Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 44 (2012) 1348 – 1350

Procedia Engineering

www.elsevier.com/locate/procedia

Euromembrane Conference 2012

[P2.073]

Cross-linked PSf membranes for SRNF application

I. Struzynska-Piron[1], J. Loccufier[2], L. Vanmaele[2], I. Vankelecom[1], S. Hermans*[1]

[1]KU Leuven, Belgium, [2]Agfa-Gevaert N.V., Belgium

Introduction

Polymeric membranes have found wide application in separation technology. However, because some of the most used polymers, such as polyimides and polyaryl sulfones are not sufficiently resistant to heat and harsh solvents, such as aprotic solvents, cross-linking procedures are required to enhance their stability.

Cross-linking membranes to apply them in SRNF has so far mainly been performed via wet chemistry [1, 2]. In this work however, the chemical cross-linking reaction will be initiated by UV-light. Polysulfon (PSf) was selected as base material.

Objectives

The aim of this research is to synthesise cross-linked PSf membranes resistant against polar aprotic solvents and with performance in the SRNF range.

Materials and Methods

The PSf membrane was synthesized by means of LIPS from a solution containing photo-crosslinkers. After solidification, the membrane was treated with UV-light in order to perform the cross-linking of PSf.

The cross-linked PSf membrane was examined by means of SEM (morphology), filtration experiment (permeability, retention) and immersion in various polar and non-polar solvents (stability).

Before filtration, all membranes were impregnated for 48h in a bath containing 40 % (v/v) of glycerol and 60 % (v/v) of IPA. Afterwards, the membranes were rinsed in distilled water for 48 h.

Filtration was performed using a HT device (HTML, Belgium). A solution of 17,5 µM of Bengal Rose (M_w = 1017 Da) in IPA was used as feed. Separation was carried out under various pressures. The concentration of the Bengal Rose in IPA was determined by means of UV-Vis spectroscopy at λ=555 nm.

Results

The cross-linked PSf membrane had a sponge structure with thin selective skin layer (Figure 1).

By increasing the solvent/co-solvent (DMF/THF) ratio, an increased permeability was observed, while the retention remained almost constant (Figure 2).

Prepared cross-linked PSf membrane showed quite good resistance in a wide range of polar and non-polar solvents. Only strong aprotic polar solvents (NMP, THF) and some solvents such as cyclohexanone, chlorobenzeneand triethylphosphate caused some limited swelling of the membrane (Table 1).

doi:10.1016/j.proeng.2012.08.781

a) b)

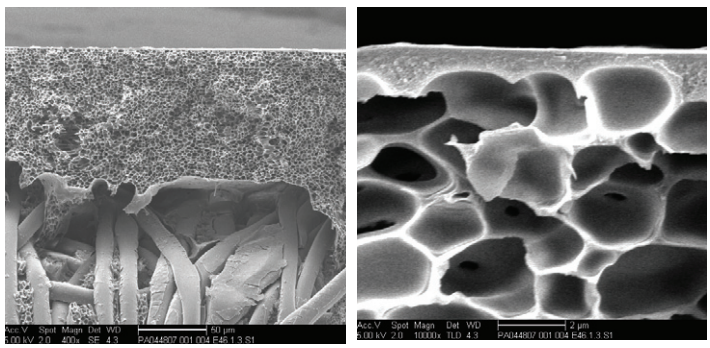

Figure 1. Cross-linked PSf membrane: a) cross-section, b) close-up of skin layer.

a) b)

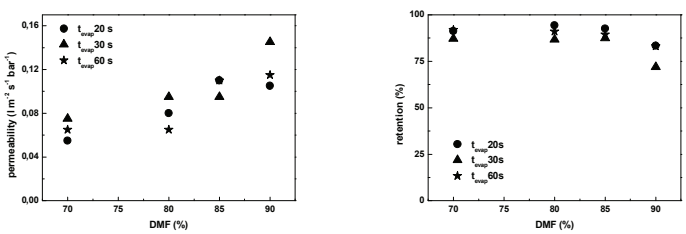

Figure 2. Effect of solvent/co-solvent ratio on membrane performance: a) permeability and b) retention.

Table 1. Solvent resistance of the cross-linked PSf membrane.

Solvent	Nascent PSf membrane	Cross-linked PSf membrane
Acetone, ethylacetate	Swelling	Stable
THF, NMP	Dissolving	Some swelling
Toluene, xylenes	Dissolving	Stable
Chlorobenzene, cyclohexanone, triethylphosphate	Dissolving	Some swelling

Conclusions

Solvent stable PSf membrane with retentions in the SRNF-range were successfully prepared, characterised and tested.

Acknowledgment

The authors would like to thank Agfa-Gevaert N.V. for financial support.

References

[1] Y.H. See Toh, F.W. Lim, A.G. Livingston, Polymeric membranes for nanofiltration in polar aprotic solvents, J. Membrane Science 301 (2007) 3-10

[2] K. Vanherck, P. Vandezande, S.O. Aldea, I.F.J. Vankelecom, Cross-linked polyimide membranes for solvent resistant nanofiltration in aprotic solvents, J. Membrane Science 320 (2008) 468-476

Keywords: cross-linking, polysulfone, organic solvent nanofiltration