EFFECT OF MOLECULAR WEIGTH CUTT-OFF, MATERIAL MEMBRANE, PH AND IONIC STRENGTH OVER THE REMOVAL OF NATURAL ORGANIC MATTER

I. Sentana, M. Rodríguez, D. Franco, P. Varo, E. Sentana, and D. Prats
Water and Environmental Science Institute. University of Alicante
P.O. Box 99. 03080 Alicante, Spain
Tel +34 965903400, ext 2920; Fax +34 965903826; e-mail: irene.sentana@ua.es

Scientific Topic: 2. Separation techniques: membrane separation, molecular separation

Natural organic matter in aquatic environments can forms carcinogenic organochlorine compounds when is chlorinated [1]. On the other hand, the lack of water in the southeast of Spain is the main reason for studying new forms of purification techniques optimisation. This optimisation will improve the use of natural waters.

The objective of this work is to study the removal of humic acids with a ultrafiltration system using polyethersulfone (5, 30 kDa MWCO) and cellulose regenerated (10, 30kDa) membranes, and study effects of conductivity and pH.

Commercial humic acid (sodium salt, Aldrich) were used as the feed water. A stock solution was prepared by dissolving 0.5 g humic acid in 1-L deionised water and filtering through 0.45 μm membrane filter. Humic acid solutions were prepared by diluting this stock solution in DI water until a concentration of 10 mg/L. The pH was adjusted by addition of buffer solution (pH 4-8 phosphate buffer 0.2 M; pH 2.5 H_3PO_4 0.2 M buffer) until a concentration of 25 mM. Conductivity was adjusted to 500-6000 μS by addition of KCl (0.1M). Dissolved Organic Carbon (DOC) was measured using a Shimadzu TOC-5000 analyser. UV absorbance was measured in a UV/VIS spectrophotometers (Shimadzu UV-1601) at the 254 nm wavelength and previously pH 7 was adjusted with addition of NaOH or HCl in the samples. Specific absorbance (SUVA)was calculated as the ratio of UVA to DOC.

Ultrafiltration disc membranes made of polyethersulfone (PES) 5 and 30 kDa and regenerate cellulose (RC) 10 and 30 kDa obtained from Amicon were used. All disc membranes had a diameter of 63.5mm. Membranes were first compacted permeating pure water at 4 bar during 8 hours. Ultrafiltration experiments were carried out in a stirred cell apparatus (Model 8200 Amicon Millipore). The stirred cell was initially filled with DI water adjusting pH and conductivity in every experiment. The water flux was measured as a function of time at a constant pressure (1 bar), until steady flux was achieve. Then, the stirred cell was emptied and refilled with a humic acid solution and the system was repressurized. The filtrate flow rate was measured with the filtrate mass using an analytical balance. Permeate samples were collected periodically for subsequent concentration analysis. At the end of the filtration experiment, the stirred cell was emptied and refilled with DI water at the same pH and conductivity as initial experiment. In all experiments the stirring speed was fixed to 200 rpm using a Micromix electronic stirrer. All experiments were carried out through the compacted membrane at 1bar, temperature 20ºC. Conductivity was adjusted between 500 to 6000 μS and pH was adjusted between 2.5 to 9.

The results show that the DOC removal decrease with the increase of conductivity for all membranes and MWCO. The DOC removal decrease and the flux declines further with the increase of MWCO. The flux declines further as the conductance increase for membranes PES 5kDa, 10kDa. There is no variation of the flux with the change of conductivity for membranes of RC. The efficiency of the removal of organic compounds are higher in PES membranes than in RC membranes. This efficiency is between 95-70% in PES, and this value decrease for RC (72-50%). The humic acid solution at pH 2.7 show the worst flux decline for membranes PES 5kDa and 30 kDa and RC 30 kDa. There is no flux variation for RC membrane of 5kDa with the variation of pH. Results are according with other authors [2].

BIBLIOGRAPHY

[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] Kimberly L. Jones, Charles R. O'Melia. Protein and humic acid adsorption onto hydrophilic membrane surfaces: effects of pH and ionic strength. Journal of Membrane Science 165 31-46, (2000).

ACKNOWLEDGEMENTS

This study was financial supported by the "Plan Nacional de I+D 2004-2007" of the Spanish Government (Ref. CTM2004-03056 , Spain) and by a grant from the Joan Gil-Albert Foundation.μ