratio of BDOC/DOC (%) was higher in the drinking water (15%). These indicate that after ozonation concentration of biodegradable organic compounds increased, but removal of biodegradable organic matter in biofilters or the production of biologically stable water is not efficient. Results of this study showed that average BDOC in BAC samples was 7 % only.

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10) Finally, at line 17, page 74, the authors indicate that by over-feeding the filter the biodegradation rate constant decreases and bacterial release into effluent occurs. Can the authors discuss the ramifications of this if it were to happen in a drinking water treatment plant? How would the optimal concentration of LOC be maintained?

In this work for the first time we demonstrate principle of biostimulation applicability for enhancing DOC removal in drinking water. For technology to be implemented in real plant, the technology should be engineered to avoid both problems with release of biomass and other problems which can related to optimal condition for filter operations such as application of automatic control of biomass and substrate dosing. In practice the optimal concentration of LOC would be depended from the DOC concentration in influent water. LOC work as stimulator, and to avoid the increase the BDOC in system after biofilter, LOC concentration should be small. LOC and DOC ratio was 0.3 (page 72, line 24-25) in this study, but this ratio should be verified for every individual plant.

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