



HAL
open science

Characterisation of the fouling of an ultrafiltration polyethersulfone membrane fouled by an emulsion modelling lipids issued from Microalgae

V Drevet, S. Liu, E Clavijo Rivera, L Villafaña López, M Frappart, Estelle Couallier, Anthony Szymczyk, M Rabiller Baudry

► To cite this version:

V Drevet, S. Liu, E Clavijo Rivera, L Villafaña López, M Frappart, et al.. Characterisation of the fouling of an ultrafiltration polyethersulfone membrane fouled by an emulsion modelling lipids issued from Microalgae. ICOM, Jul 2017, San Francisco, United States. hal-02353535

HAL Id: hal-02353535

<https://hal.science/hal-02353535v1>

Submitted on 7 Nov 2019

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.

Characterisation of the fouling of an ultrafiltration polyethersulfone membrane fouled by an emulsion modelling lipids issued from Microalgae

V. Drevet¹, S. Liu², E. Clavijo Rivera², L. Villafaña López², M. Frappart², E. Couallier^{2*}, A. Szymczyk¹, M. Rabiller Baudry^{1*}

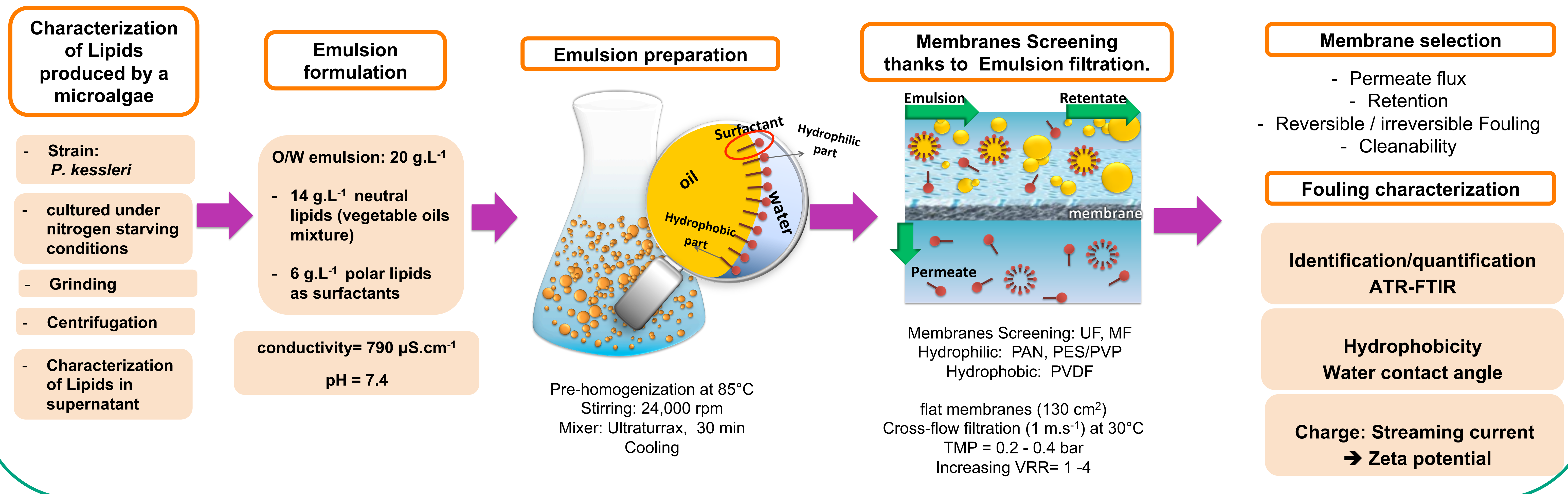
¹ Université de Rennes 1, Université Bretagne Loire, Institut des Sciences Chimiques de Rennes, France

² CNRS, Université de Nantes, Université Bretagne Loire, Laboratoire GEPEA, Saint Nazaire, France

Context / Objectives

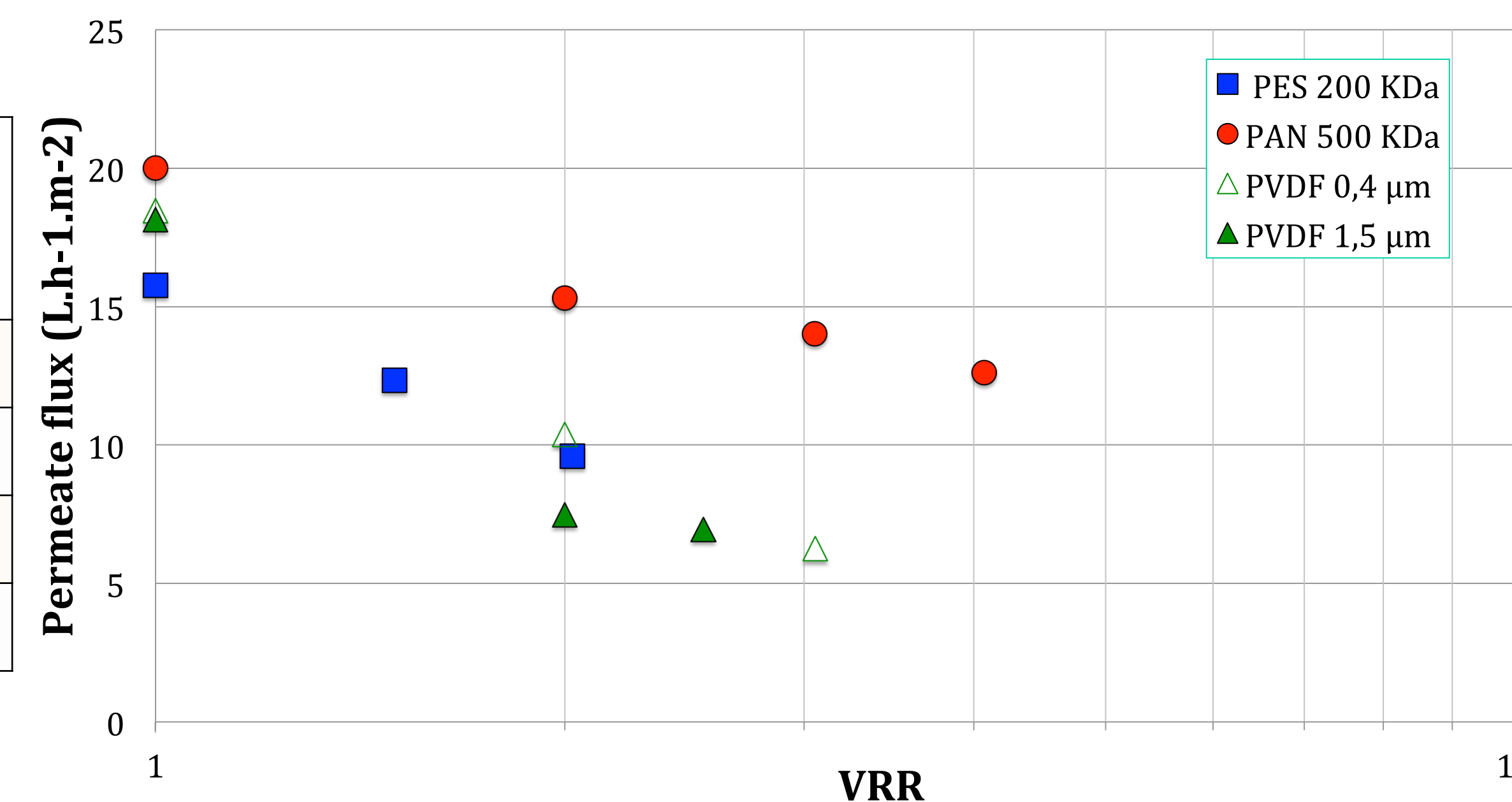
- Microalgae can transform CO₂ in biomass and in high value molecules such as **triglycerides**, proteins or polysaccharides.
- Membrane filtration is a promising process for Microalgae biorefinery : low energy consumption / integrity of all valuable compounds / valorization of all fractions.
- However integration of membranes is not trivial because of the complexity of feed solutions that may contain cell fragments, lipids, etc.
- This work aims at the integration of **ultrafiltration for the recovery of lipids**.
 - A **synthetic Oil / Water emulsion** was formulated based on the lipids profile of a microalgae cultured under nitrogen starving conditions
 - **Fouling** was characterized thanks to **permeate flux**, **ATR-FTIR** and **streaming current** measurements

Modelling of Oil / Water emulsion and general approach



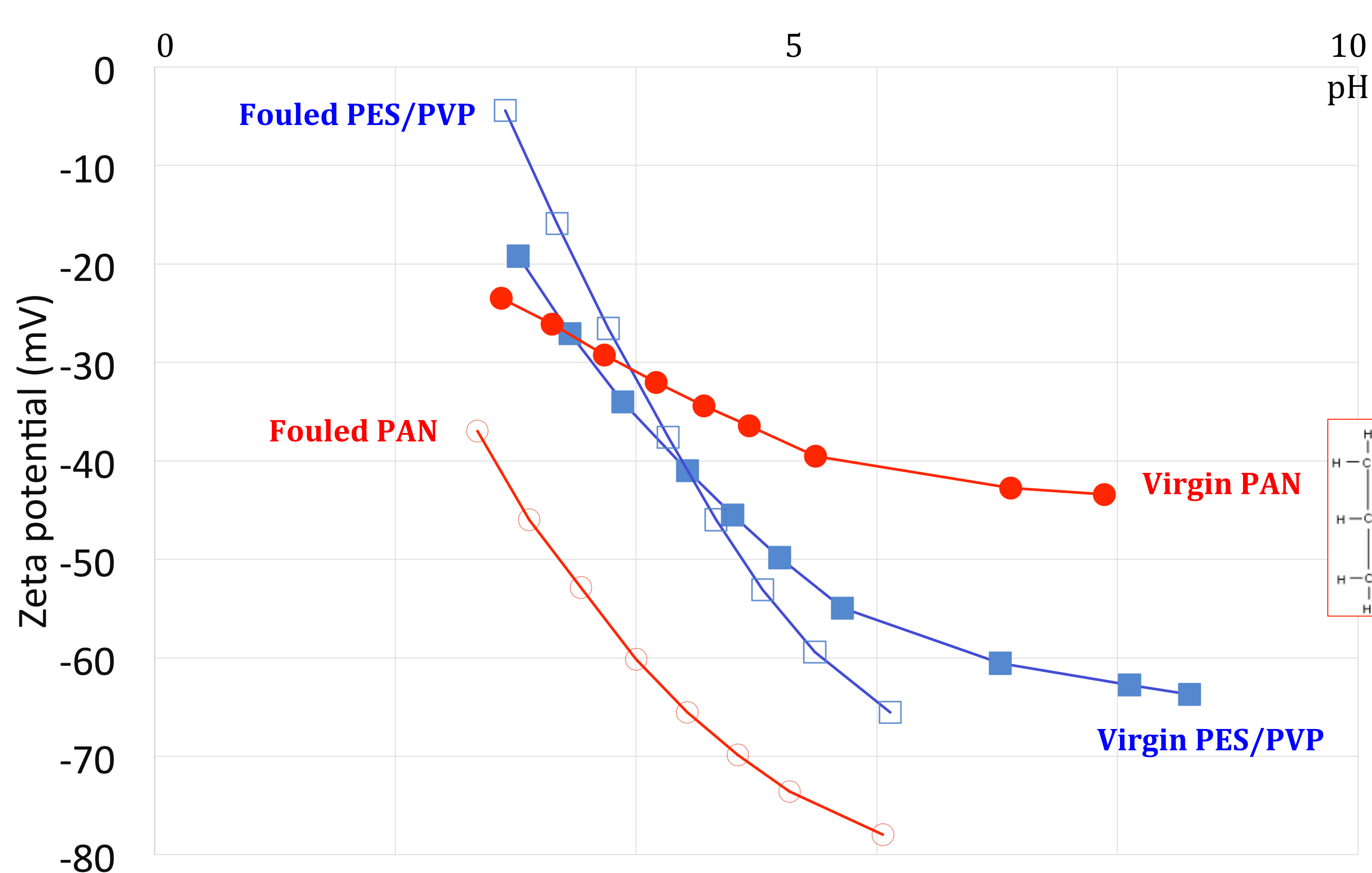
UF / MF → PAN membrane: the best one

Membrane Polymer	MWCO / pore size	Critical TMP (bar)	Lp _{water} L.h ⁻¹ .m ⁻² .bar ⁻¹	Lp _{emulsion} L.h ⁻¹ .m ⁻² .bar ⁻¹	Lp _{emulsion} / Lp _{eau}	J _{cleaned membrane} / J _{water}	Lipid Retention
PAN	500 kg.mol ⁻¹	0.25-0.40	82 - 325	63 - 160	0.5 - 0.8	0.92	0.985
PES/PVP	200 kg.mol ⁻¹	0.26-1.00	20-152	15-85	0.5-0.8	0.81	0.987
PVDF	0.4 μm	0.20-0.25	50-250	50-110	0.4-0.9	0.98	0.946-0.985
PVDF	1.5 μm	0.25	51	27	0.5	0.86	0.966-0.981

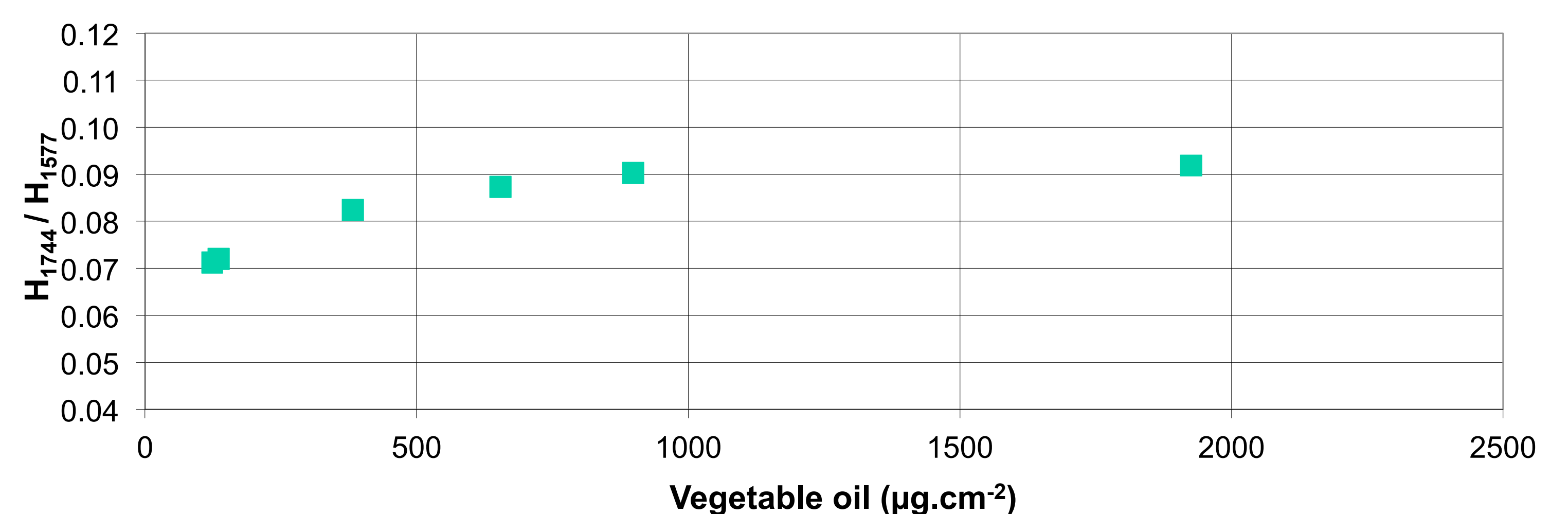
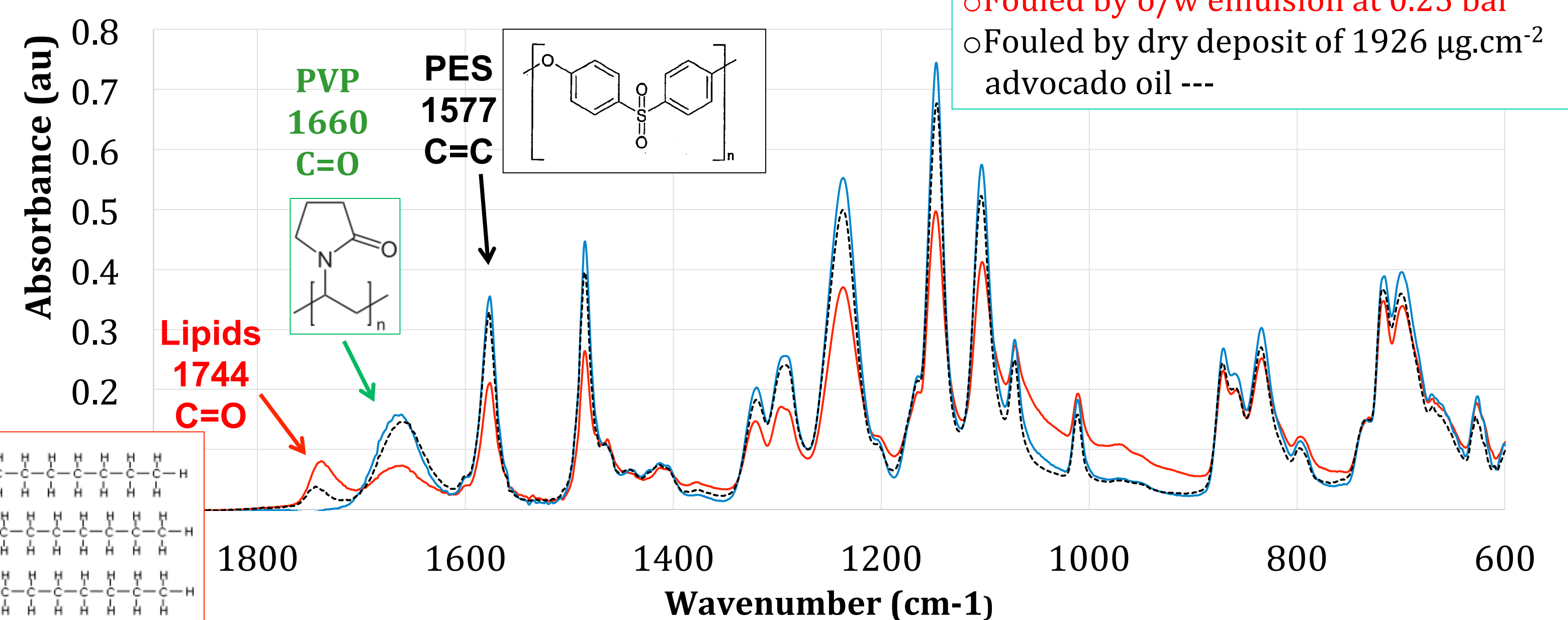


UF virgin / fouled membranes:

Zeta potential



ATR-FTIR



- The PES/PVP membrane isoelectric point increased after fouling
- The PAN membrane charge was more negative after fouling
- Fouling had more impact on the PAN membrane surface charge than on PES/PVP membrane