www.elsevier.com/locate/memsci

REDUNDANCY ANALYSIS FOR DETERMINATION OF THE MAIN PHYSICOCHEMICAL CHARACTERISTICS OF FILTRATION MEMBRANES EXPLAINING THEIR FOULING BY PEPTIDES

Mathieu Persico, Pascal Dhulster, Laurent Bazinet

PII: S0376-7388(18)31357-7
DOI: https://doi.org/10.1016/j.memsci.2018.06.036
Reference: MEMSCI16253

To appear in: *Journal of Membrane Science*

Received date: 18 May 2018
Revised date: 18 June 2018
Accepted date: 19 June 2018

Cite this article as: Mathieu Persico, Pascal Dhulster and Laurent Bazinet, REDUNDANCY ANALYSIS FOR DETERMINATION OF THE MAIN PHYSICOCHEMICAL CHARACTERISTICS OF FILTRATION MEMBRANES EXPLAINING THEIR FOULING BY PEPTIDES, *Journal of Membrane Science,* https://doi.org/10.1016/j.memsci.2018.06.036

REDUNDANCY ANALYSIS FOR DETERMINATION OF THE MAIN PHYSICOCHEMICAL CHARACTERISTICS OF FILTRATION MEMBRANES EXPLAINING THEIR FOULING BY PEPTIDES

Mathieu Persico[a,b], Pascal Dhulster[c], Laurent Bazinet[a,b*]

[a]*Institute of Nutrition and Functional Foods (INAF) and Department of Food Sciences, Université Laval, Québec, QC, Canada*

[b]*Laboratory of Food Processing and ElectroMembrane Processes (LTAPEM), Université Laval, Québec, QC, Canada*

[c]*Univ. Lille, INRA, ISA, Univ. Artois, Univ. Littoral Côte d'Opale, ICV, Lille, France*

Abstract

Peptide fouling is a technological drawback in filtration membrane processes. The impact of membrane characteristics on fouling by peptides from a complex whey protein hydrolysate (WPH) fouling was assessed based on advanced statistical redundancy analysis. Six membranes were characterized and tested: PES, PVDF, CF55, S11, $S11^+$ and $S11^-$. Among the eight physicochemical characteristics analyzed, zeta-potential (ZP) and roughness (Rz) were highly correlated with total fouling quantity (TFQ), suggesting that peptide fouling was mainly due to electrostatic interactions over wider surfaces. Concerning peptide sequences, redundancy analysis indicated that at least one characteristic among ZP, Rz, contact angle and thickness contributed significantly to the fouling of ALMPHIR, LIVTQTMK, TKIPAVFK, VLVLDTDYK, TPEVDDEALEK, TPEVDDEALEFDK or SLAMAASDISLLDAQSAPLR. It appeared that membranes with hydrophilic surfaces were more likely to be fouled by WPH regardless the peptide hydrophilicity. Besides, wider surface would enable more contact area for peptides, increasing consequently fouling. The TFQ was described by an empirical model using the combined effect of ZP and Rz, of the form: $\ln(TFQ) = 8.64 + 0.072.X_{Rz} + 0.088.X_{ZP}$ (R^2=0.9098). Moreover, statistical models were also established for each peptide, enabling to predict their specific fouling on a variety of membranes with different physicochemical characteristics.

Keywords: Filtration membrane, Membrane physicochemical characteristics, Peptide fouling, Redundancy analysis, Predictive multivariate regression model

1. Introduction

Pressure-driven and electrically-driven membrane technology are widely used in separation and purification processes. The growing interest in membrane technology is especially due to the