
Article

Oxidation to control cyanobacteria and cyanotoxins in drinking water treatment plants: challenges at the laboratory and full-scale plants

Farhad Jalili ^{1,*}, Hana Trigui ¹, Juan Francisco Guerra Maldonado ¹, Sarah Dorner ¹, Arash Zamyadi ², B. Jesse

Shapiro ^{3,4,5}, Yves Terrat ³, Nathalie Fortin ⁶, Sébastien Sauvé ⁷ and Michèle Prévost ¹

Table S1. Characteristics of untreated sludge

-: shotgun metagenomic sample not taken, *: shotgun metagenomic sample taken.

| Sampling date | Shotgun metagenomic sequencing | Taxonomic cell counts | | MCs (ng/L) | | DOC (mg/L) | pH | Turbidity (NTU) | TSS (mg/L) | TVS (mg/g/L) | Sludge storage time (d) |
|--------------------------------|--------------------------------|------------------------------|--------------------|------------|-----------|------------|------|-----------------|------------|--------------|-------------------------|
| | | Cells/mL x10 ⁶ | mm ³ /L | Cell-bound | Dissolved | | | | | | |
| July 31 st 2018 | * | 2.25 | 147.4 | 24.9 | 37.9 | 3.60 | 7.05 | 201 | 716 | 367 | 7 |
| August 7 th 2018 | * | 2.71 | 96.20 | 22.0 | 138.5 | 3.19 | 7.54 | 171 | 728 | 456 | 5 |
| August 17 th 2018 | * | 2.35 | 138.3 | 41.6 | 46.6 | 3.35 | 7.12 | 327 | 1092 | 434 | 3 |
| September 5 th 2018 | - | 2.37 | 52.76 | 951.8 | 131.2 | 9.80 | 6.81 | 701 | 1957 | 1230 | 6 |

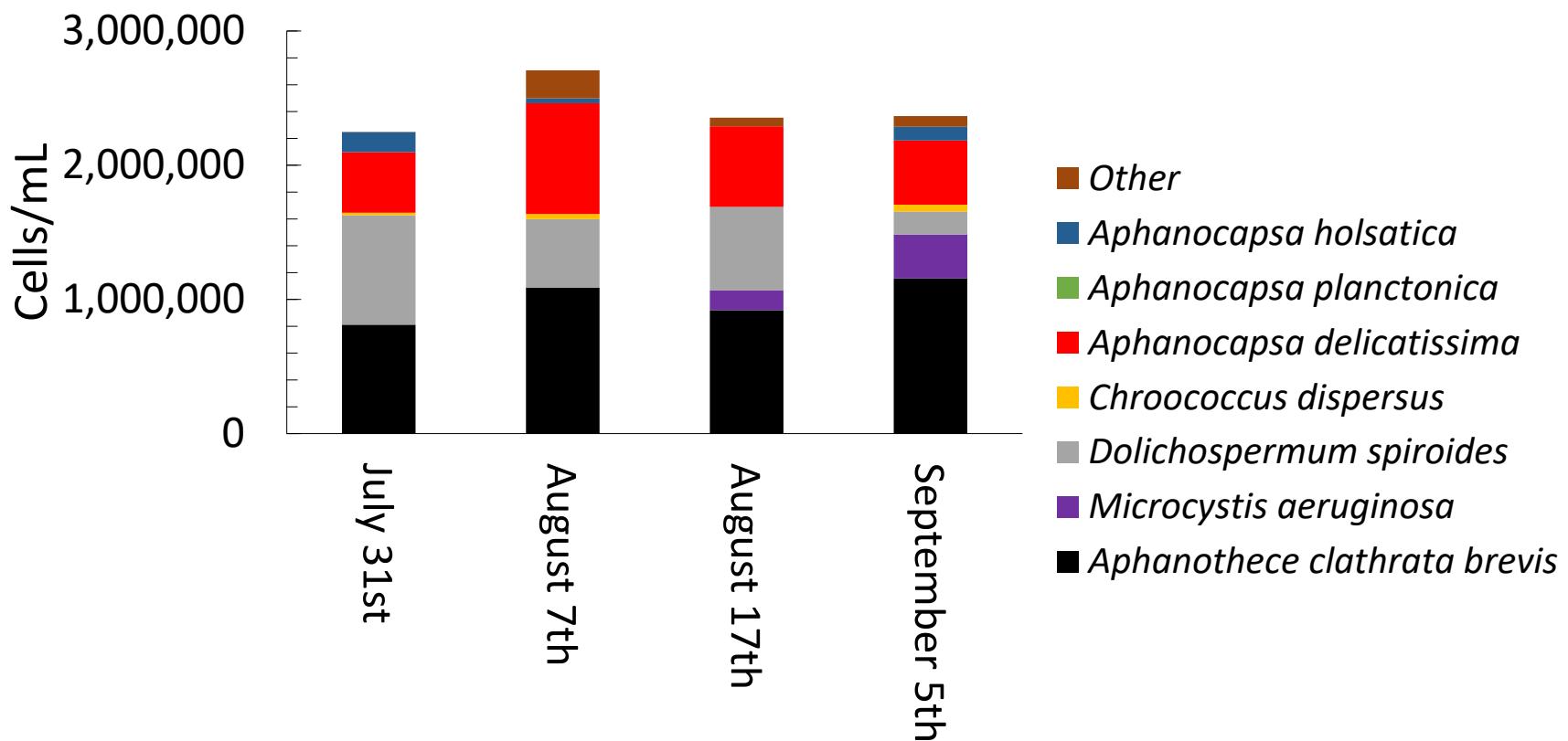


Figure S1. Taxonomic cell counts in the untreated sludge before oxidation or stagnation, Other: species with less than 5% of total cell counts.

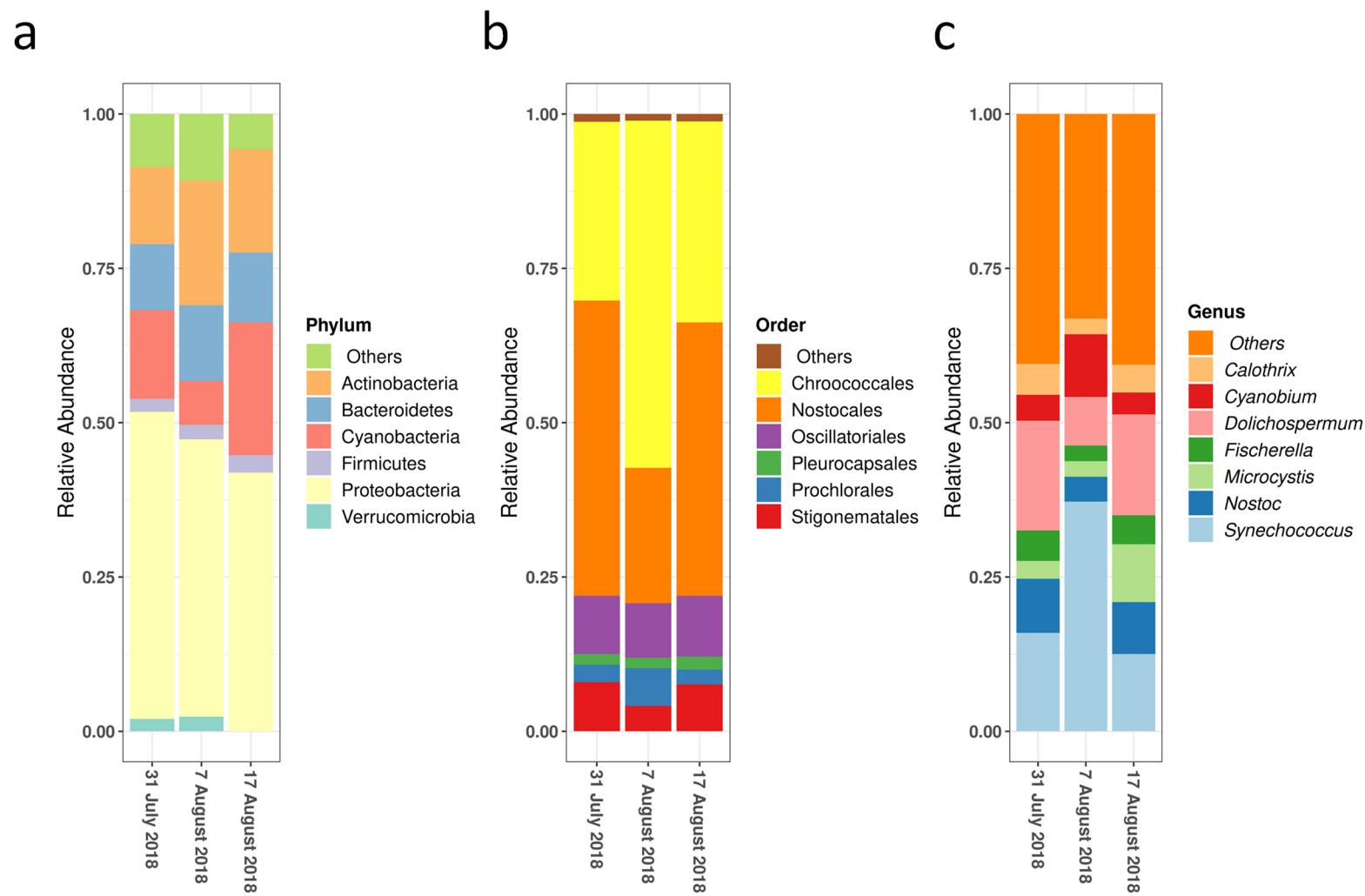


Figure S2. a) Microbial communities at the phylum level, b) Cyanobacterial communities at the order level, and c) Cyanobacterial communities at the genus level in the sludge samples.

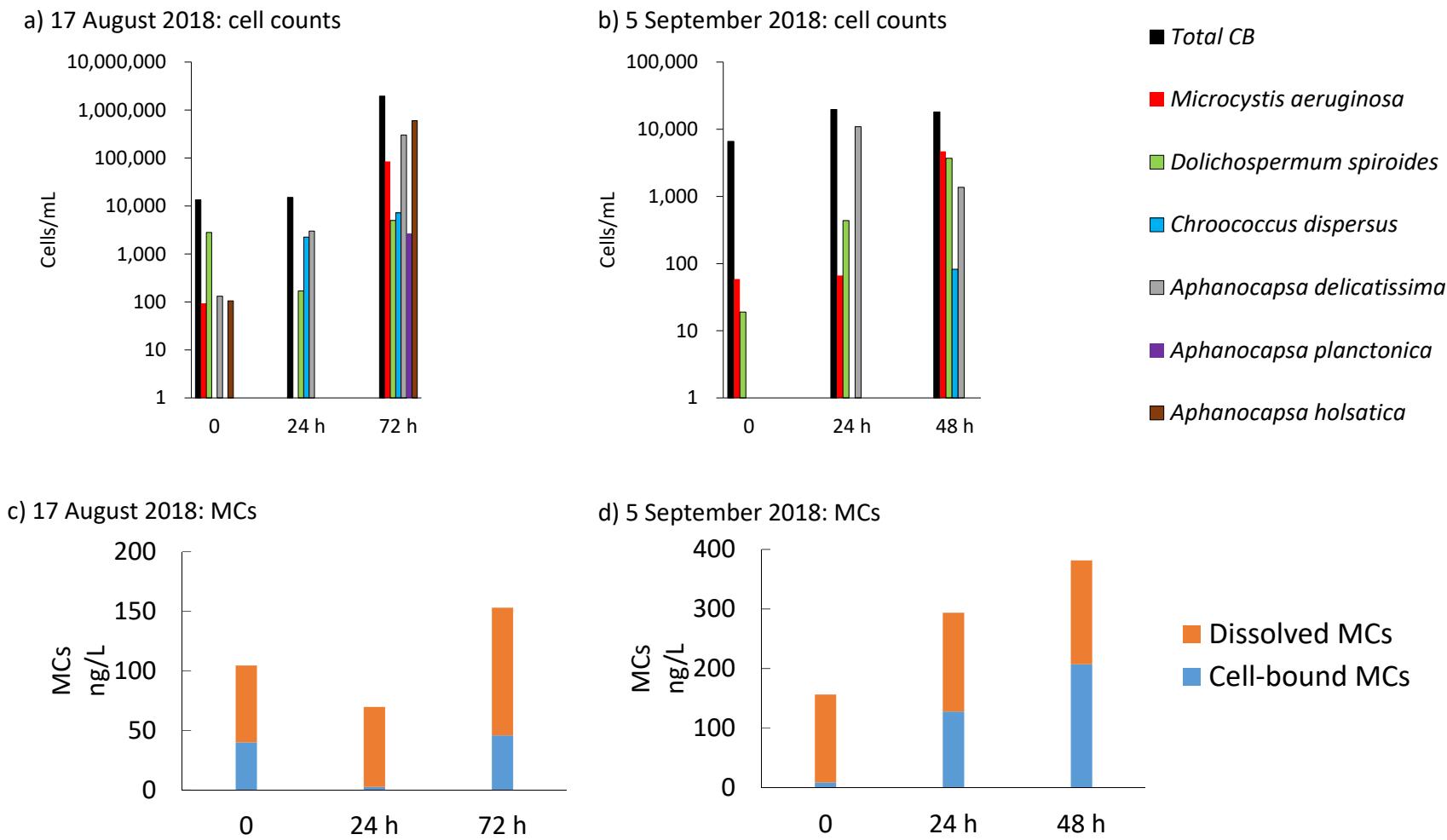


Figure S3. Taxonomic cell counts on a) 17 August and b) 5 September; MC concentrations on c) 17 August and d) 5 September in the sludge supernatant after on-site oxidation.

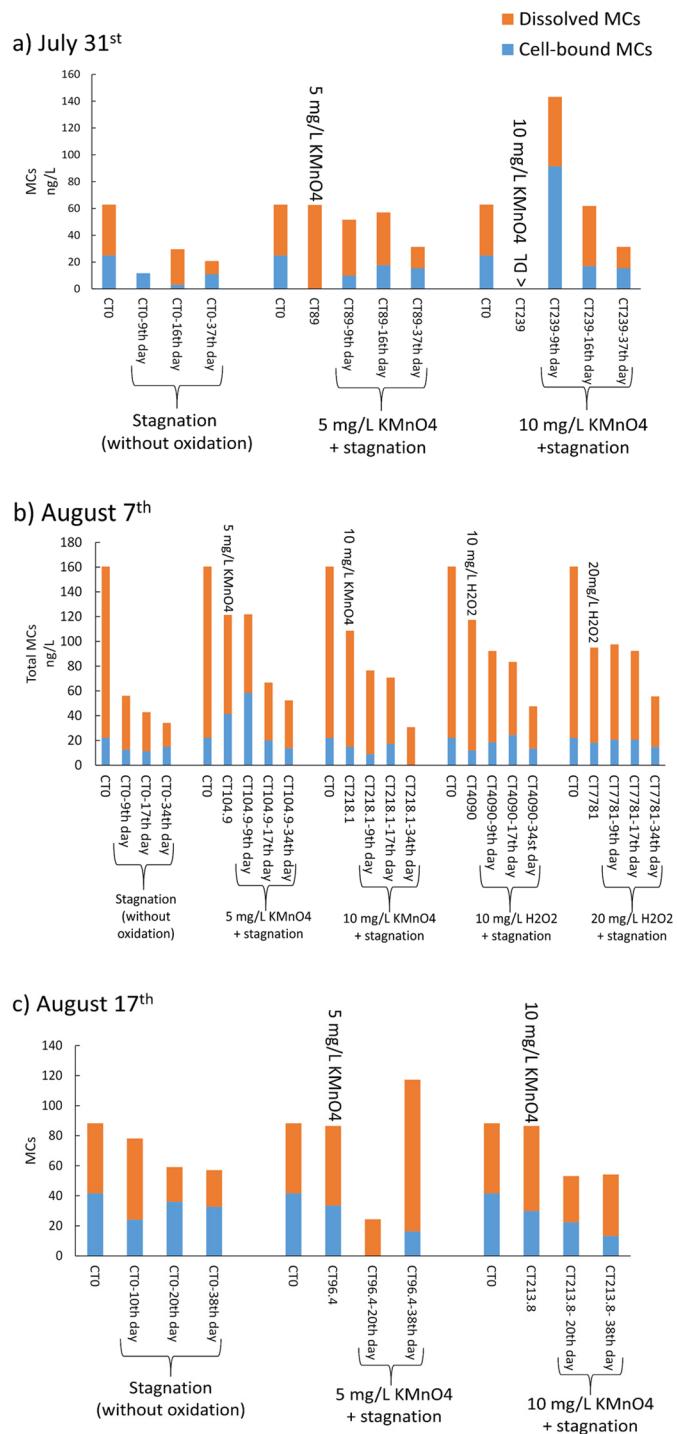


Figure S4. MC concentrations during laboratory oxidation followed by stagnation on a) 31 July using 5 and 10 mg KMnO₄/L, b) 7 August using 5, 10 mg/L KMnO₄ and 10, 20 mg/L H₂O₂, and c) 17 August using 5 and 10 mg/L KMnO₄, CT: exposure (mg·min/L), CT0: Before oxidation, day: stagnation day.

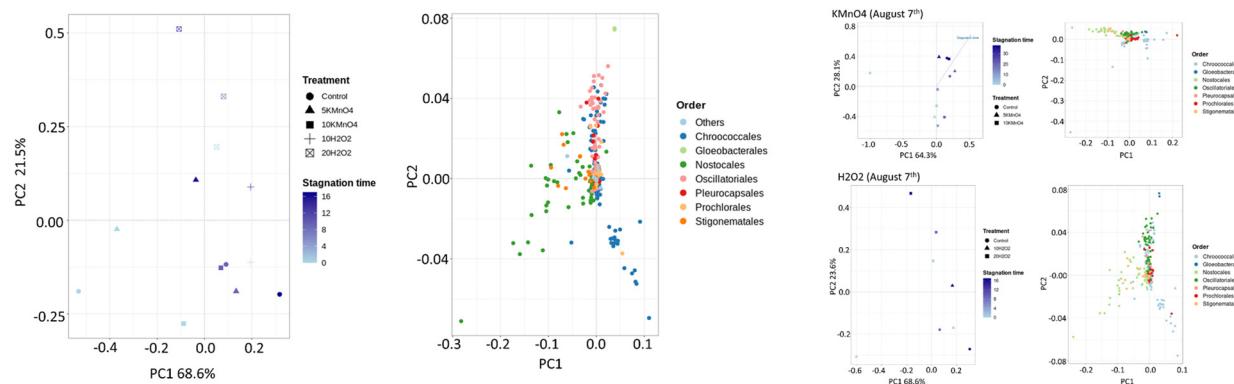
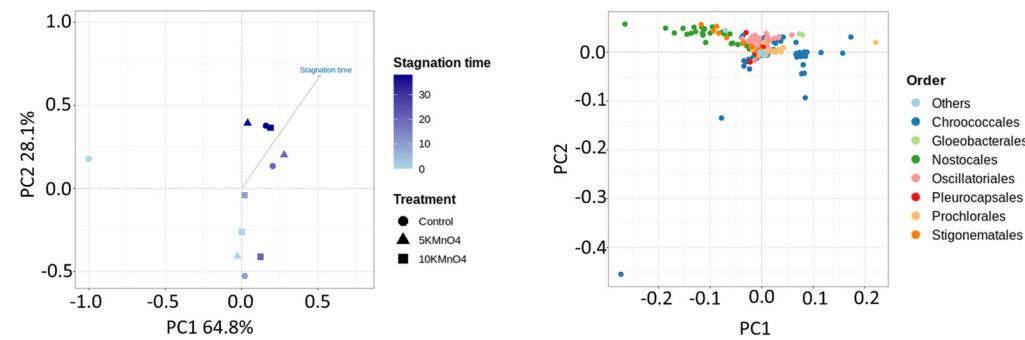
a) August 7thb) August 17th

Figure S5. Principal component analysis (PCA) of cyanobacterial communities and cyanobacterial species grouped at the order level on oxidized/ stagnated samples in the laboratory scale on a) 7 August, PC1: 68.6, PC2: 21.5% and b) 17 August, PC1: 64.8, PC2: 28.1%. Significant parameters ($p < 0.05$): stagnation time after oxidation by KMnO₄, and oxidation by H₂O₂.

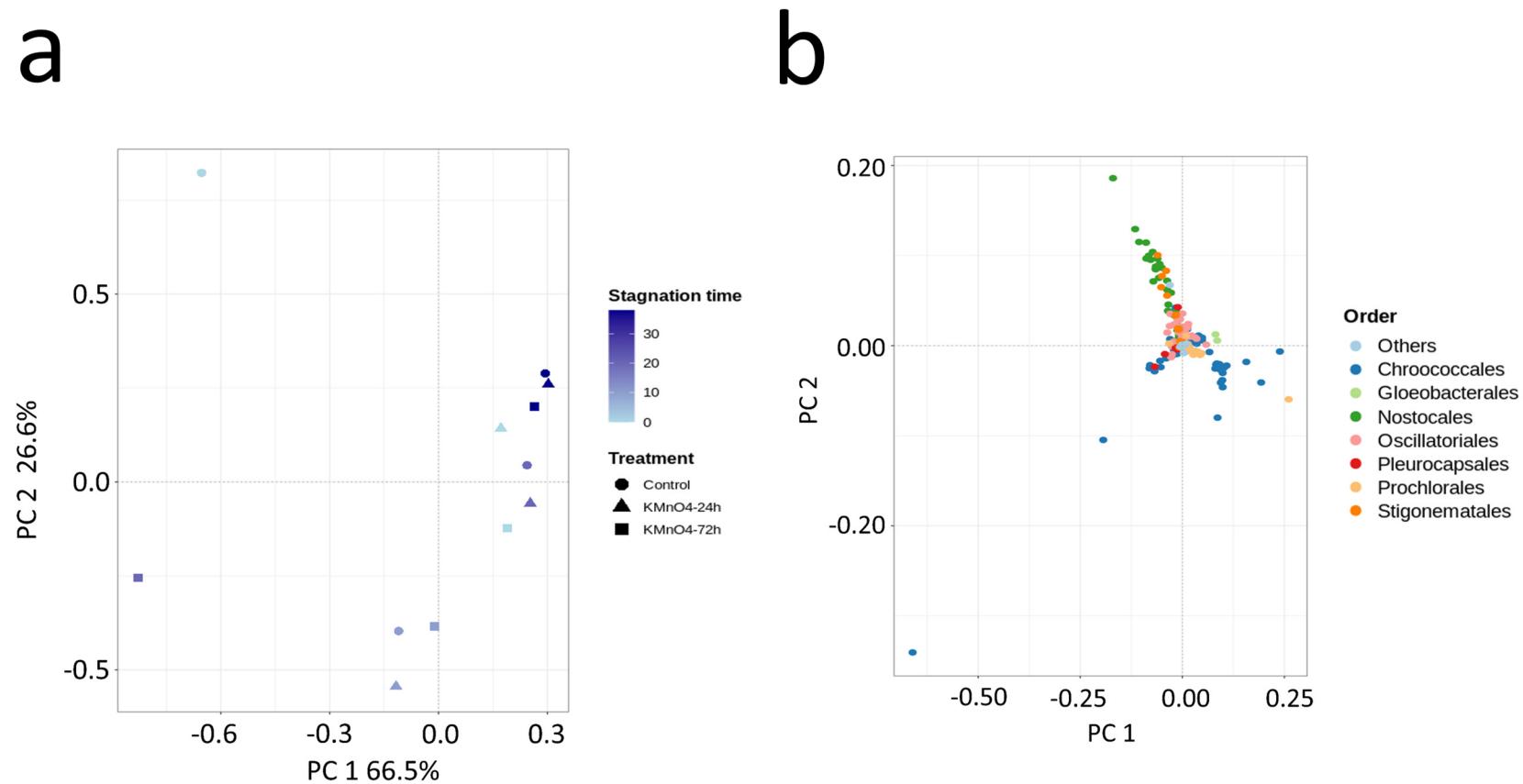


Figure S6. a) Principal component analysis (PCA) on sludge samples after on-site oxidation followed by stagnation on 17 August, PC1: 66.5%, PC2: 26.6%, b) Cyanobacterial species grouped at the order level.

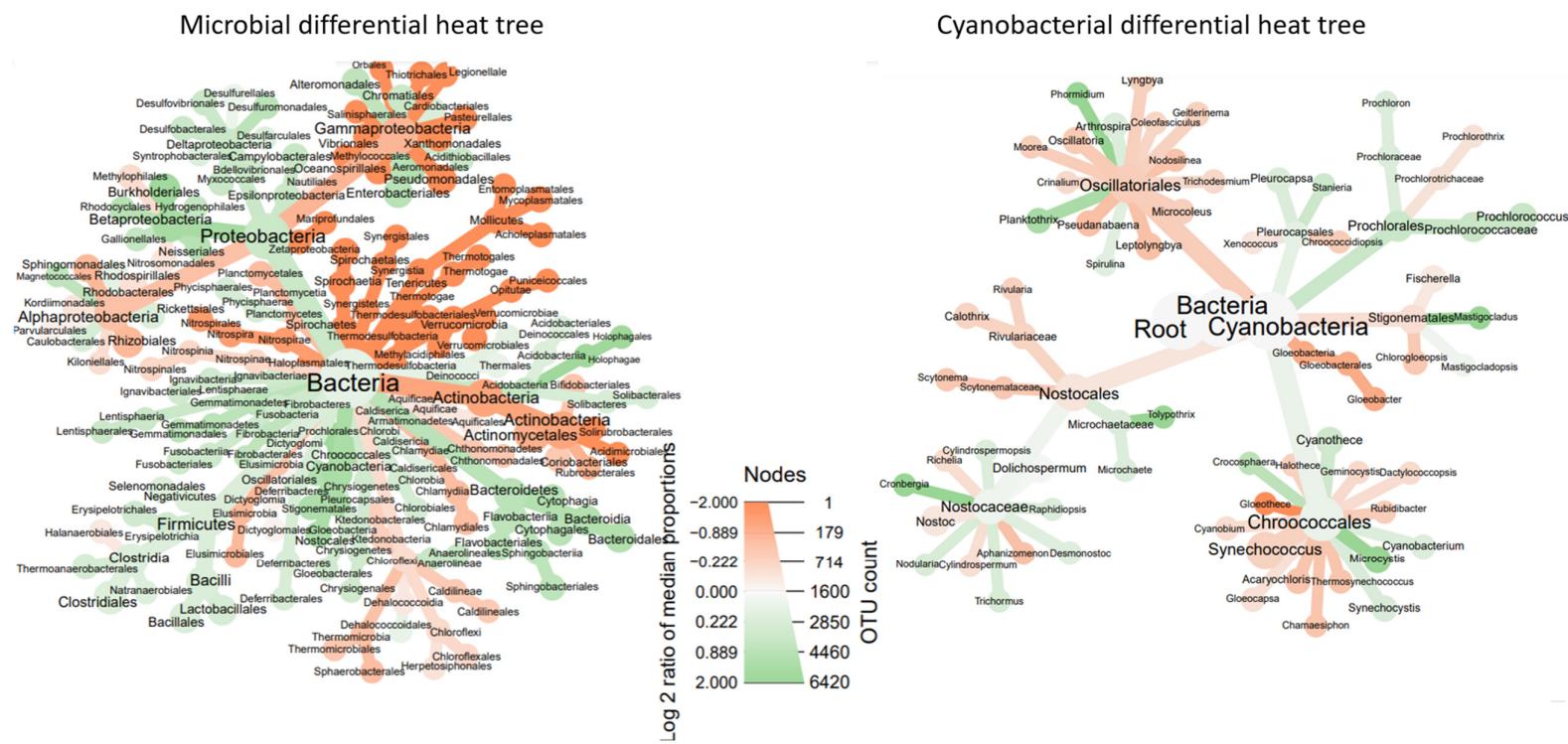


Figure S7. Differential heat tree demonstrating changes in microbial and cyanobacterial taxonomic profiles of KMnO₄ oxidized sludge for 72 h at T0/T38. T0: not stagnated after oxidation, T38: stagnated for 38 days after oxidation. The intensity color of nodes and edges are correlated with the abundance of taxa in each community. The green color indicates that the taxa is more abundant in the sludge at T0 than the sludge at T38, while the orange color indicates the opposite.