

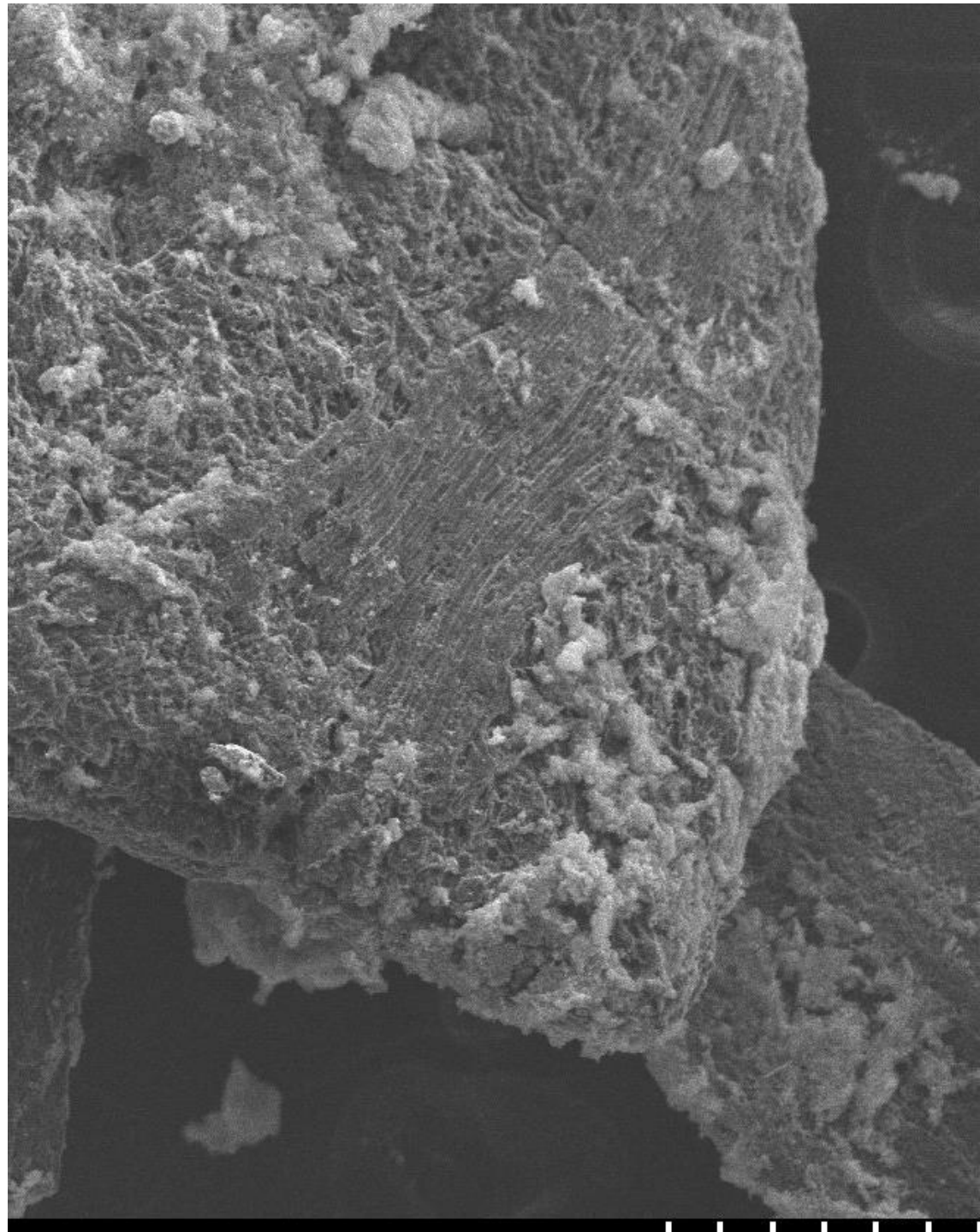


**UNSW**  
SYDNEY



# Adsorption and biodegradation of T&O in GAC and BAC

Rafael Paulino  
Associate Lecturer – UNSW  
Project Manager - NHASP

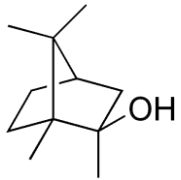




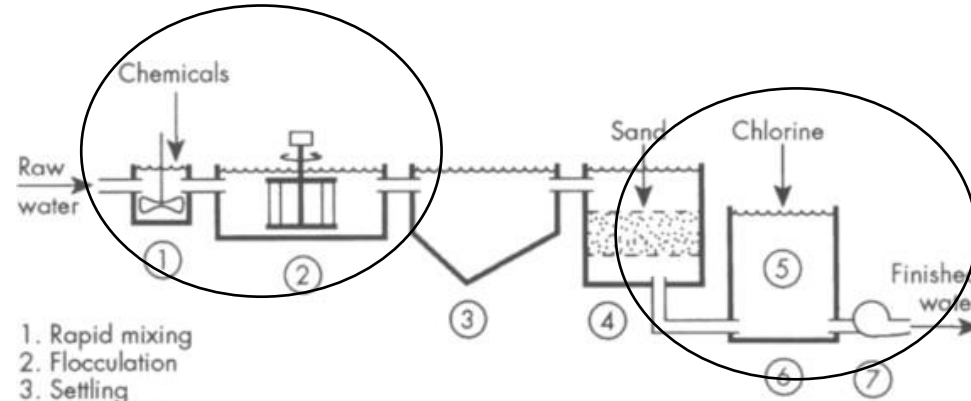
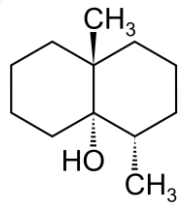
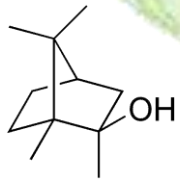
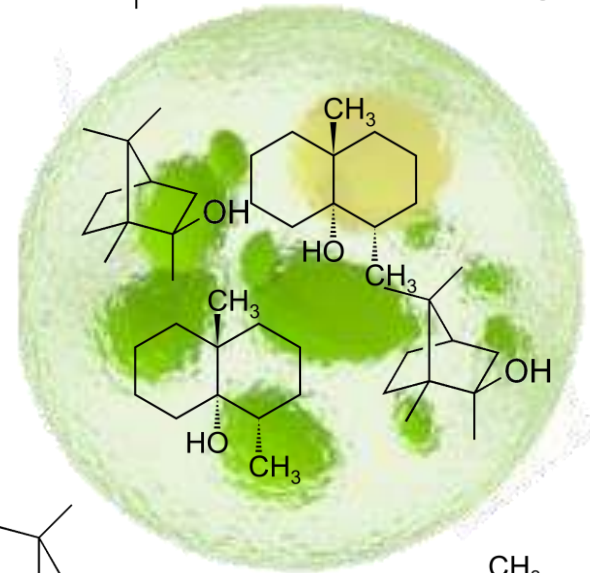
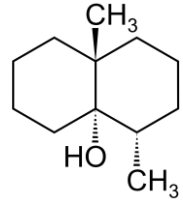


# Introduction: T&O treatment

**MIB**



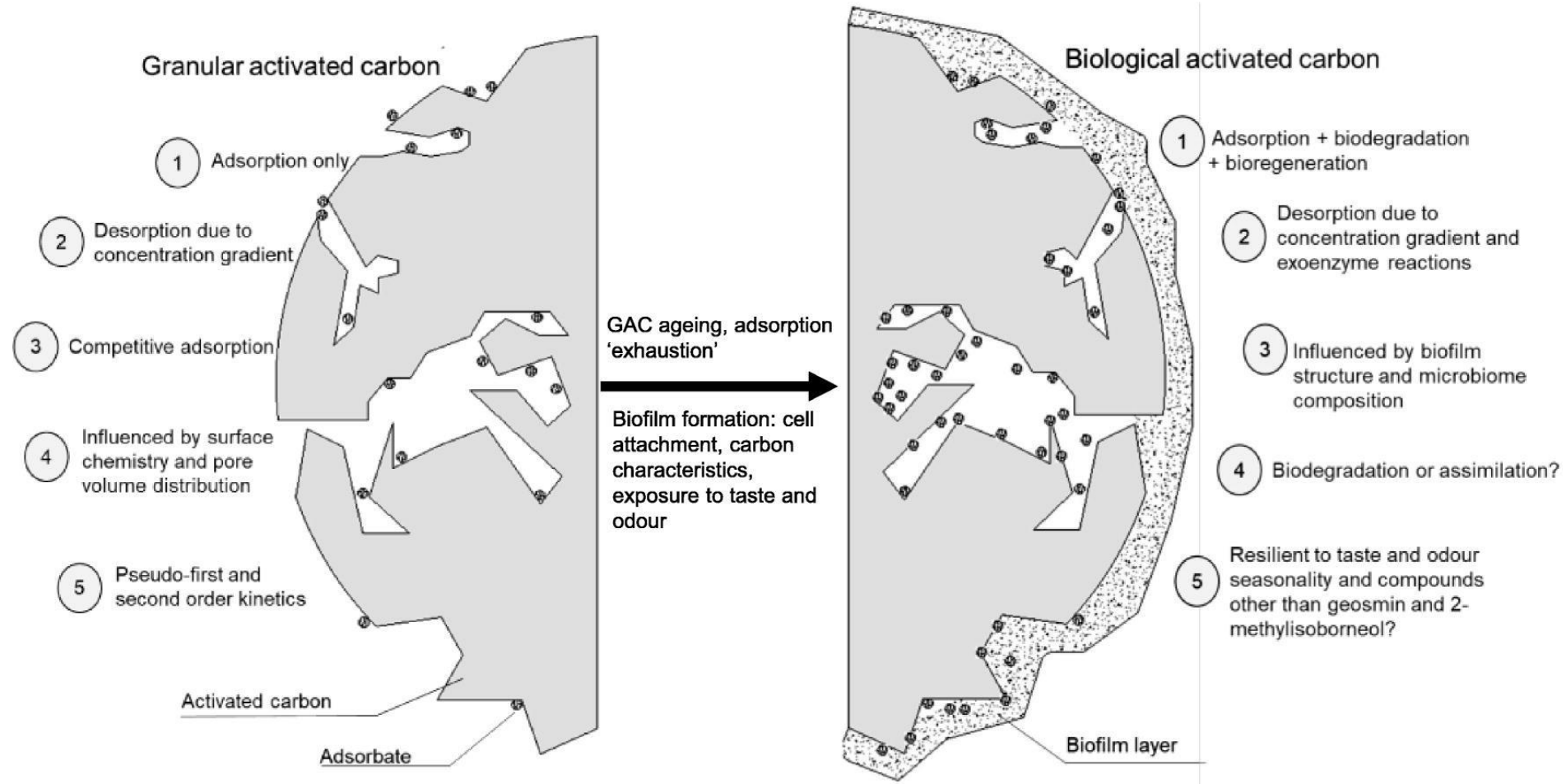
**Geosmin**



1. Rapid mixing
2. Flocculation
3. Settling
4. Sand filtration
5. Chlorination
6. Clear well storage
7. Pumping to distribution system



# Introduction: GAC & BAC

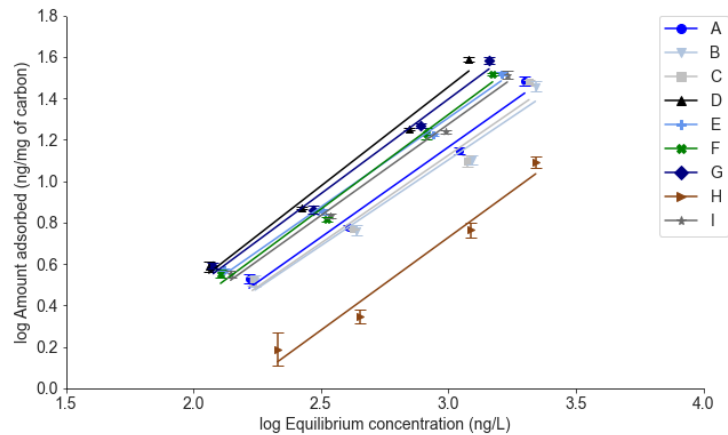
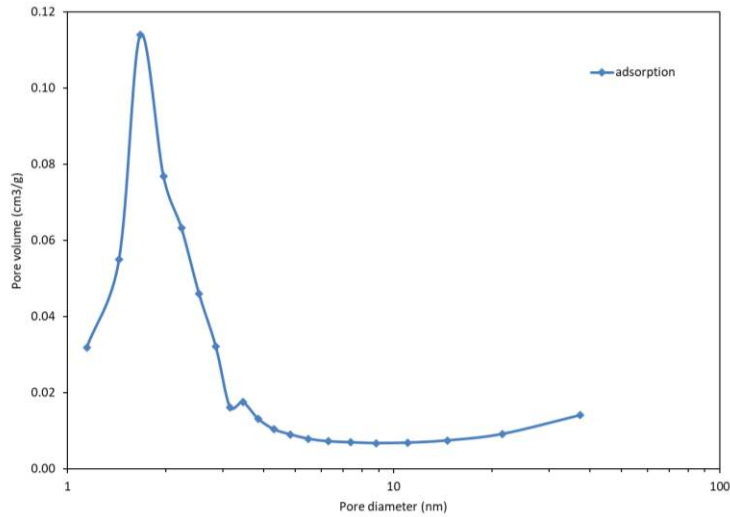


# Objectives

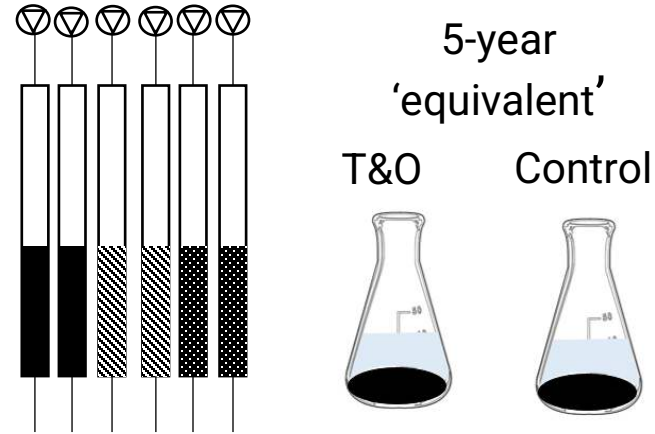
- Understand the effect of carbon characteristics on adsorption.
- Understand the effect of carbon characteristics on biofilm formation and biofiltration.
- Assess the impact of seasonality on the removability of T&O.
- Investigate changes in the biofilm due to exposure to T&O.

# Methodology

## Characterisation & Adsorption monitoring

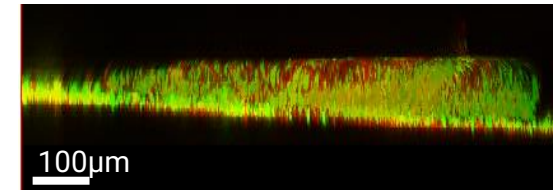


## Biofilm & adsorption evolution



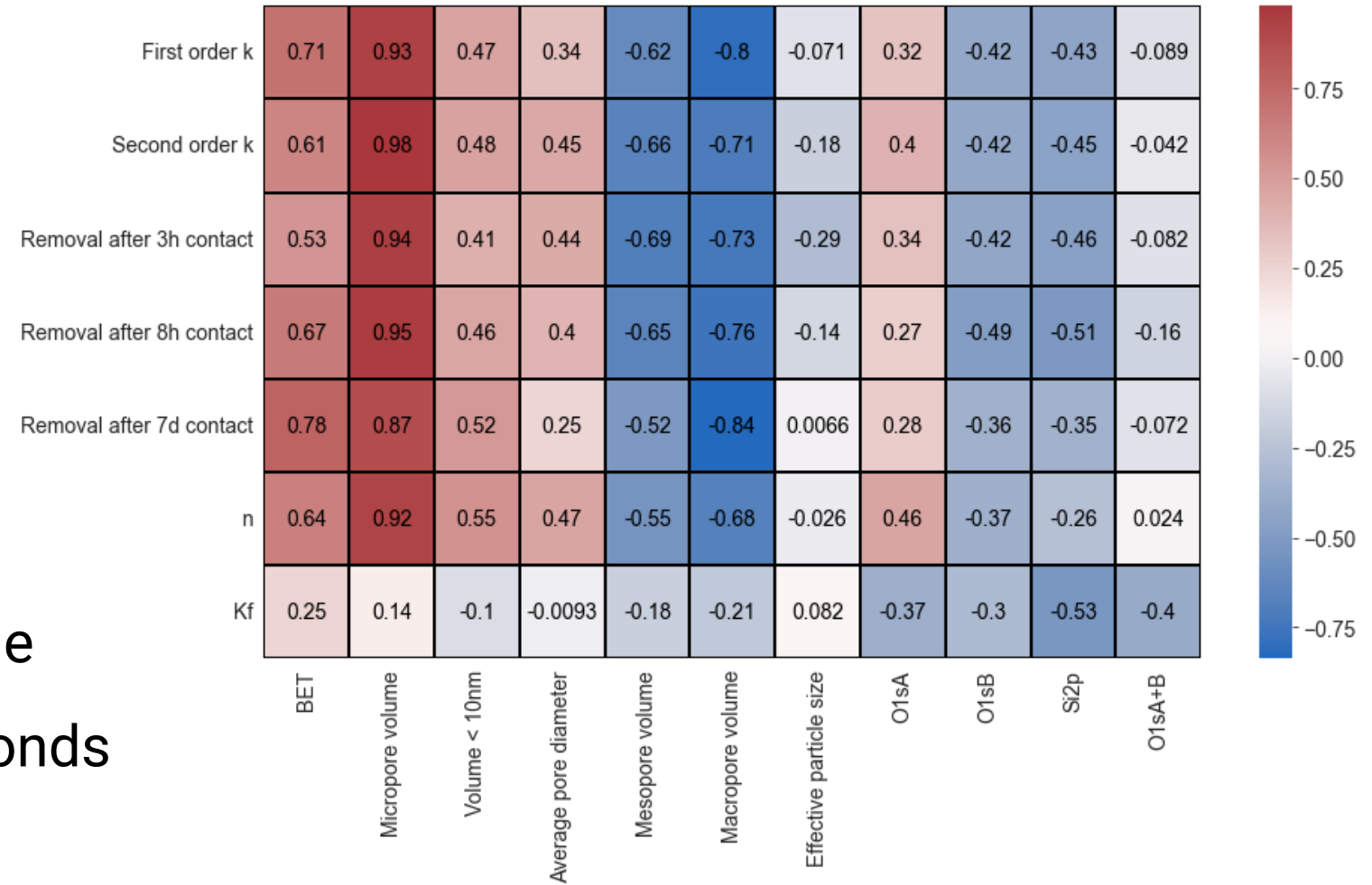
## Biofilm characterisation

### Metagenomics sequencing



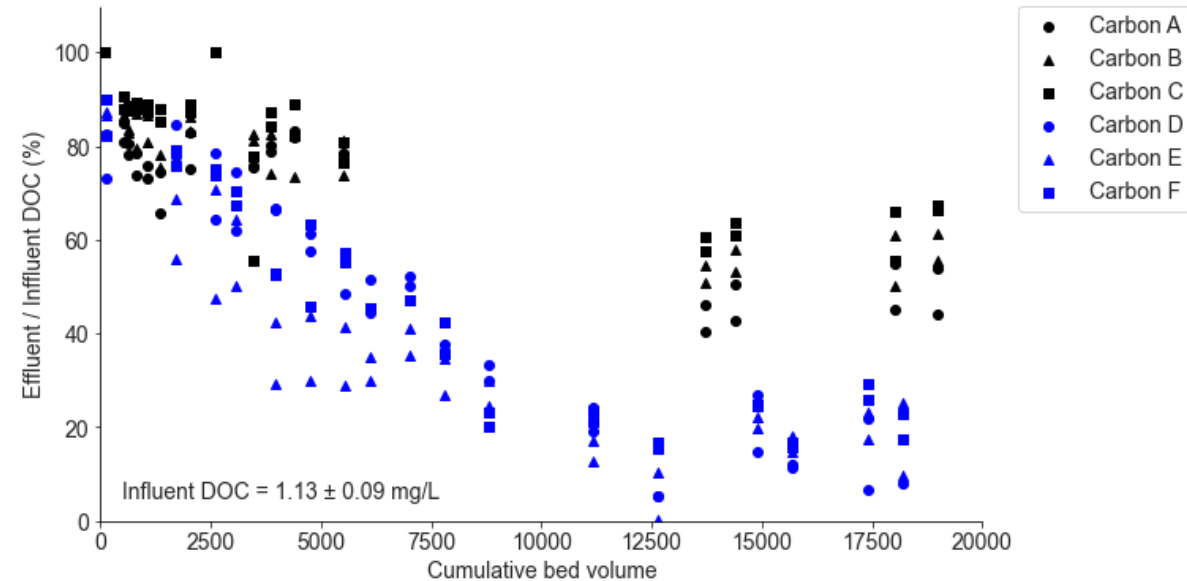
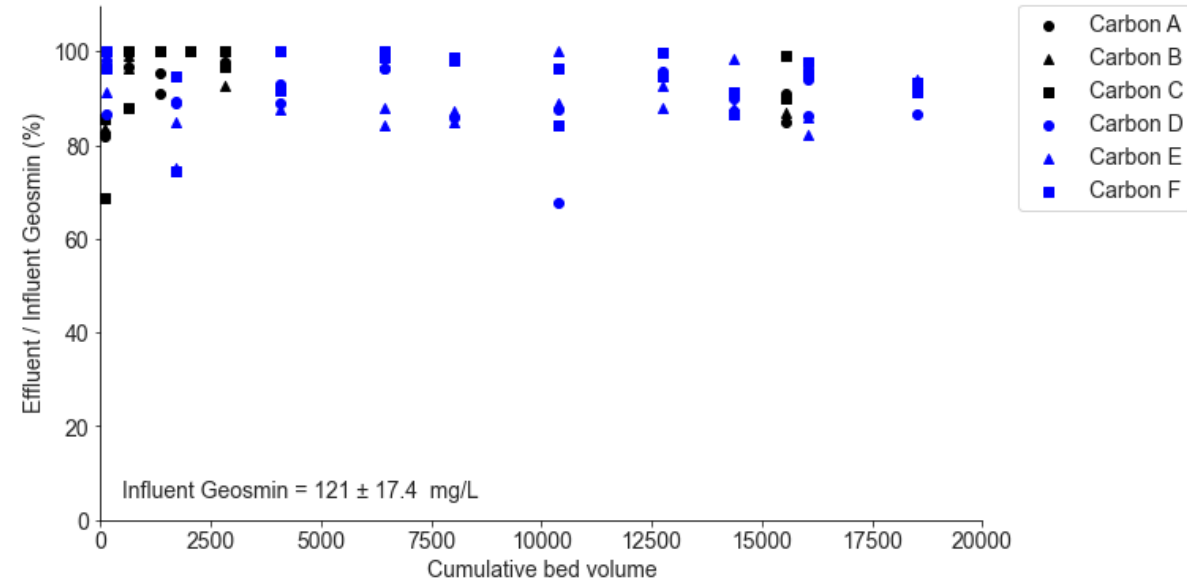
# Adsorption

- Micropore volume.
- BET as fallback option.
- Oxygen content has little influence: conflicting bonds



# Adsorption evolution

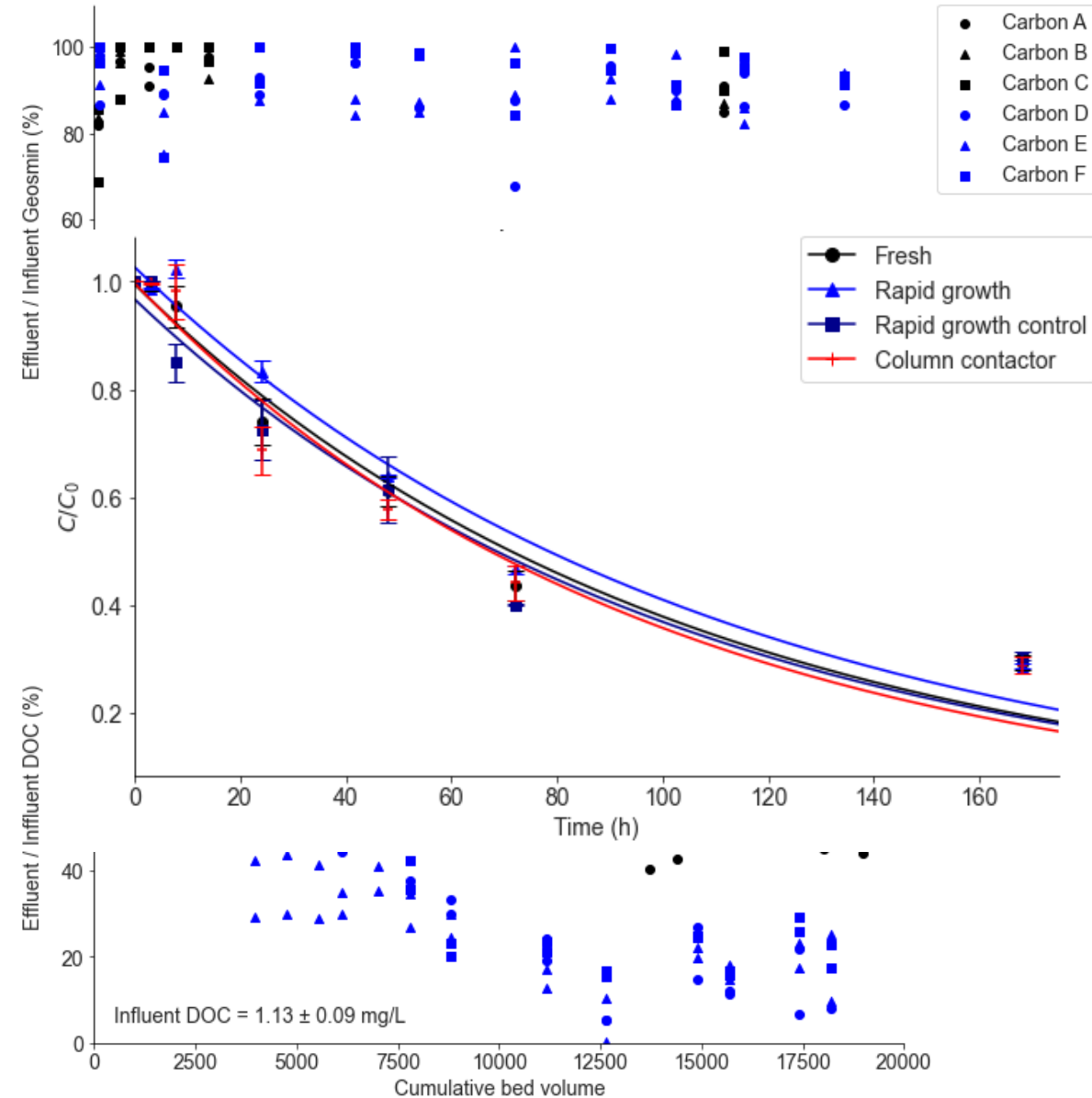
- Steady T&O removal.
- Rapid decline in DOC removal.  
Not a good indicator
- Similar kinetic and isothermal removability.



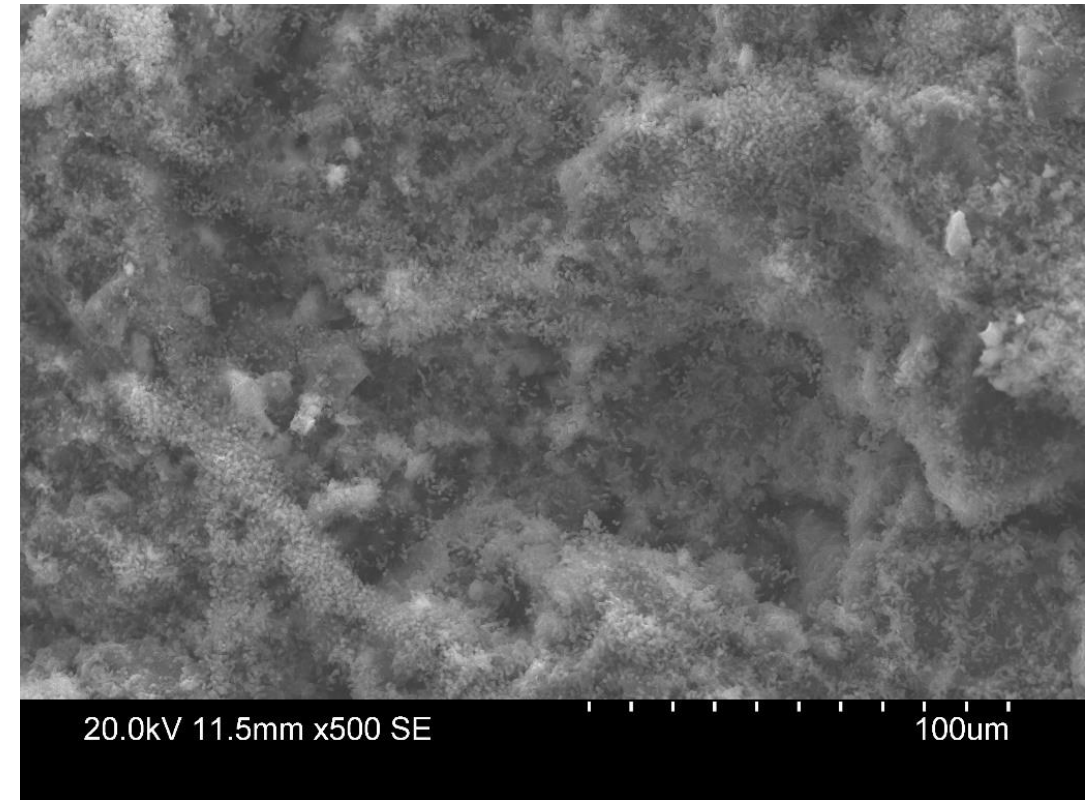
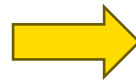
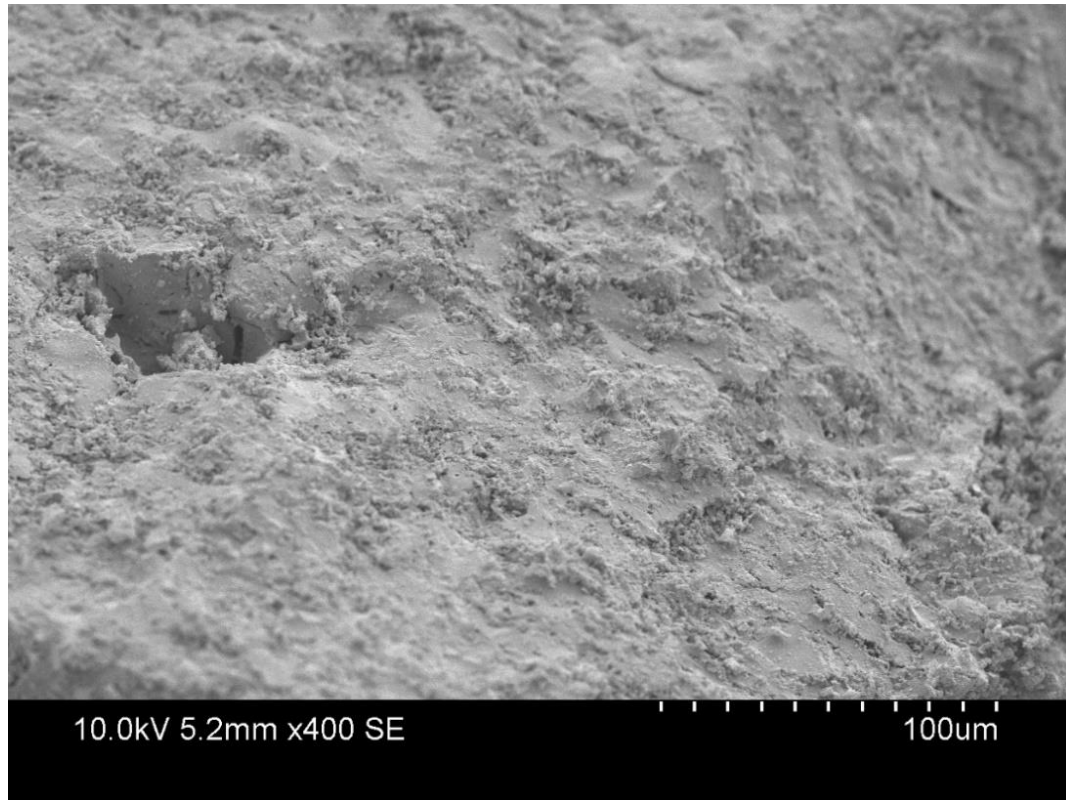


# Adsorption evolution

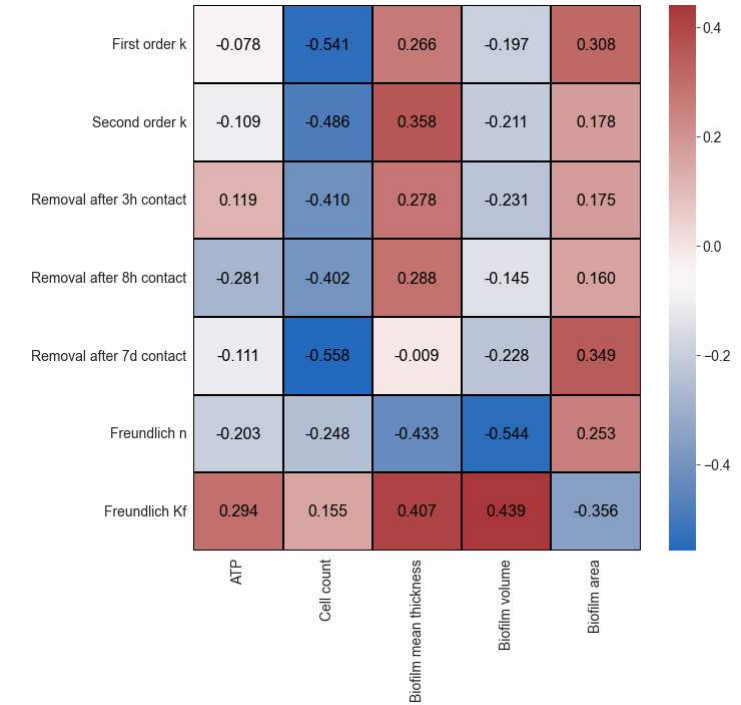
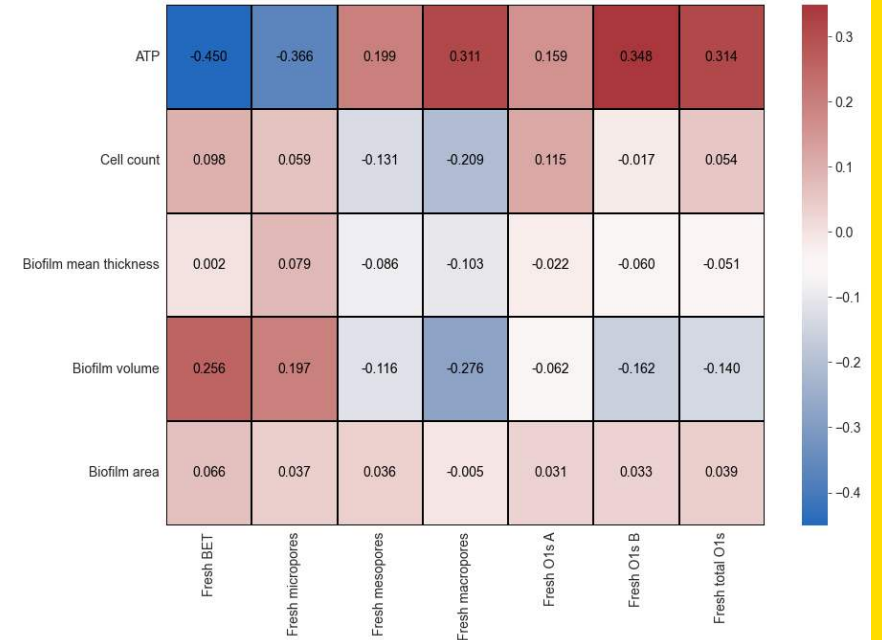
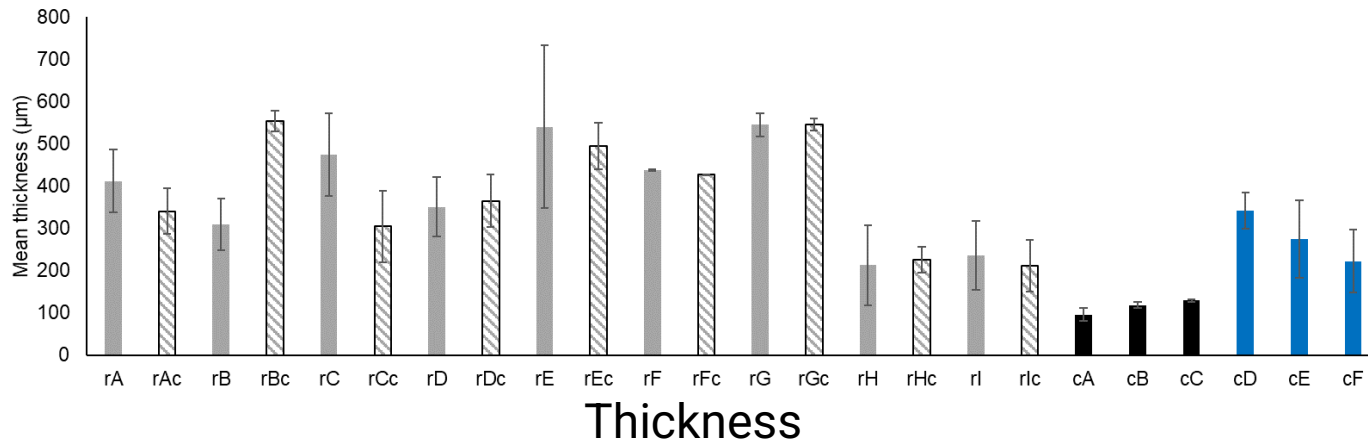
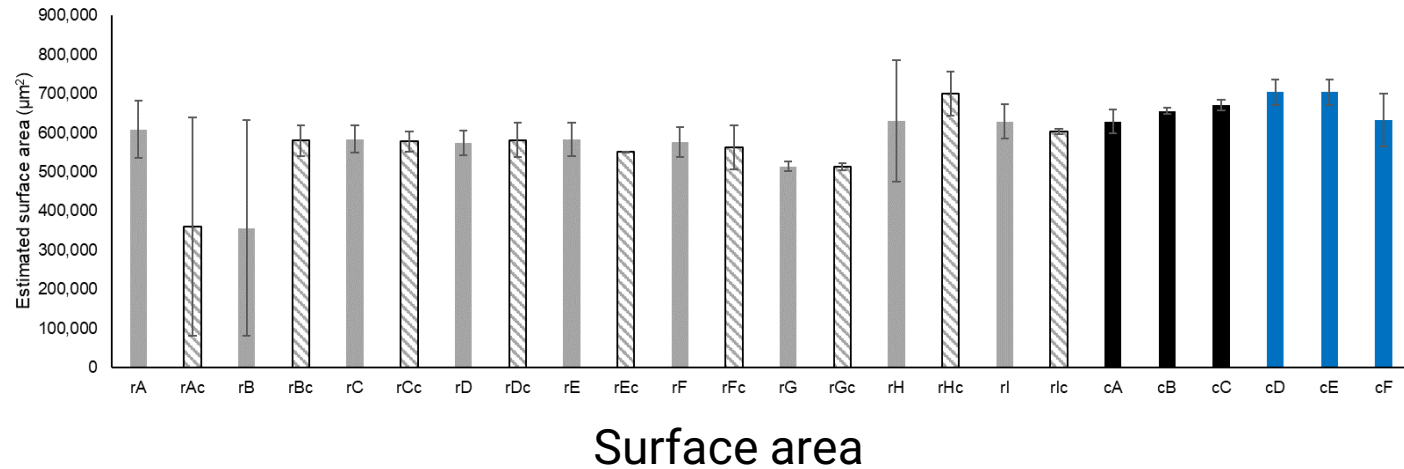
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# Biofilm growth



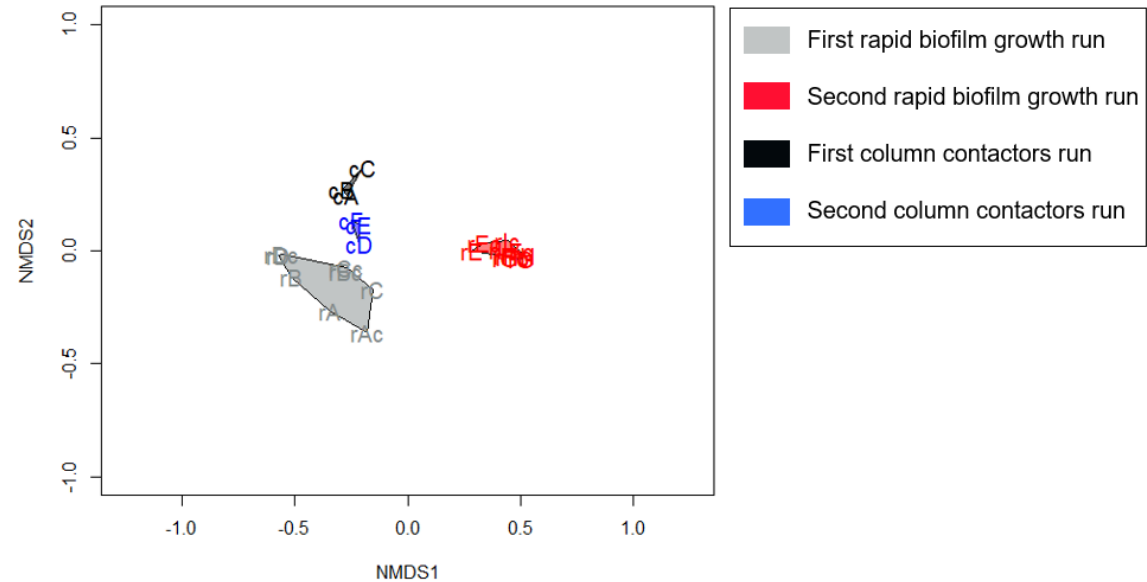
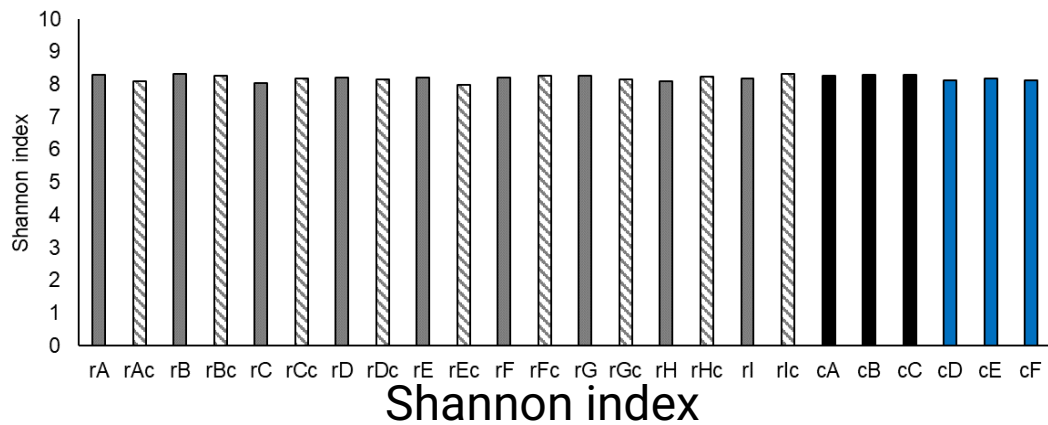
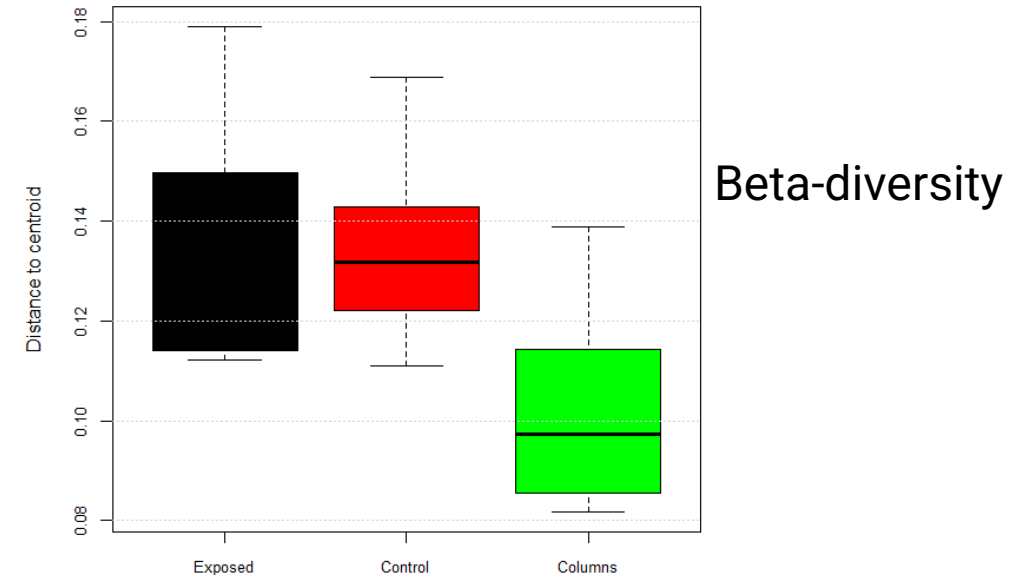
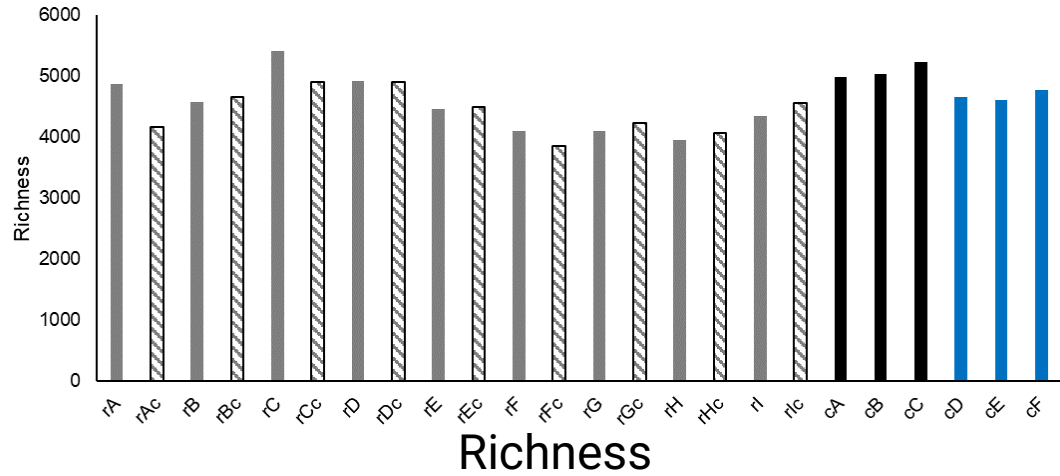
# Biofilm properties







# Microbiome changes with age and pre-exposure



# Conclusions

- Adsorption is controlled by micropore volume ( $< 2$  nm).
- Carbon characteristics have little impact on biofilm growth, but still play a major role on biofiltration performance.
- Kinetics and isothermal experiments suggest adsorption is primary mechanism.
- Biofilm is complex, diverse, and quickly colonises the granules, increasing in thickness as time goes on.
- Alpha diversity does not change much with age, but beta does.
- Pre-exposure to T&O has little to no effect on the microbiome or on the removability.

# Acknowledgements



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