ADAPTATION OF ORGANIC MATTER CONTENT IN WATERS RESERVOIRS OF ALICANTE PROVINCE USING MEMBRANE ULTRAFILTRATION

Sentana, I.; Rodríguez ,M.; Sentana, E. and Prats, D.

Water and Environmental Science Institute. University of Alicante

P.O. Box 99. 03080 Alicante, Spain e-mail: irene.sentana@ua.es

INTRODUCTION

Water is a fundamental resource for the life. In many regions of the Mediterranean, surface's waters have a high content in organic matter. This organic content can form organ chlorine products (DBPs) when the water is disinfected using chlorine. Some of DBPs are considered carcinogenic like trihalometanes [1] (THM). The Spanish regulation RD 140/2003 fixes the limit of THM at 100µg/L from January 2009 [2].

The objective of this work is to study the reduction of DOC with an ultrafiltration system using poliacrylonitrile anionic and cationic membranes (50kDa), polyethersulfone (5, 30 kDa MWCO) and cellulose regenerated (10, 30kDa).

.

MATERIALS

♦**EQUIPMENT**: Ultrafiltration experiments were carried out in a stirred cell apparatus (Model 8200 Amicon Millipore).

♦ **MEMBRANES**: Ultrafiltration disc membranes obtained from Amicon were used. Membranes had a diameter of 63.5mm.

MEMBRANE	MATERIAL	MWCO (Da)
PES	polyethersulfone	5000 - 30000
RC	regenerate cellulose	10000 - 30000
PAN CATIONIC	poliacrylonitrile	50000
PAN ANIONIC	poliacrylonitrile	50000

♦ **FEED WATER**: Two different waters were tested; Amadorio and Pedrera reservoirs. Both are situated in southeast Spain, in the Alicante province, (Weight distribution figure 1)

♦**ANALYTICAL METHODS** ::
Dissolved Organic Carbon (DOC): Shimadzu TOC-5000 analyser.
UV absorbance: UV/VIS spectrophotometers at the 254 nm.

METHODS

♦ FILTRATION PROTOCOL

1.) Stirred cell was initially filled with DI water. Water flux was measured as a function of time at a constant pressure (100kPa), until steady flux was achieve.

2. Stirred cell was emptied and refilled with reservoirs water and the system was repressurized. The filtrate flow rate was measured. Permeate samples were collected periodically for subsequent concentration analysis.

3. Stirred cell was emptied and refilled with DI water as initial experiment and water flux was measured.

Note:

P= 100kPa; Tª= 20 ºC; stirring speed 200rpm.

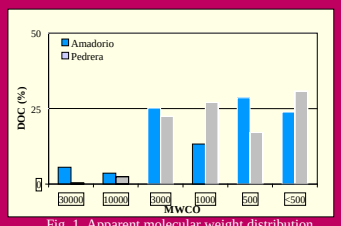

Fig. 1. Apparent molecular weight distribution of Amadorio and Pedrera reservoir water

RESULTS AND DISCUSSION

♦ FLUX REDUCTION

The decrease of flux reduction is major using PES 30 kDa and CR 30 kDa membrane than in the rest of membranes.

Membranes wihg low MWCO CR 10kDa and PES 5 kFa display a minimum drop in permeate flow-rate, below 10%.

Permeate flux reduction is higher in anionic membrane than cationic membrane, probably because of differences of matter composition [3] (hydrophobic and hydrophilic character).

For all membranes permeate flux reduction is higher in Pedrera's reservoir than in Amadorio reservoir due to de different compositio of organic matter (fig 1.)

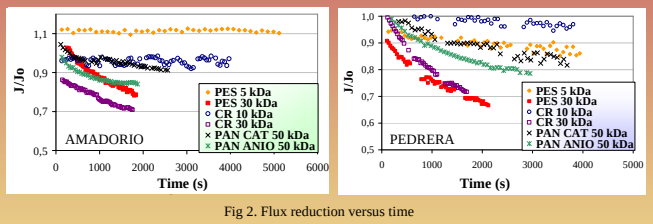

Fig 2. Flux reduction versus time

	Flux reduction (%)		DOC removal (%)	
Membrane	Amadorio	Pedrera	Amadorio	Pedrera
PAN cationic 50 kDa	9.6	13.9	69	41
PAN Anionic 50 kDa	15.5	21.2	53	33
CR 10 kDa	4.8	3.9	68	51
CR 30 kDa	28.8	28.0	64	62
PES 5 kDa	1.5	13.5	77	54
PES 30 kDa	20	32.5	71	65

Table 1 Flux reduction and DOC removal (%)

♦ DOC REMOVAL

DOC removal is greater in PES 5kDa (77-71%) and 30 kDa (76%-68%) Amadorio and Pedrera respectively

DOC removal decrease with the increase of MWCO

The efficiency of the removal of organic compounds are higher in PES membranes than in RC membranes due to the diferent hydrophobic and hydrophilic character of this membranes.

The lowest reduction of DOC take place using PAN anionic membrane due to the negative charge of the membrane and its high MWCO

DOC reduction in Amadorio reservoir is higher than in Pedrera reservoir, probably because Pedrera reservoir has higher conductivity and the different NOM composition

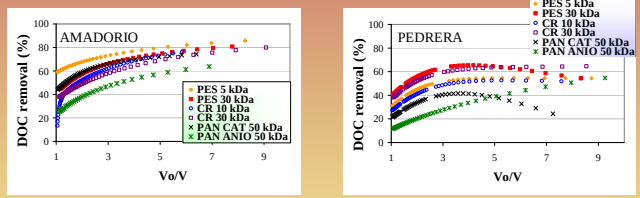

Figure 3. DOC removal versus Vo/V

♦ CONCLUSION

This study show, that the best remove of NOM in natural waters occurs using PES 30kDa (76%) membranes, although PES 5kDa has good reductions too.

The fouling is bigger in PES membranes than in RC membranes. Flux reduction in PES 30kDa is higher than 5 kDa

The reduction of NOM is higher in Amadorio than in Pedrera reservoir

In order to remove a major percentage of organic matter in natural waters it would suit to use membranes with a smaller pore size

♦ REFERENCES

[1] Cheng-Fang Lin, Tze-Yao Lin and Oliver J. Hao. Effects of humic substance characteristics on UF performance. Wat. Res. Vol 34, No4, pp. 1097-1106, (2000).
[2] Ministerio de la Presidencia. BOE 45. Real Decreto 140/2003 de 7 de febrero por el que se establecen los criterios sanitarios de la calidad del agua de consume humano. PP 7228-8469 (2003)
[3] Siddiqui M.; Amy, G. Ryan, J. and Odem, W. Membranes for the control of natural organic matter from surface waters. Water Research. Vol 34. Nº 13 (3355-3370), 2000.

♦ ACKNOWLEDGEMENT

This study was financial supported by the "Plan Nacional de I+D 2007-2010" of the Spanish Government (Ref. CTQ2007-66780 , Spain) and by a grant from the Joan Gil-Albert Foundation