



Aalto University
School of Engineering

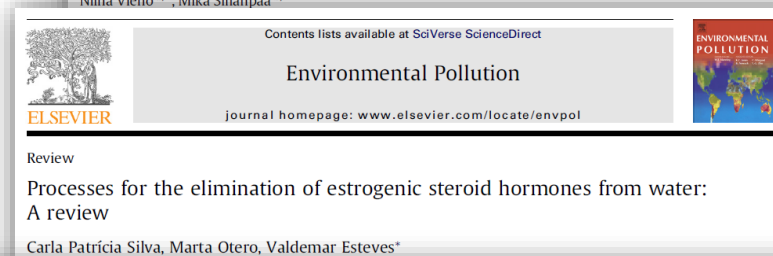
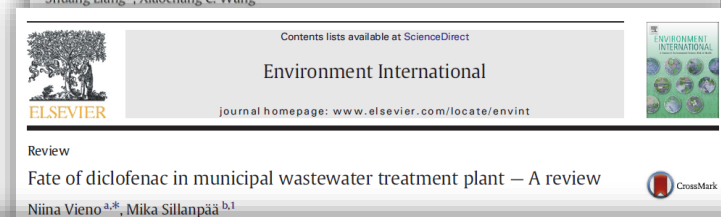
Effect of emerging micropollutants on activated sludge bacterial communities structure in conventional and membrane bioreactors under 8 °C conditions

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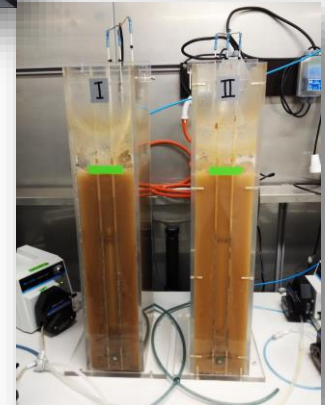
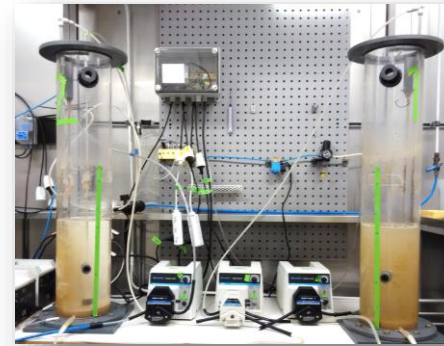
Background

- **Emerging micropollutants** are constantly detected in wastewater treatment plants (WWTPs) influents and effluents
- Chronic long-term negative impacts on living organisms in very low concentrations have shown
- Higher concentrations detected in rivers during **winter season**
- **Biodegradation** is one of the most important process for eliminating emerging compounds



Objectives

1. Micropollutants: ibuprofen
diclofenac
estrone
17 α -ethinylestradiol
2. Pilot-scale WWTPs:
 - Sequencing Batch reactors (SBRs)
 - Membrane Bioreactors (MBRs)
3. Constant temperature



Aim of the study:

to investigate activated sludge bacterial communities under the presence of four emerging micropollutants taking into account low temperature conditions

Experimental conditions

- Temperature 8°C
- Sludge Retention Time (SRT) - 14 d (SBRs),
- 30 d (MBRs)
- Synthetic wastewater with additional:
(Kruglova et al., 2014)
 - 10 mg/l of ibuprofen
 - 1 mg/l of diclofenac
 - 5 ng/l estrone (E1)
 - 5 ng/l 17 α -ethinylestradiol (EE2)
- Control plants – no micropollutants in wastewater



Sampling

Sampling days: 0 day, 30th day and 60th day
of experimental period



1. Removal experiments (24 h)

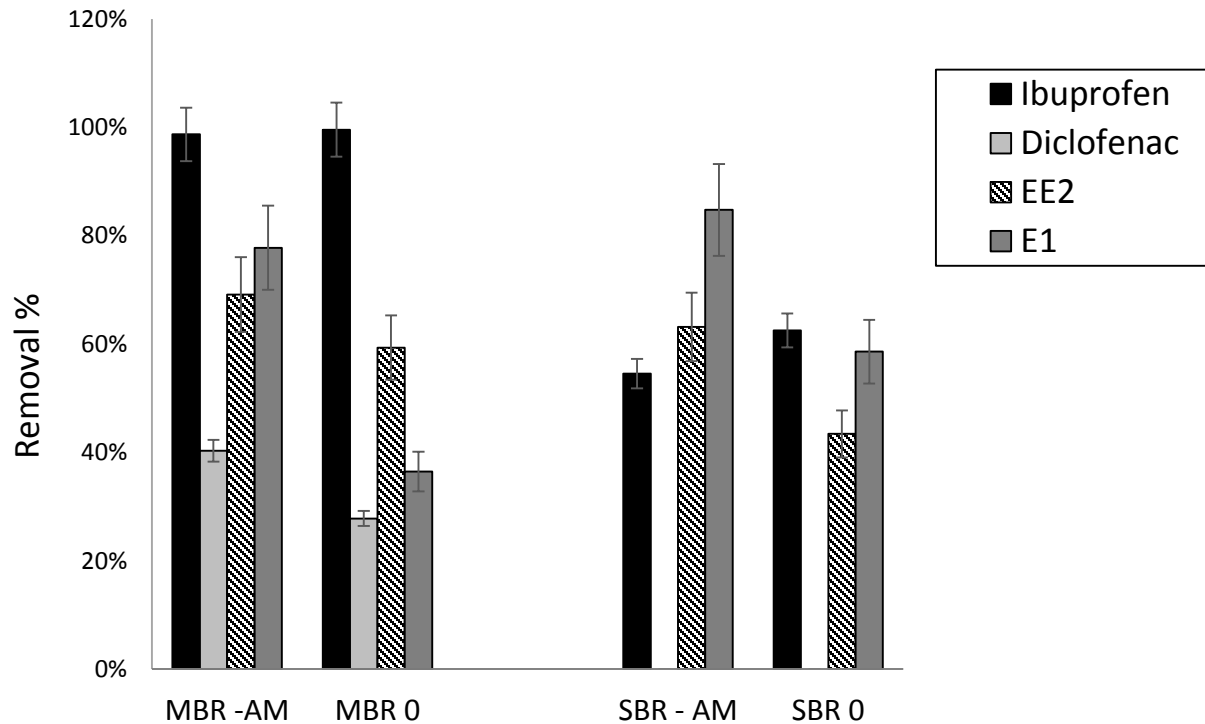
LC-MS/MS analysis

(Kruglova et al., 2016)

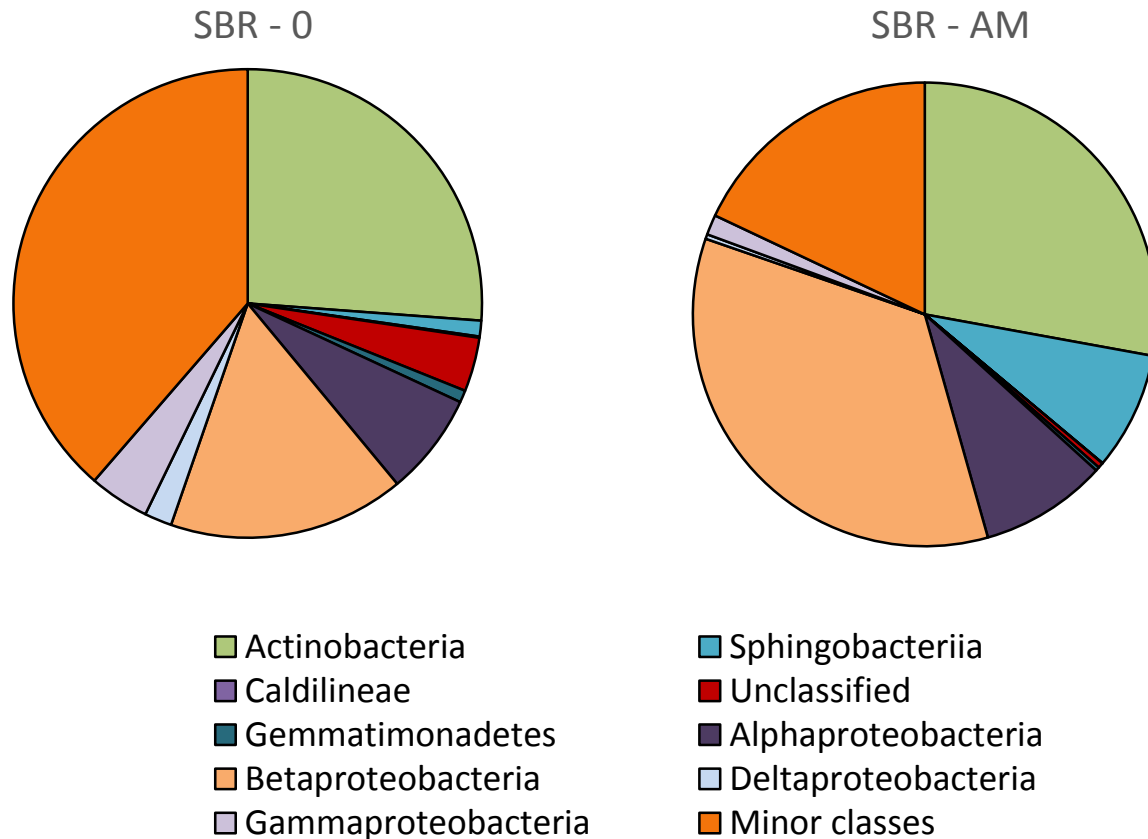
2. Microbiological studies

Illumina sequencing

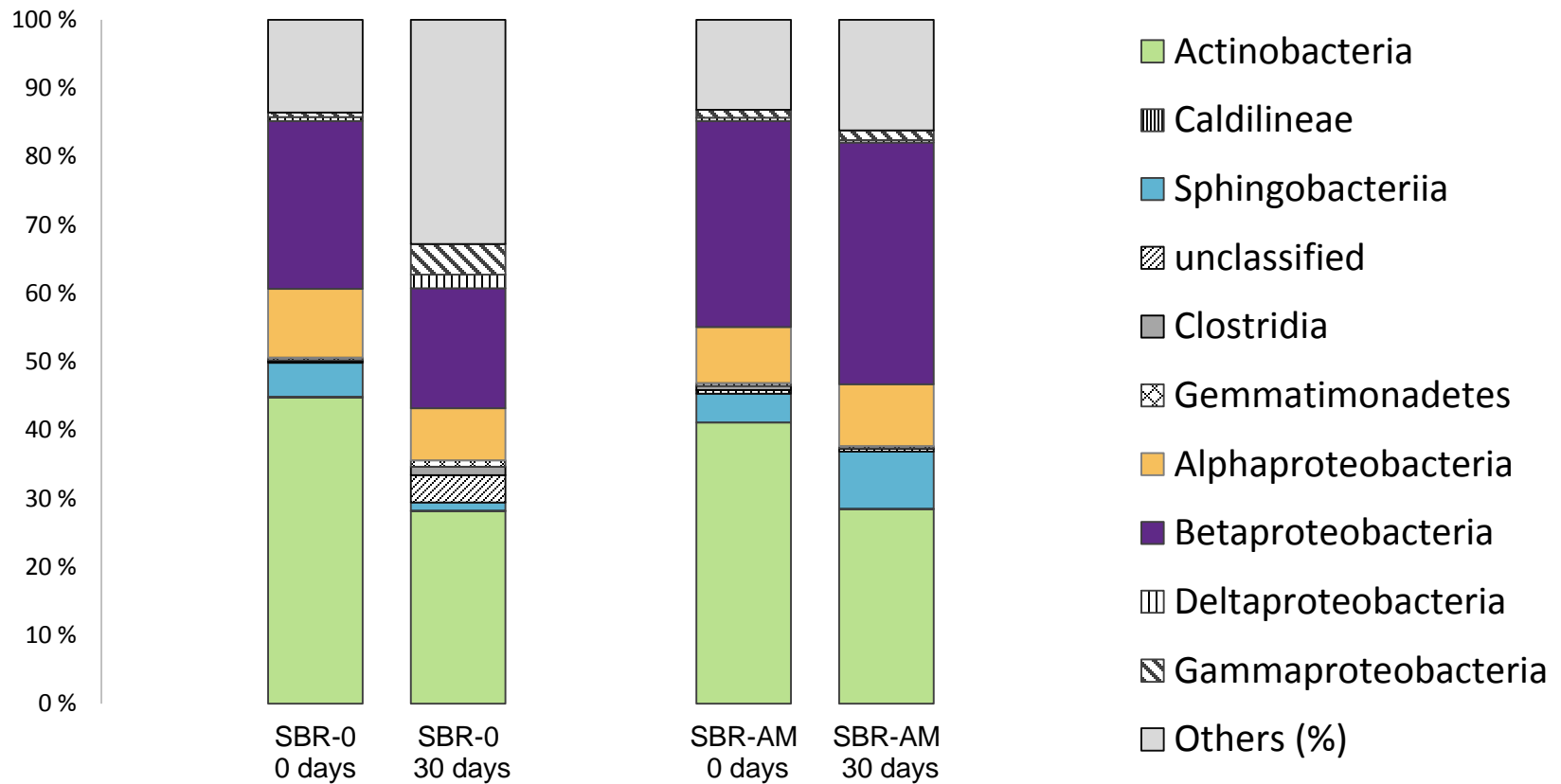
Removal rates (%) of studied micropollutants at 8 °C



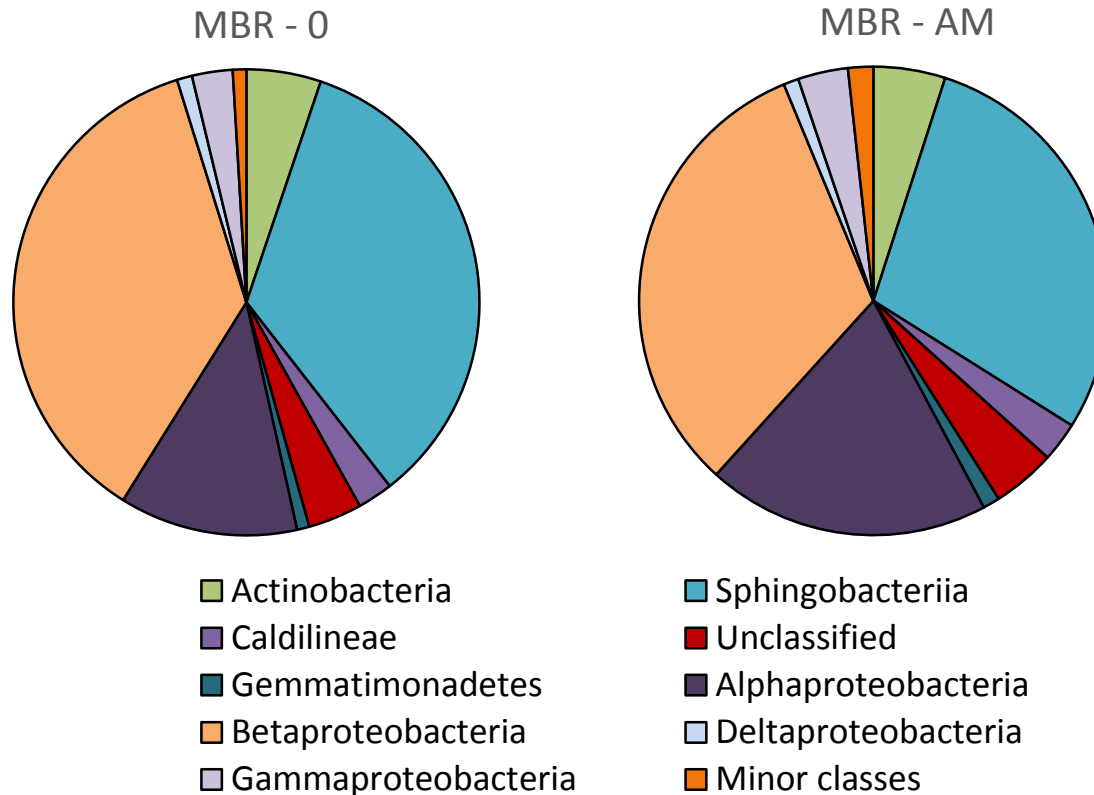
Relative abundance of the most important bacterial groups in activated sludge of SBR reactors



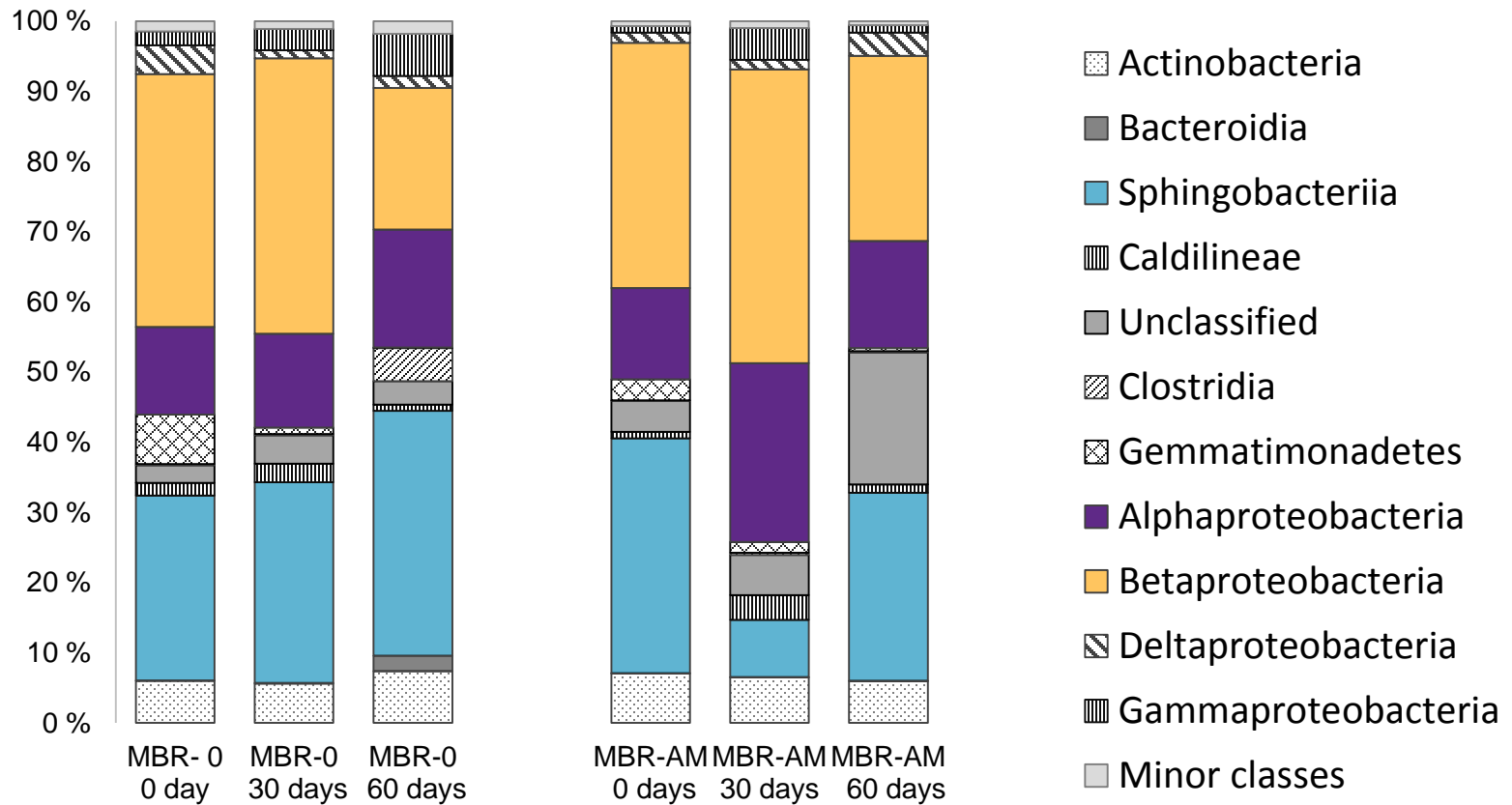
Dynamics of activated sludge bacterial community in SBR reactors



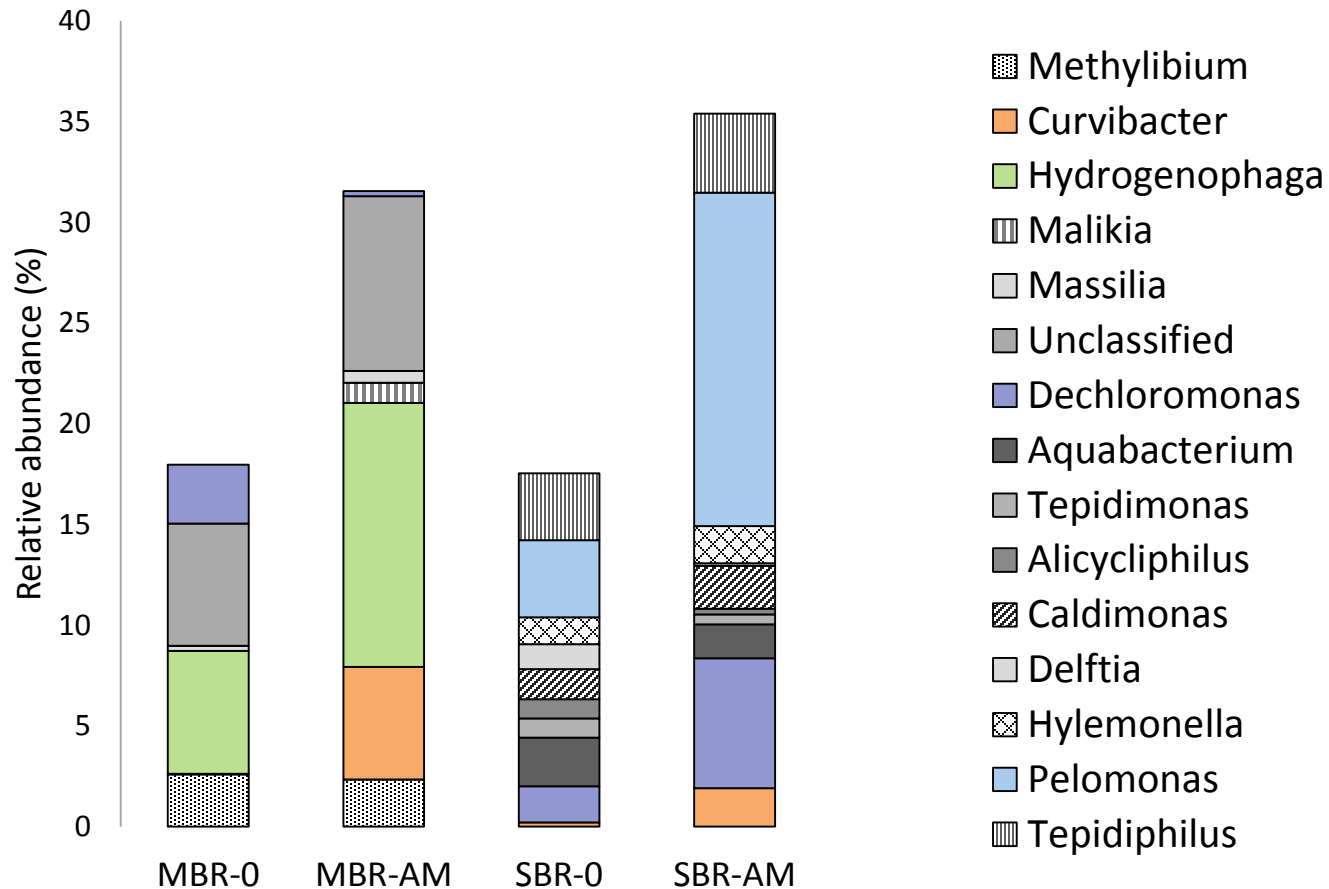
Relative abundance of the most important bacterial groups in activated sludge of MBR reactors



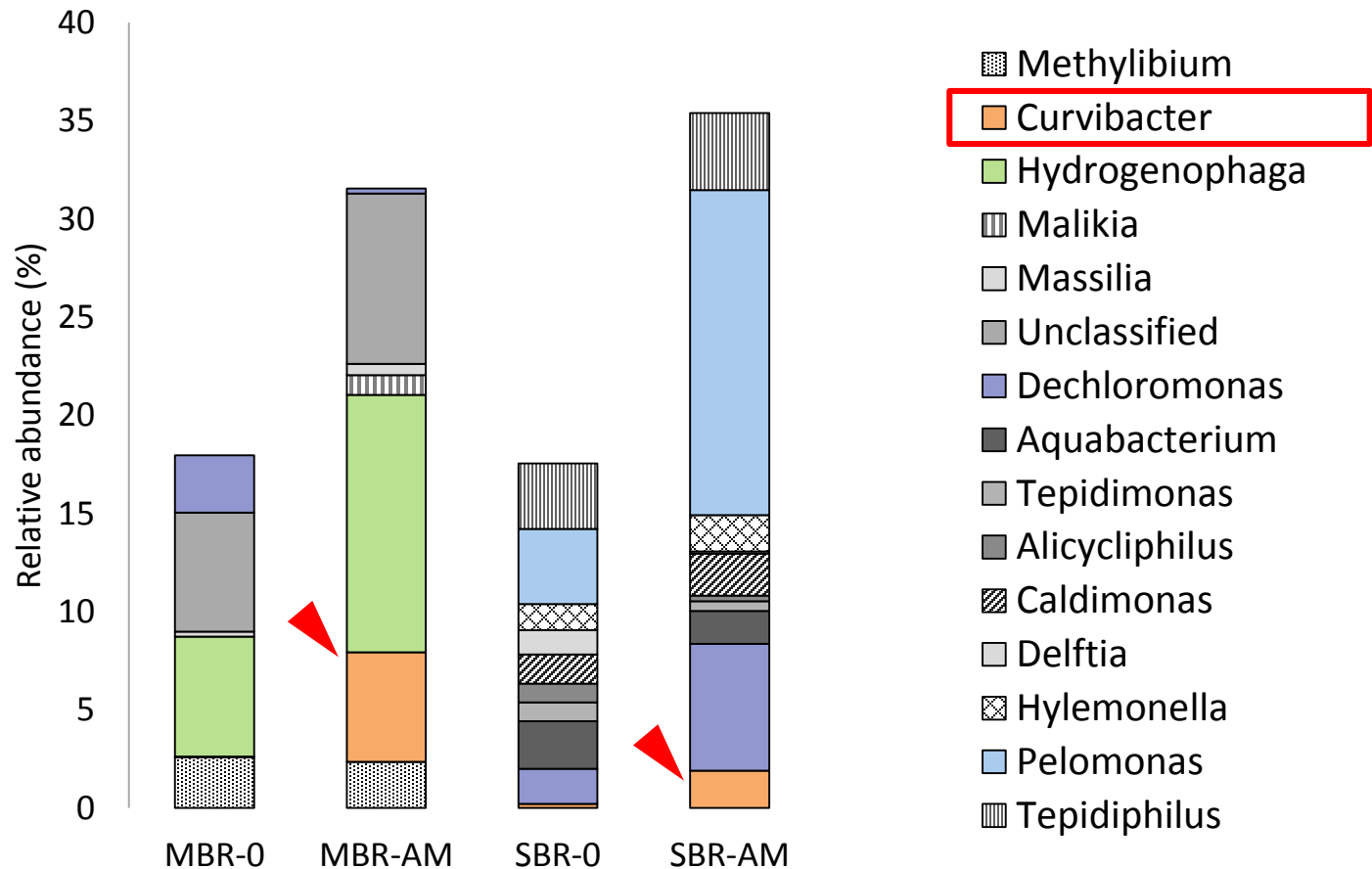
Dynamics of activated sludge bacterial community in MBR reactors



Relative abundance of *Betaproteobacteria* in activated sludge



Relative abundance of *Betaproteobacteria* in activated sludge



Conclusions

1. MBR technology produces a deep effect on bacterial community structure and removal efficiency of micropollutants due to long SRT operational conditions
2. *Alphaproteobacteria* and *Betaproteobacteria* are the most abundant classes of bacteria in activated sludge
3. Higher concentrations of *Betaproteobacteria* were observed in presence of micropollutants in both types of activated sludge
4. Noticeable growth of *Curvibacter sp.* was detected in presence of micropollutants in both types of activated sludge