**Drinking Water
Engineering and Science
Discussions**

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 Rene var der Aa for the comments.

Page 71, lines 7-9: how was the figure of 5.23 x 10E11 recalculated? Can you provide a reference?

5.23 x 10E11 is the total biomass concentration per cm2, was calculated taking into account columns and beads sizes, as result total available surface, and ATP concentration. The ratio $2.1 \times 10-8$ ng ATP/cell was used (Magic-Knezev A, Van der Kooij D. Optimization and significance of ATP analysis for active biomass in granular activated carbon filters used in water treatment// Water Research. $-$ 2004. $-$ Vol. 38(18). $-$ pp.

$3971-3979$). This reference will be added.

Page 71, line 18: what was the power input and the frequency during sonification?

Sonicator power (Ultra Sonic processor, Cole Parmer, USA) - 130 W, and sonification for 2 min with 40% amplitude is average 115 Joules of energy. This will be added in the text.

Page 72, lines 17-20: you use an own definition of BDOC. Please put it in perspective of other definitions for BDOC from literature.

We have used the definition developed by (Fahmi et al., 2003, Hammes and Vital, 2008, Volk et al., 1993, Ribas et al., 1991 and Yavich et al., 2004), in he figure only principle of calculation used in the study are presented.

Page 74, lines 17-21: can you show the increased cell concentration in the effluent and correlate it with the ATP concentrations in the biofilter?

No, we did not find significant correlation between cell concentration in the effluent and the ATP concentrations in the biofilter. See page 71, line 5 "The biomass in all the columns was kept constant by the homogenization after each experiment."

Page 74, lines 17-18: can you explain in more detail why the biodegradation only was stimulated temporary?

This phenomena is not well understood, but current knowledge are discussed in Brand et al., 2003; Shimp and Pfaender, 1985; Spain et al., 1980; Wiggins and Alexander, 1988. See page 69 lines 3-8.

Page 74, line 22 – page 75, line 6: in your experiments you can not be sure that the remaining DOC after 272 minutes of contact time was not biodegradable. Can you give an indication of the biodegradability of the original DOC and the remaining DOC, for example by AOC measurements?

We cannot compare the AOC and BDOC tests, because this is two different parame-

ters. AOC showed assimilable organic carbon concentration used in anabolic reaction of cells (anabolic reactions in which the relatively simple compounds formed complex matter – new cells). BDOC showed biodegradable dissolved organic carbon concentration involved in catabolic processes - degradation of complex structure compounds, to get energy for all processes in living cell including anabolic reactions. BDOC determination is based on measuring the consumption of DOC. This is relatively simple combination of biological systems and chemical analysis.

For indication of the biodegradability of the original DOC and the remaining DOC can be used rapid fractionation (RF) technique described by Chow et al. (2004) for characterization of NOM physical properties: the higher molecular weight fraction of NOM such as very hydrophobic acids (VHA) and slightly hydrophobic acids (SHA) and the lower molecular weight fractions such as charged hydrophilic acids (CHA) and neutral (NEU).

Page 74, line 22 – page 75, line 6: did you check other water quality parameters involved in biodegradation, like oxygen consumption, CO2-production, AOC, ATP/cells released in the effluent? If so, please provide the information and discuss the results.

Of course, as indicators of biological activity decreasing of dissolved oxygen concentration in filtrate (Simpson, 2008) and the biomass quantity determined as adenosine triphosphate (ATP), which correlate with the number of living, viable biofilm cells (Fonseca et al., 2001, Hammes and Vital, 2008, Magic-Knezev and Van der Kooij, 2004, Simpson, 2008) can be used. The most important parameter is an efficient organic substrate removal or decreasing of concentration of DOC would suggest that the biofilter was saturated with active bacteria (Miettinen et al.1999, Ribas et al., 1991, Simpson, 2008). So, main parameters were chosen DOC (mg/l) and ATP/cells in this study.

Page 80, table 1: can you recalculated the ATP concentrations in the sample volume to the filter volume and compare it with literature values?

This in remark will be taken into account. According obtained measurements in this

study and recalculation biomass concentration is 806 ng ATP per cm3 in our experimental system. This value can be comparable with Magic-Knezev and Van der Kooij (2004), where authors has been showed that ATP concentration ranged from 25 to 5000 ng ATP per cm3 in 30 different GAC filters at nine treatment plants. In table 1 has been showed biomass concentration detached from biofilter when biodegradation process was completed. Recalculated total biomass amount in our system was 405170 ng ATP, and max detached biomass amount – 33640 ng ATP, what is 8 % of total biomass concentration in system.

Page 80, table 1: can you show all measured BDOC and ATP concentrations at EBCTs of 272 minutes in a graph?

For particle time the sample taken were not taken due to practical reasons.

Page 82, figure 2: from which day are these results, or over which days are these the DOC averages?

This in remark will be taken into account. We were used the average changes of DOC in original BAC sample obtained in this study (n=14) to compare of the obtained results during each biostimulation experiment. BAC+NaAc and BAC+LB curves in this figure were obtained from one experiment with repetitions of measurements of DOC (n=3).

Following your comment the legends will be revised as follows: Legends: water sample after biofilters from Daugava water treatment plant (BAC, n=14); water sample after biofilters from Daugava WTP with biostimulant sodium acetate after 30 h feeding (BAC+NaAc; n=3) and with Luria Bertrani broth after 48 h feeding (BAC+LB; n=3), respectively.

Technical corrections and additions:

Page 69, lines 20 and 24: describe the meaning of "γ".

This symbol is the abbreviation of concentration of stock solution.

Page 70, line 15: describe the meaning of "CV".

CV is known as instrumental relative standard deviation expressed as a % (in this study for each DOC sample with TOC analyzer 5000A).