



# Natural Organic Matter Membrane Fractionation: A new Approach

Karlien Dejaeger

## ► To cite this version:

| Karlien Dejaeger. Natural Organic Matter Membrane Fractionation: A new Approach. Euromembrane Conference 2022, Nov 2022, Sorrento, Italy. hal-03920040

HAL Id: hal-03920040

<https://hal.univ-lille.fr/hal-03920040>

Submitted on 16 Feb 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Natural organic matter membrane fractionation: a new approach

Dejaeger Karlien

24<sup>th</sup> November 2022

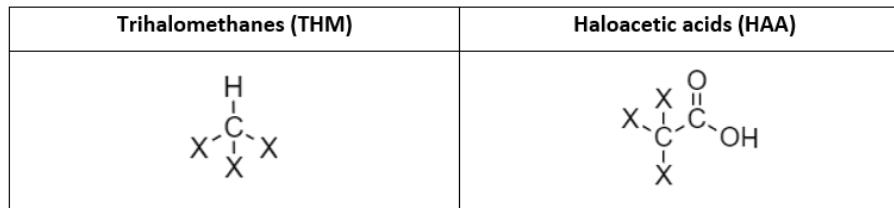
Marjolein Vanoppen, Gabriel Billon, Justine Criquet, Cécile Vignal, Emile R. Cornelissen



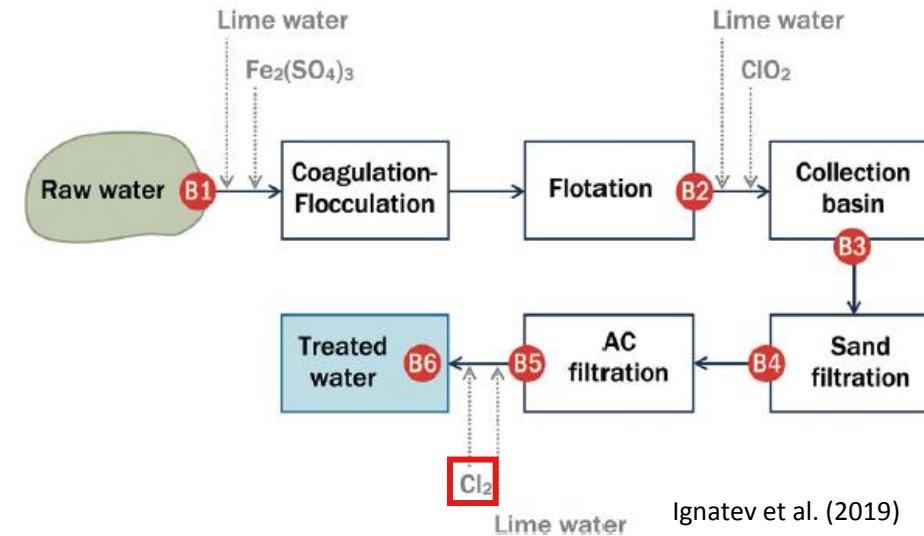
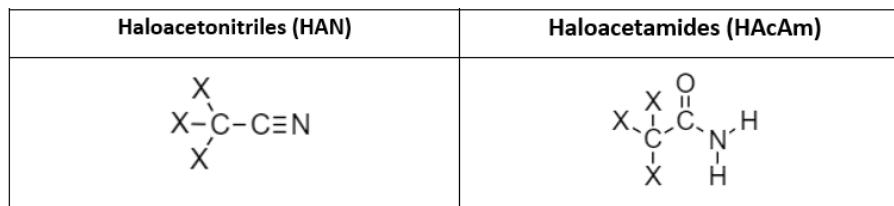
## Why membrane fractionation?

1. To split the **complex organic matter** mixture into fractions with **similar physical properties**
2. To **correlate** these properties to certain **water-related issues** such as disinfection by-product formation

Regulated (µg/L)



Unregulated (ng/L)

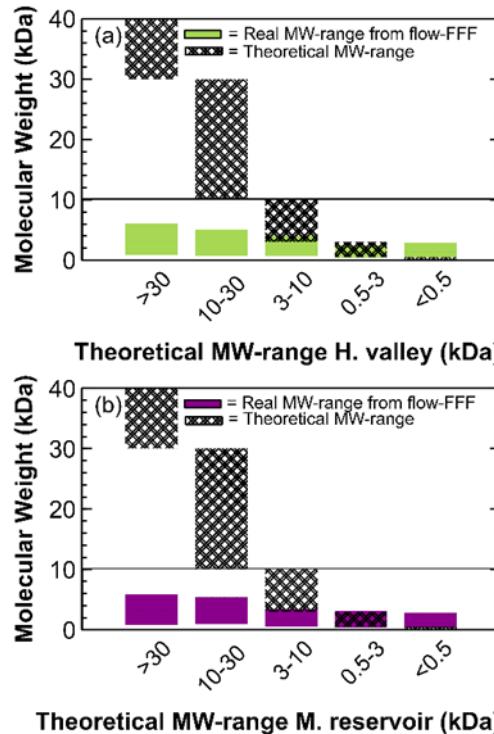
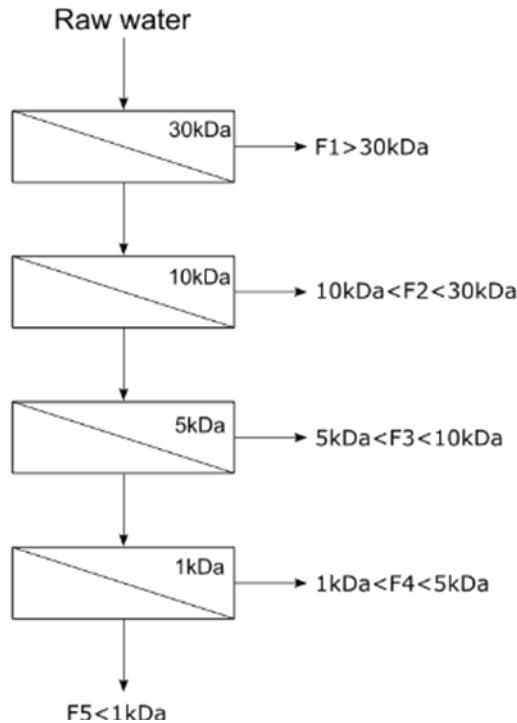


Ignatev et al. (2019)



## Current approach

- Fractionation based on the MWCO of a series of ultrafiltration membranes



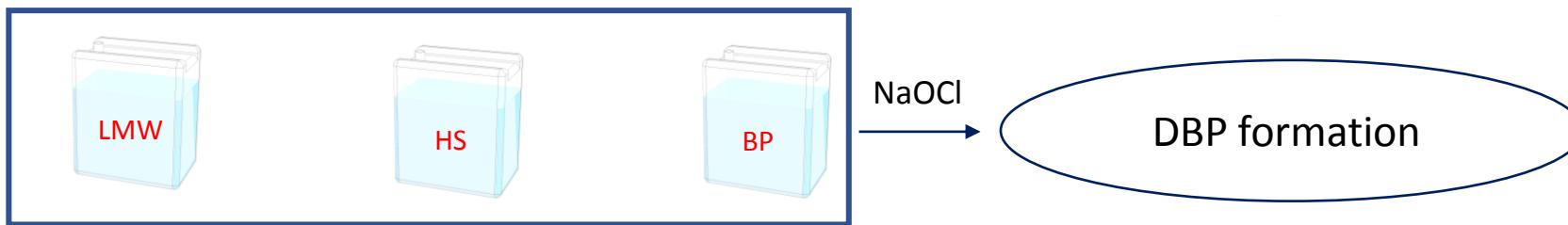
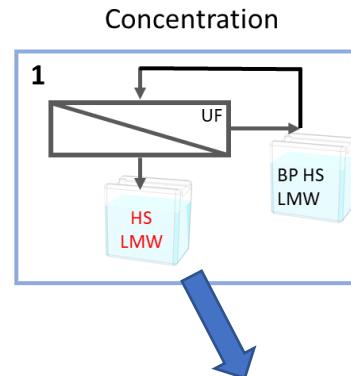
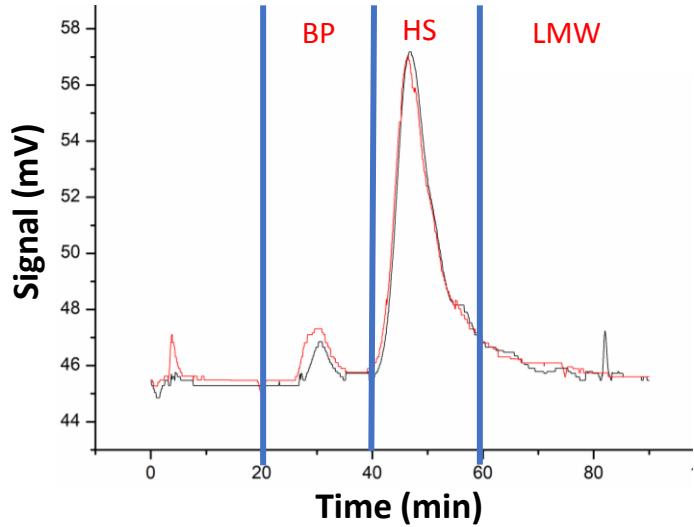
Identification of disinfection by-product precursors by natural organic matter fractionation: a review





## The new approach

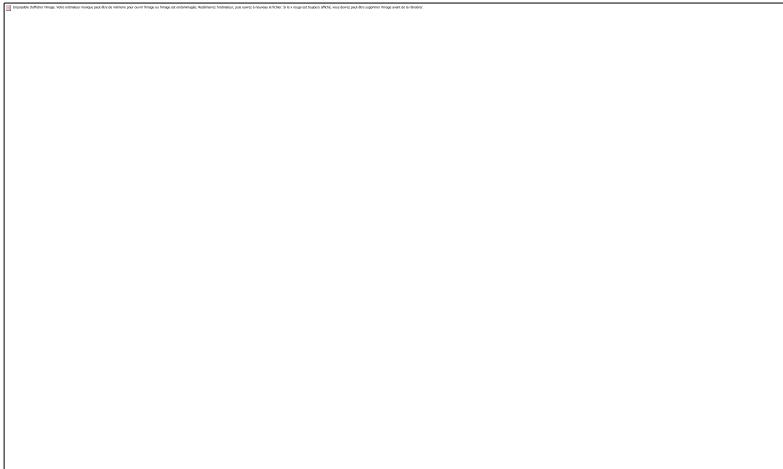
- Fractionation based on HPSEC-TOC





## STEP 1: Membrane selection

- Ultrafiltration membrane screening

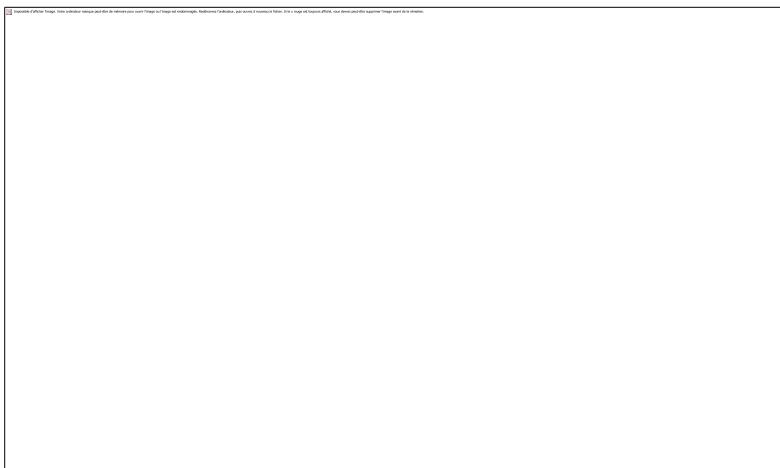


Separation efficiency factor:

$$\alpha = 1 - \frac{1 - Retention_{BP}}{1 - Retention_{HS}}$$

	1 BAR	2 BAR
MT MEMBRANE	0.72	0.85
XT MEMBRANE	0.78	0.91

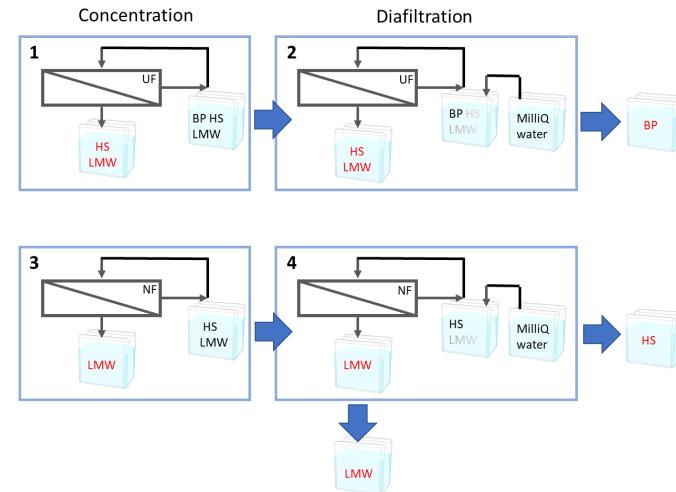
- Nanofiltration membrane screening



Separation efficiency factor:

$$\alpha = 1 - \frac{1 - Retention_{HS}}{1 - Retention_{LMW}}$$

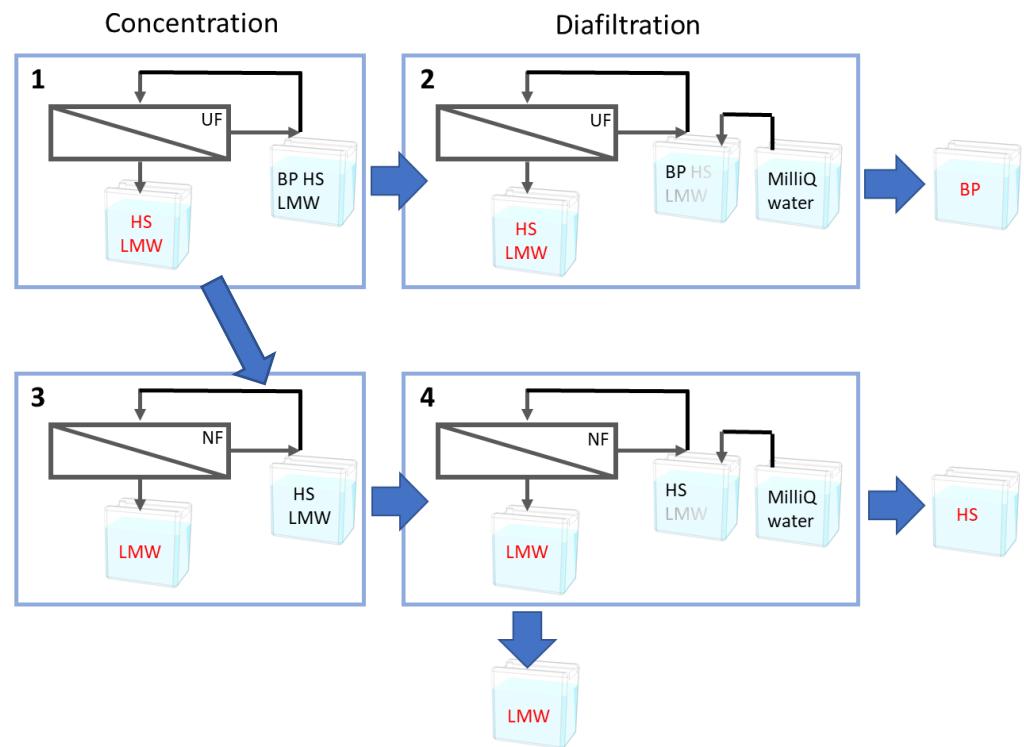
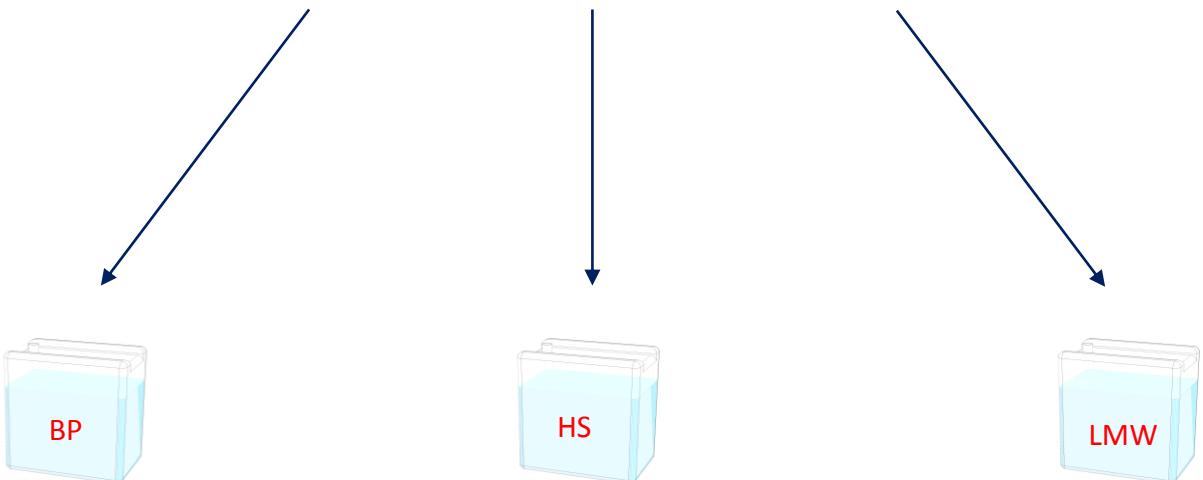
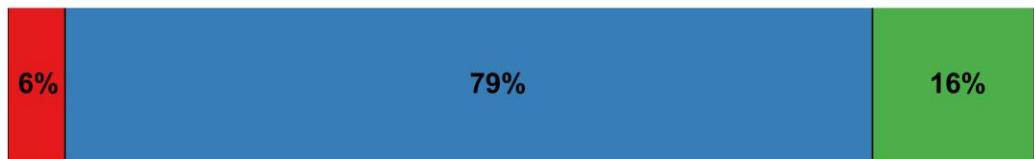
	3 BAR	5 BAR
NFW MEMBRANE	0.93	0.92
NFX MEMBRANE	0.90	0.91





## STEP 2: Fractionation of surface water

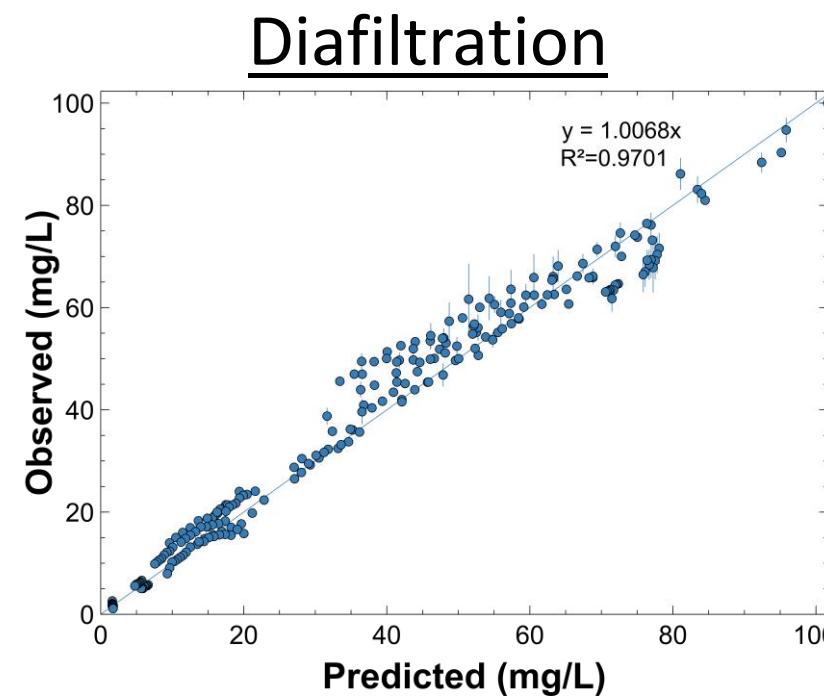
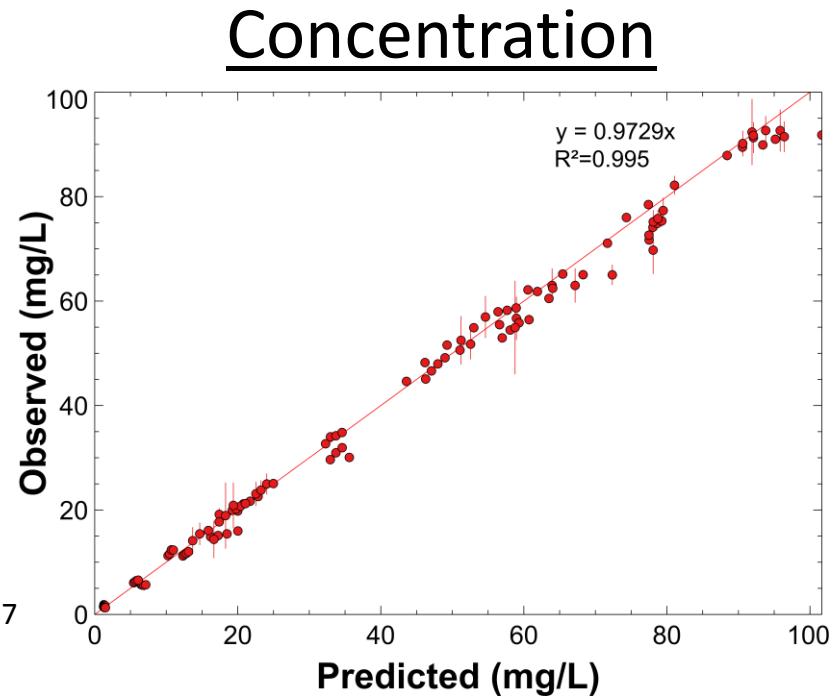
Start composition:





## STEP 3: Massbalance model (black box) to predict fractionation

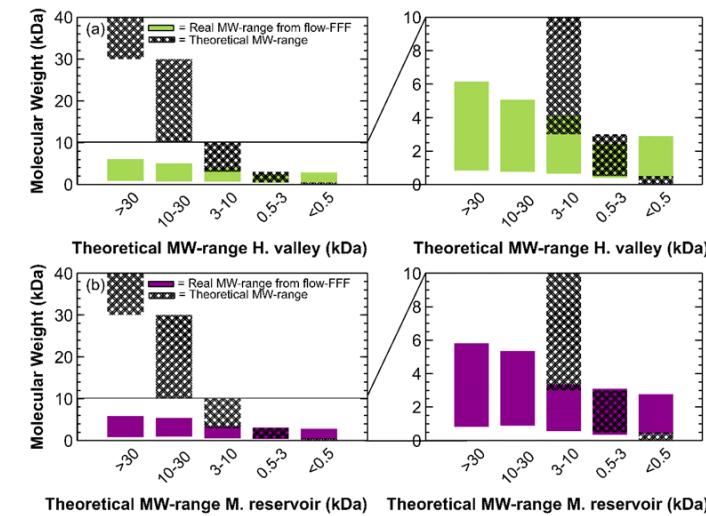
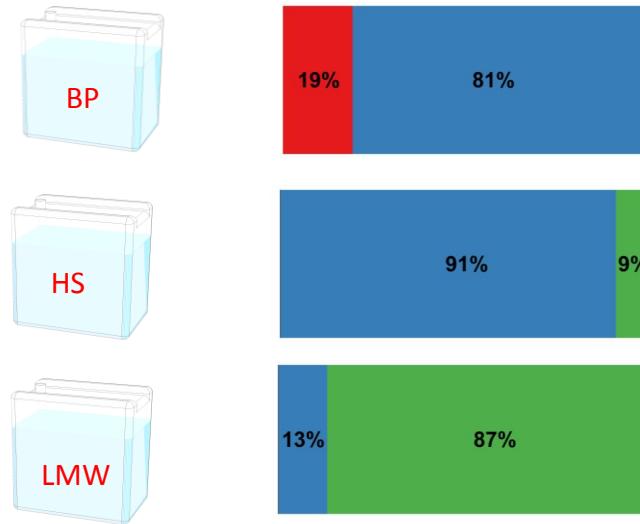
- Input variables:
  - Flux
  - Start concentration
  - Retention
- Validated during nanofiltration with a synthetic ionmatrix





## Conclusions and outlook

- Fractionation based on HPSEC-TOC yields better separated fractions compared to the fractionation based on MWCO



- Improvements needed in terms of recovery

Identification of disinfection by-product precursors by natural organic matter fractionation: a review





[karlien.dejaeger@ugent.be](mailto:karlien.dejaeger@ugent.be)  
[karlien.dejaeger@univ-lille.fr](mailto:karlien.dejaeger@univ-lille.fr)



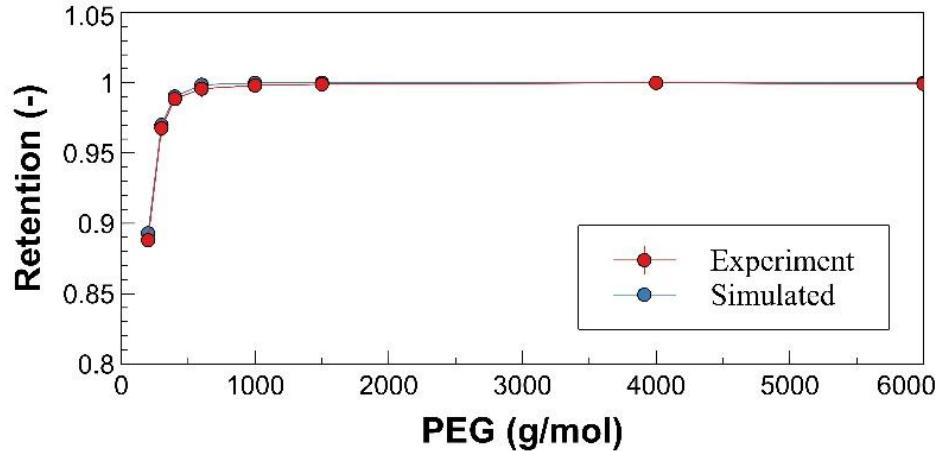
[https://www.linkedin.com/in/  
karlien-dejaeger/](https://www.linkedin.com/in/karlien-dejaeger/)



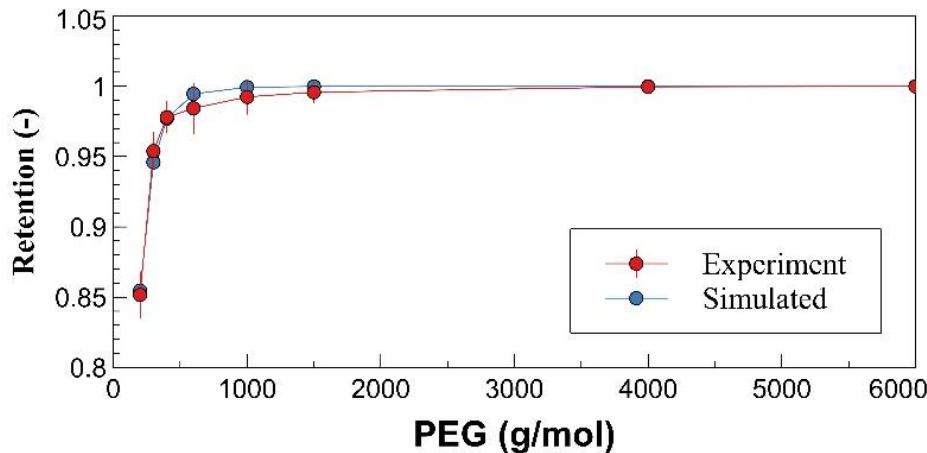


## Supporting info: MWCO determination

$$R(MW^*) = \int_0^{MW^*} \frac{1}{s_{MW} * \sqrt{2\pi}} * \frac{1}{MW} * e^{-\frac{(\ln(MW) - \ln(MWCO) + 0.56*s_{MW})^2}{2*s_{MW}^2}} dMW$$



NFX  
150-300 Da membrane  $\longrightarrow$  MWCO: 130 g/mol



NFW  
300-500 Da membrane  $\longrightarrow$  MWCO: 139 g/mol



## Supporting info: Flux during fractionation

