Polyelectrolyte Multilayer Thin Film Composite Nanofiltration Membrane for Ion Separation

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Introduction

Nanofiltration (NF) membrane faces problems with fouling in particular, biofouling. This problem is due to mainly membrane material which is polyamide and the fabrication technique. One of the solution of this problem is using hydrophilic material prepared using a method called Layer-by-Layer (LbL) assembly. LbL assembly produces a thin film by depositing alternating layers of oppositely charged materials on a support. This method can be done by using different techniques such as immersion (dip), spray, spin. One of the work that has been used to produce NF using dip LbL was done by Seong Uk Hong *et al* in 2006. The best case was deposition of $(PSS/PDADMAC)_3$ PSS depositing on porous alumina support. This case give a rejection of SO_4^{2-} 95.6 % and Cl^- / SO_4^{2-} selectivity 26.4 and a solution flux 2.7 (m^3/m^2 day).

PDADMAC : Poly (diallyl dimethyl ammonium chloride) solution
PSS: Poly- sodium 4-styrene sulfonate
PES : Poly Ether Sulfone

Results

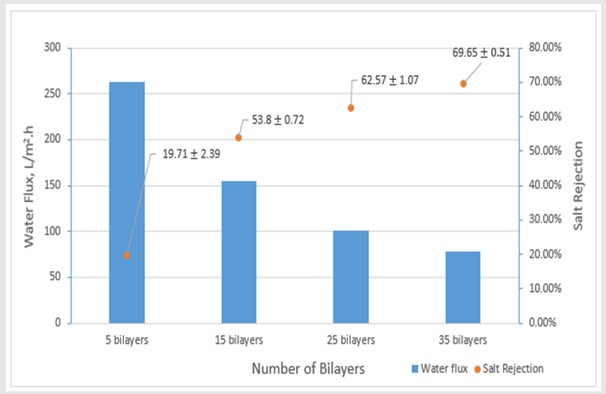

Figure 1: Effect of no. of bilayer on the Permeation Performance (Membrane was tested at 10 bar using 1000 ppm $MgCl_2$)

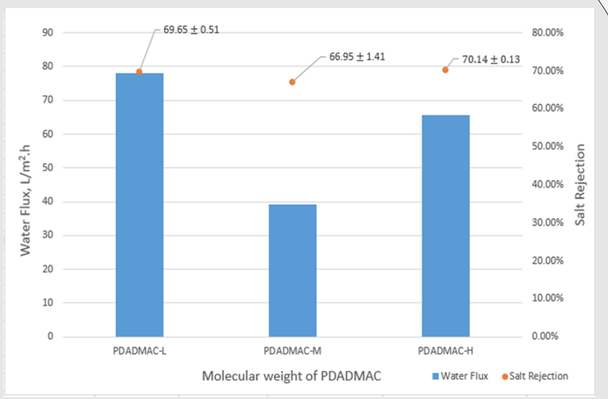

Figure 2: Effect of Molecular weight on the Permeation Performance (Membrane was tested at 10 bar using 1000 ppm $MgCl_2$)

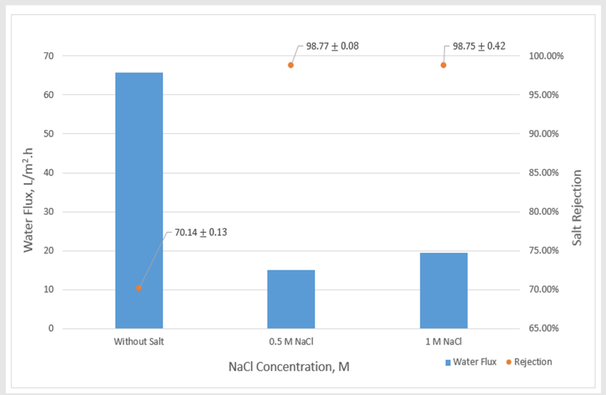

Figure 3: Effect of Adding salt on the Permeation Performance (Membrane was tested at 10 bar using 1000 ppm $MgCl_2$)

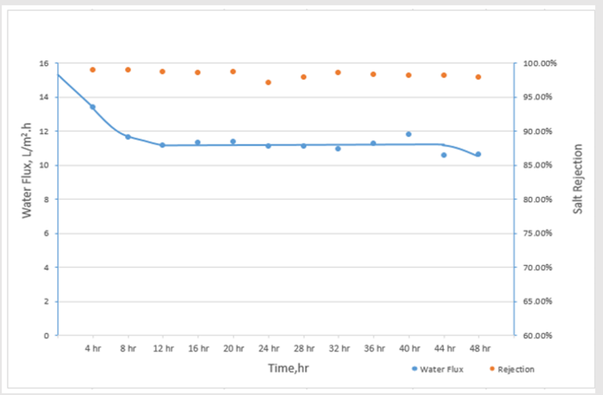

Figure 4: Effect of Adding Foulant on the Permeation Performance (Membrane was tested at 10 bar using 1000 ppm $MgCl_2$)

Conclusion

Thin film polyelectrolyte membrane has been fabricated and tested for evaluating their performance in terms of flux and rejection. The membrane is fabricated using spin assisted LbL assembly.

The flux decreases as the number of bilayer increases because the increase of film thickness. Similarly, this result high rejection due to the decrease of permeability of salt.

The salt rejection increases with addition of salt to the polyions solutions. This is because the film thickness is increase with increasing salt concentration.

Experimental results show that our membranes have a little effect on flux when we add the Foulant and this indicates that our membrane has good resistance to Foulant.

Methodology

Spin assisted LbL assembly was used to fabricate thin film composite NF membrane. The material used in our work is as follows PDADMAC (polycation) with three different molecular weight (low, medium and high), PSS (polyanion) and PES (support). The membrane was tested by using CF016 (innovator) permeation test cell from Sterlitech.

Acknowledgment

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References

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