INTERNATIONAL SYMPOSIUM „THE ENVIRONMENT AND THE INDUSTRY" 2020
SIMI

INSTITUTUL NAȚIONAL DE CERCETARE-DEZVOLTARE PENTRU ECOLOGIE INDUSTRIALĂ
ECOIND
EXCELENȚĂ ÎN CERCETARE ȘI SERVICII DE MEDIU

NITROGEN CONTENT AND HEAVY METALS REMOVAL BY POLYETHERSULPHONE ULTRAFILTRATION MEMBRANE

Roxana-Elena Scutariu[1,2], Gheorghe Batrinescu[1], Anda Gabriela Tenea[1], Vasile-Ion Iancu[1], Florinela Pirvu[1], Alina Tatarus[1]

[1]National Research and Development Institute for Industrial Ecology-ECOIND, 71-73 Drumul Podu Dambovitei Street, district 6, 060652, Bucharest, Romania,
[2]University Politehnica Bucharest, Faculty of Applied Chemistry and Materials Science, 1-7 Polizu Street, district 1, 011061, Bucharest, Romania

INTRODUCTION

Heavy metals removal from aqueous systems can be achieved by conventional treatment processes such as ion exchange, electrochemical removal and chemical precipitation. Membrane processes, such as reverse osmosis (RO), nanofiltration (NF), microfiltration (MF) and ultrafiltration (UF), represent a valid alternative to treatment and to improve the quality of aqueous systems.

This study will investigate the applicability of the ultrafiltration process for removal of nitrogen content and heavy metals Cr, Ca^{2+}, Na^+ and K^+ from aqueous collagen solutions. The study was conducted using two polyethersulfone membranes with different molecular weight cut-off (5 kDa and 10 kDa) that were characterized the point of view of ultrapure water fluxes, permeability and rejection.

EXPERIMENTAL

- The feed solutions used in the experiments consisted of stock solutions of bovine collagen hydrolysate with a molecular weight of 2000 Da, 5600 Da, 7000 Da, 10000 Da.
- All ultrafiltration experiments were performed using a 5 kDa (M1) and 10 kDa (M2) polyethersulfone flat-sheet membrane (Sartorius Stedim Biotech GmbH, Germany), with 76 mm diameter.
- The filtration experiments were performed with ultrafiltration membrane system, LABCELL CF-1 Koch Membrane Systems, United Kingdom.
- All the solutions were prepared in ultrapure water, with a concentration of 1%.

RESULTS

- The ultrapure water fluxes for the two membranes tested in the study were performed at five different pressures, from 2 to 6 bar, with 1 bar increment.
- The degree of rejection of polyethersulfone membranes was determined by analyzing the total nitrogen in the initial solutions, permeates and concentrates.
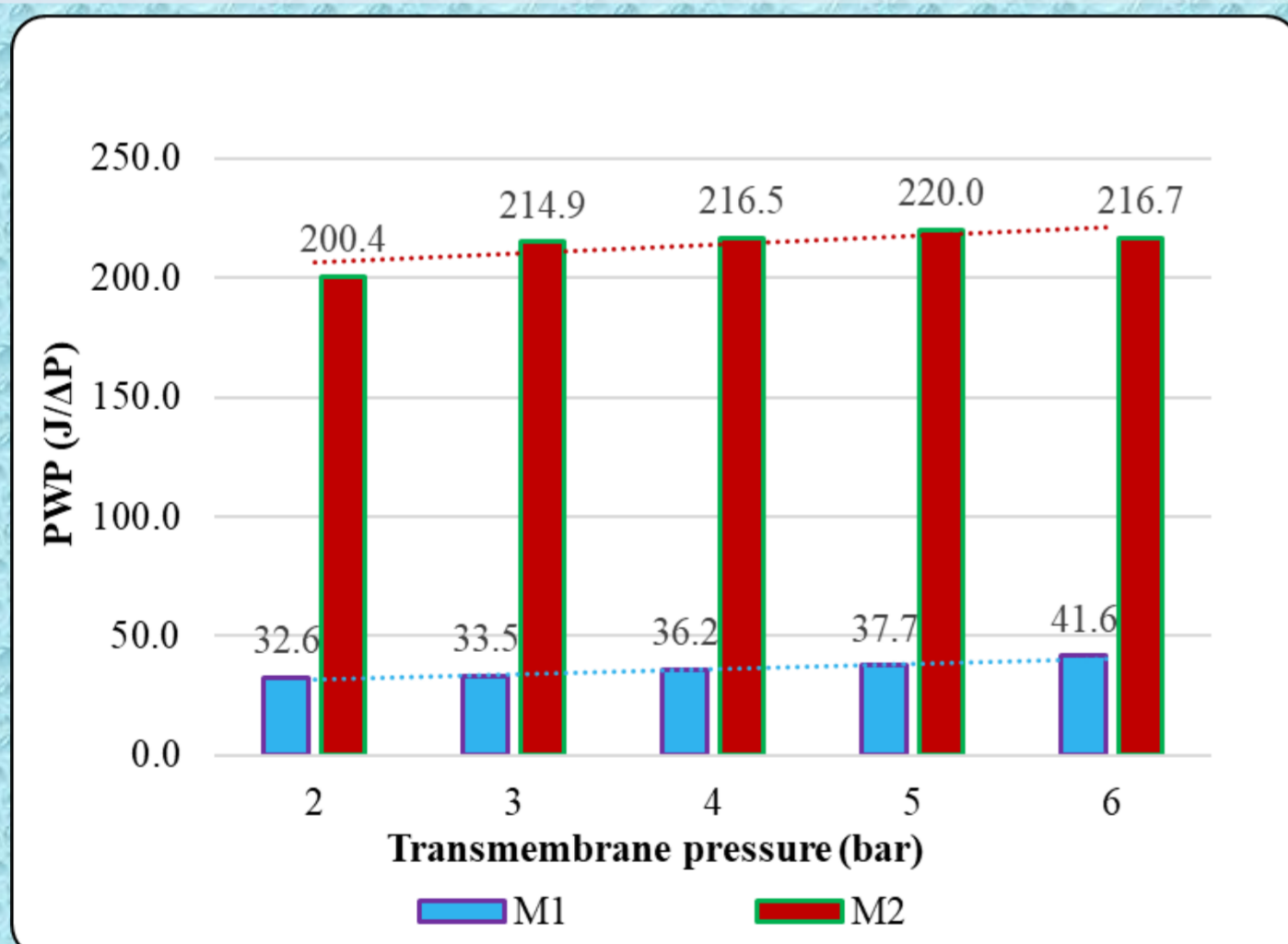

Fig. 1. Permeability of M1 and M2 membranes depending on transmembrane pressure.
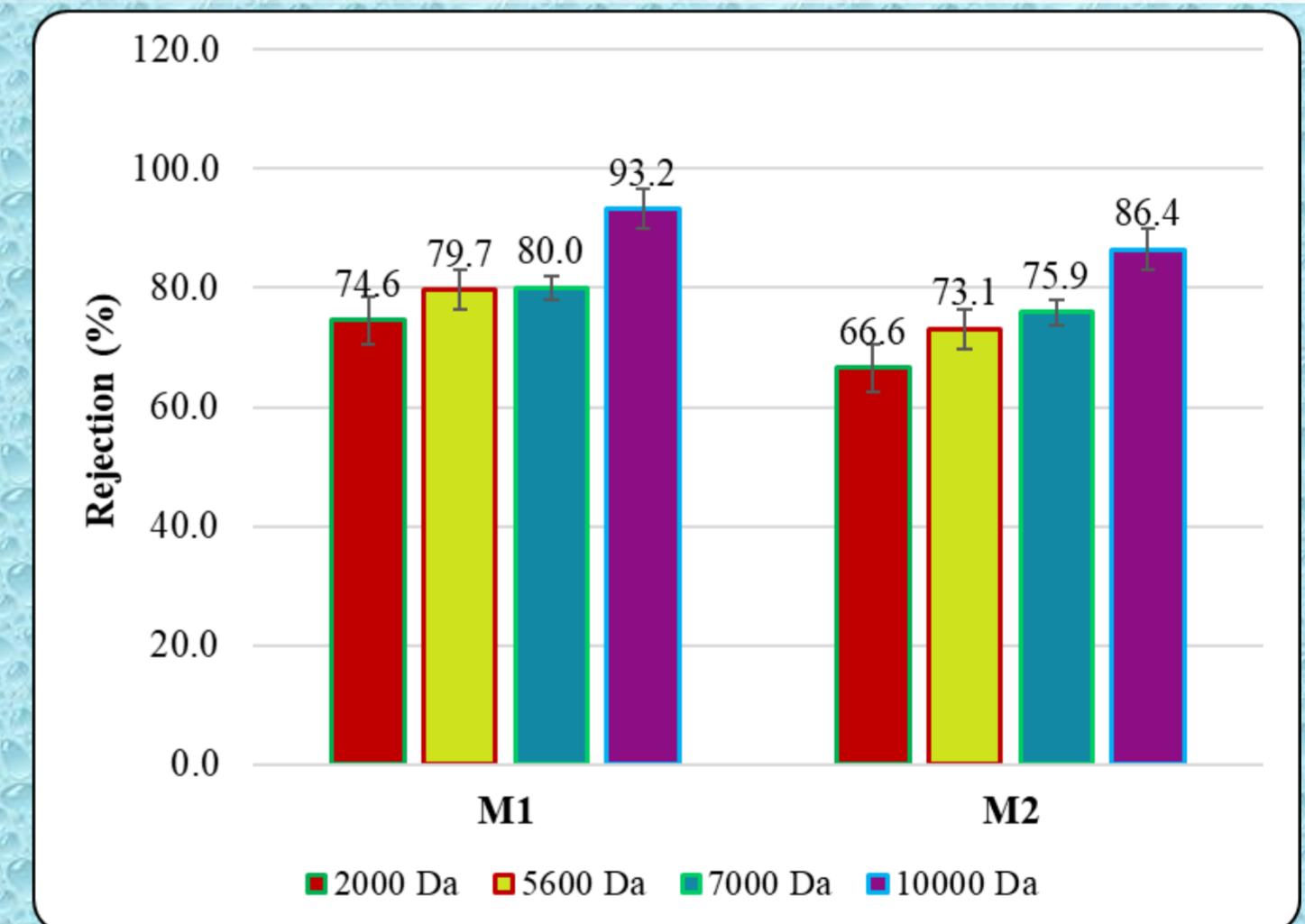

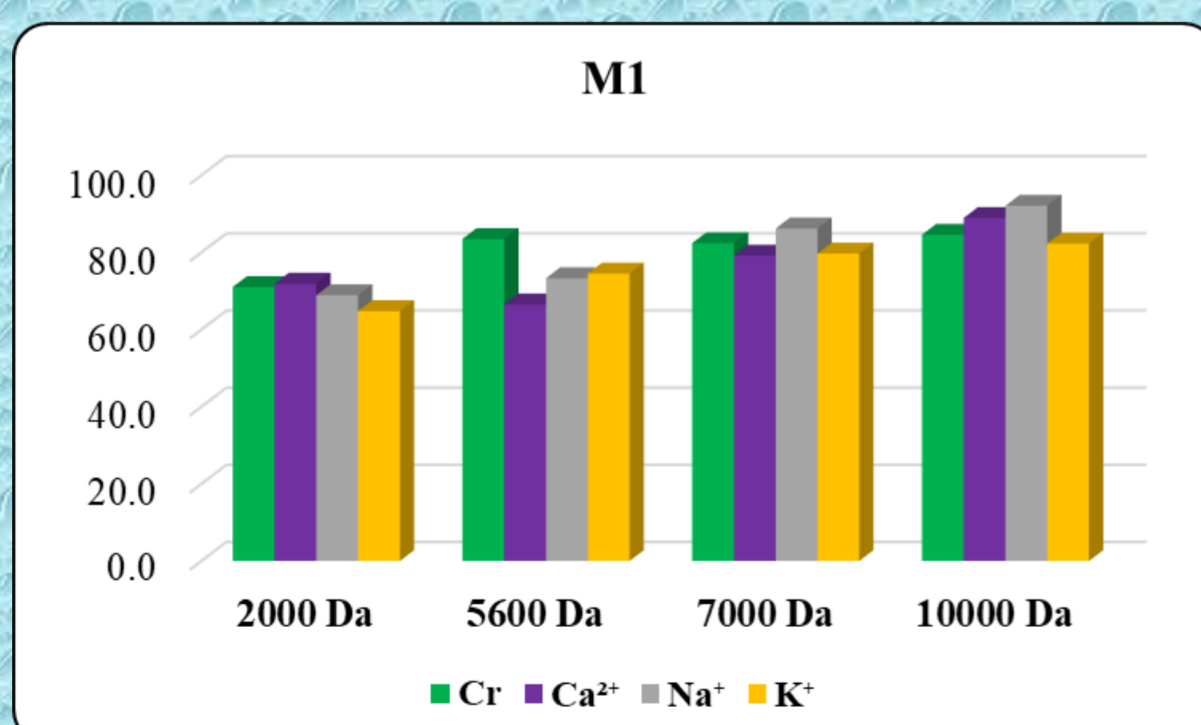**Fig. 2.** Rejection of nitrogen content with M1 and M2 membranes.

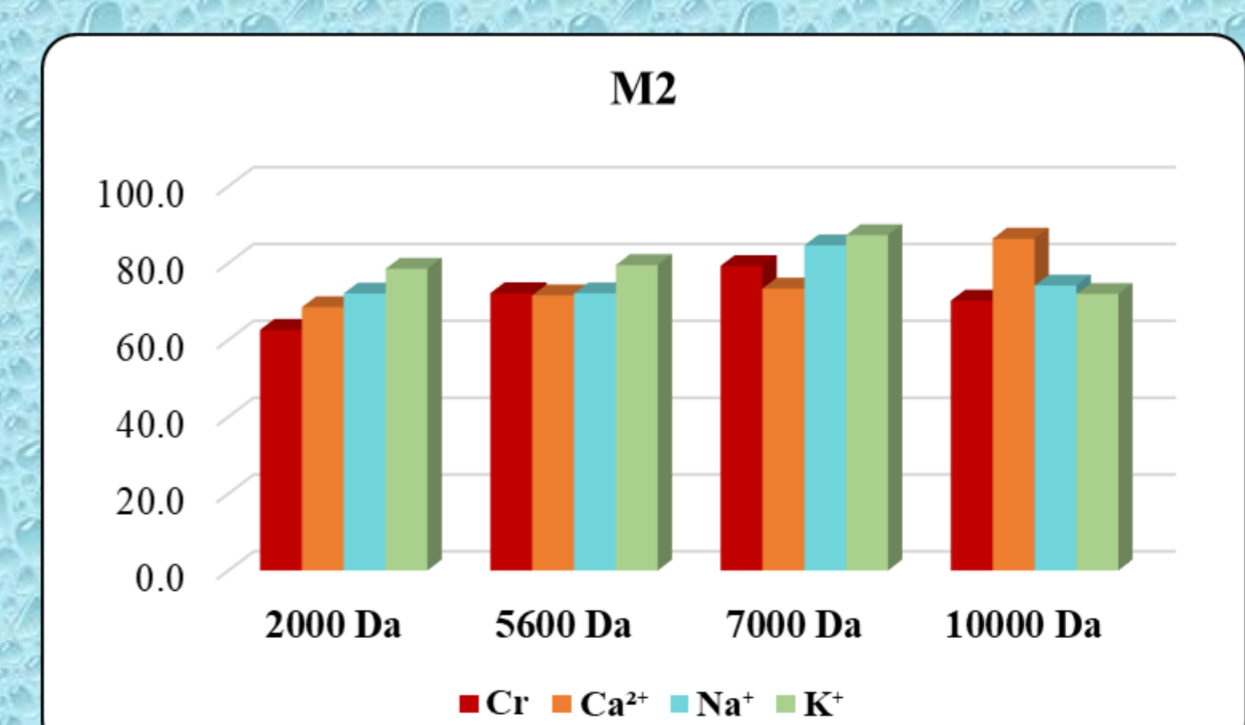**Fig. 3.** Rejection of heavy metals with M1 membrane.

Fig. 4. Rejection of heavy metals with M2 membrane.

CONCLUSIONS

- The permeability's increases with increasing transmembrane pressure.
- The M1 membrane performs better rejection in terms of nitrogen content for all four tested solutions compared to the M2 membrane.
- Nitrogen rejection for the four solutions used increases with increasing molecular weight of the collagen hydrolysate.
- Heavy metal rejection varies between 64.8 and 88.9% for the M1 membrane, and between 62.6 and 87.2% for the M2 membrane.