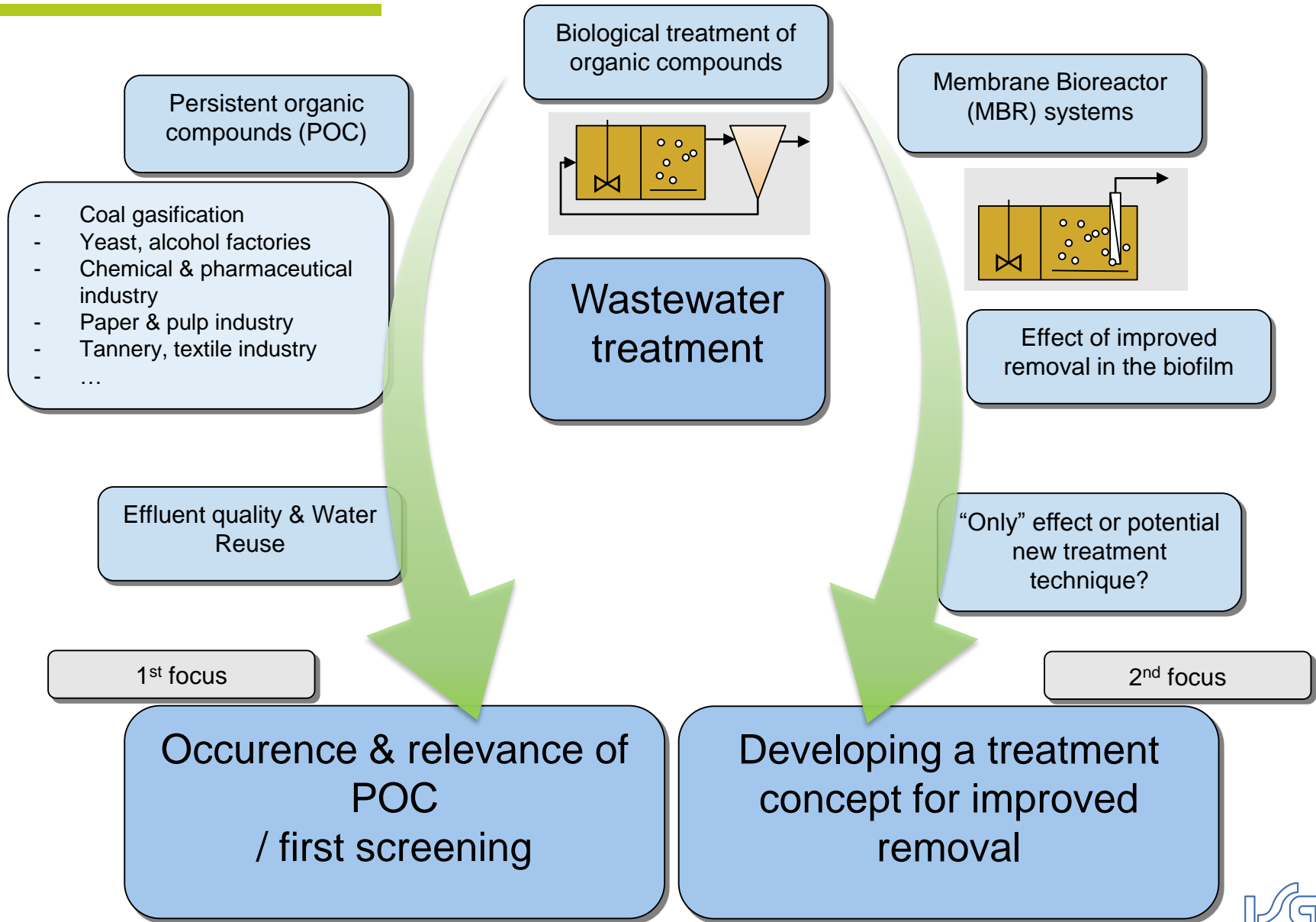


# Improved removal of persistent organic compounds by exploiting biofilms on surfaces in industrial MBR systems

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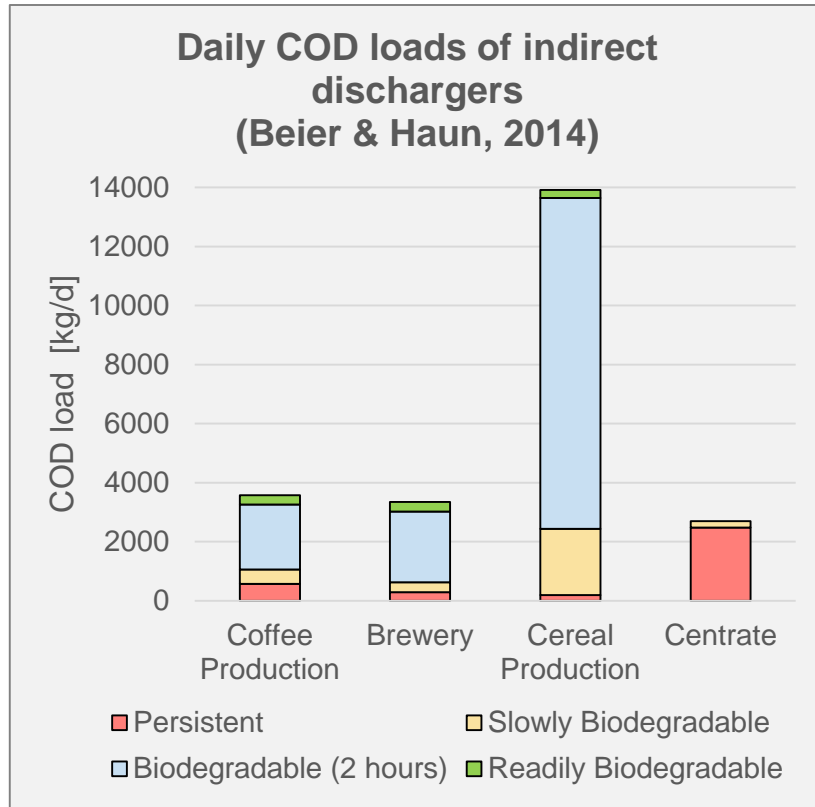


# Motivation



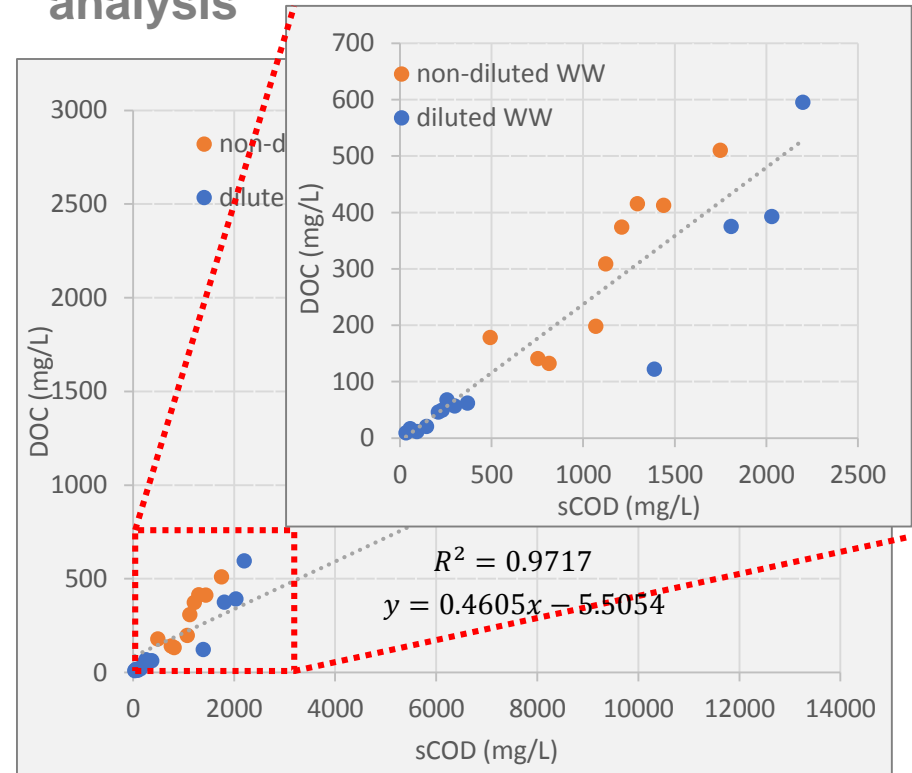
# Occurrence & relevance / first screening

## Importance of POC



- Industrial dischargers vary greatly in loads and wastewater characteristics
- Persistent soluble fraction is problematic – despite its low percentage
- Sensitive parameter needed!

## sCOD and DOC regression analysis



- Good regression results, especially at low concentrations
- DOC can be used instead of sCOD for specific wastewaters

# Remarkable effect: POC reduction in the biofilm?

## Literature review on POC removal in MBR systems

Author(s)	Drensla (2015)	Martinez (2011)	Achtabowski & Neuhaus (2008)	Choo & Lee (1996)
Plant	Nordkanal	Garching (Pilot-scale)	Bergkamen // BAYER Pharma	South Korea (Lab-scale)
Wastewater	Municipal	Municipal + glucose	Chemical industry	Alcohol-distillery
Membrane	Hollow fiber Zenon 500C	Flat-sheet Microdyn-Nadir	Hollow fiber Zenon 500C	Flat-sheet DDS Lab 10 FS61PP
Pore size	< 0.1 µm	38 nm	< 0.1 µm	20,000 Dalton (< 10nm)
O <sub>2</sub> config.	Aerobic	Anaerobic	Aerobic	Anaerobic
Filter Sampling (Point A)	0.1µm (syringe filter)	0.45µm (cellulose membrane filter)	0.45µm (prior centrifugation)	0.45µm (prior centrifugation)
Removal efficiency (median)	8 mg COD/L // 30%	620 mg COD/L // 89%	40 mg TOC/L // 20%	250 mg COD/L // 30%

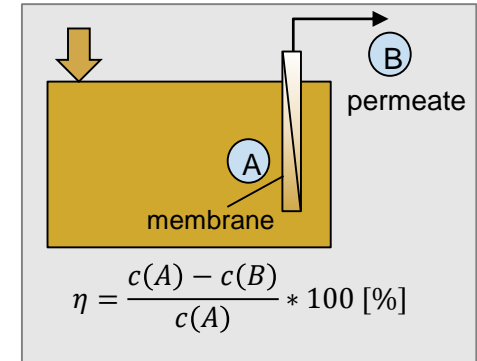


Figure: Experimental set-up for analysis of biofilm removal efficiency  $\eta$

- Pore size for sampling  $\neq$  membrane pore size!
- Only Drensla (2015) used comparable pore sizes; removal effect still 30%
- Conclusions made by authors are contradictive (degradation/ adsorption)

# Developing a treatment concept for improved removal

## Understanding the driving forces

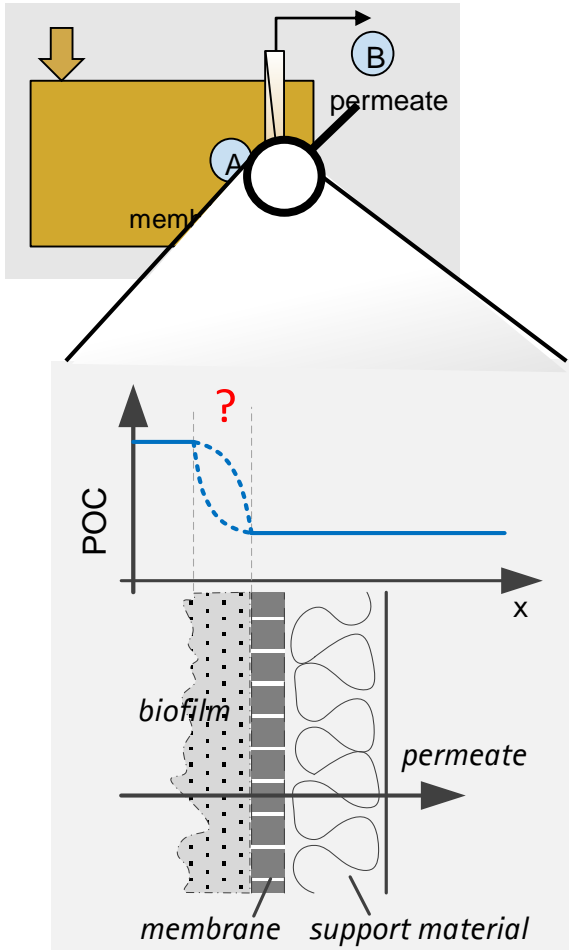
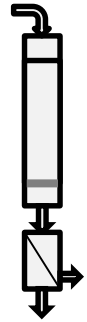
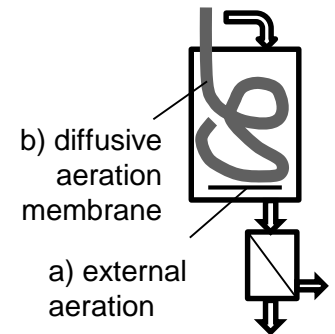
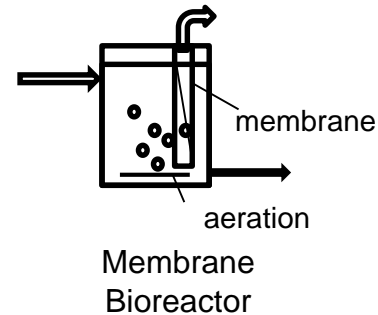
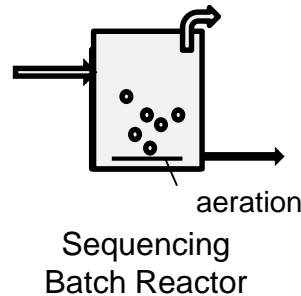


Figure: Scheme of persistent organic compounds removal in the biofilm

- Hypothesis: Degradation
- Influencing factors are possibly...
  - Sludge Retention Time
  - Organic Loading Rate OLR [gCOD/g DS]
  - O<sub>2</sub> concentration
  - Specific adaptation to substrate
  - Biofilm thickness



Substrate:

- a) Municipal effluent + POC (e.g. MC)
- b) Industrial effluent

# Developing a treatment concept for improved removal

## Future outlook on treatment concepts

→ Adjust MBR settings  
(backwashing, etc.)?

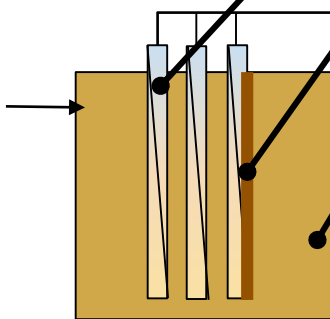
Removal of...

Particulate COD

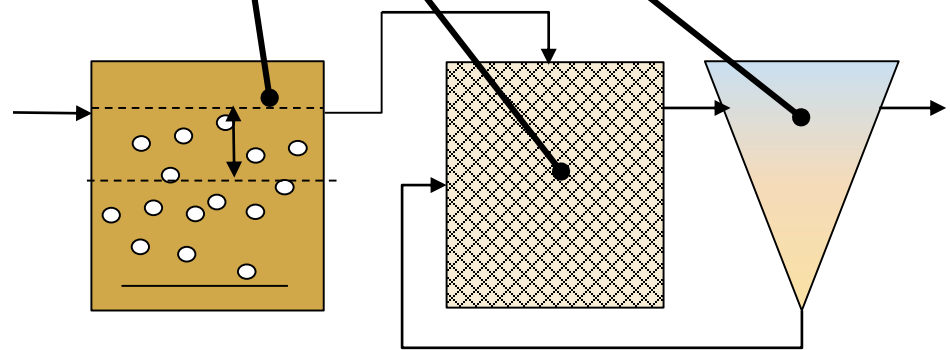
Persistent COD

Readily & slowly  
biodegradable COD

→ Transfer knowledge about  
optimal conditions (influencing  
factors) to other  
reactor types/ combinations?



Membrane Bioreactor



e.g. Sequencing Batch Reactor + Biofilm Reactor?

→ Results expected in 2019

# Thank you for your attention!



## Contact persons

- |                               |  |
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