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# Ionic complexing induced fabrication of highly permeable and selective polyacrylic acid complexed poly (arylene ether sulfone) nanofiltration membranes for water purification

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## Abstract

Ionic complexing induced phase inversion in an aqueous polyacrylic acid (PAA) coagulation bath was studied for fabricating highly permeable and selective nanofiltration (NF) membranes. To obtain membranes using classical liquid-liquid phase inversion, poly (arylene ether sulfone) with tertiary amine groups (PES-TA)/ N, N-dimethylformamide /tetrahydrofuran was used as the polymer dope solution. The polycationic character of PES-TA allows ionic complexation with the carboxylic acid groups of PAA. The complexing reaction at the interface of the two liquids was shown to affect the rate of phase inversion, the morphology of membranes in the phase inversion process, and enhance membrane performance. At optimized conditions, the pure water flux of the PES-TA-PAA NF membrane was  $26.1 \text{ L m}^{-2} \text{ h}^{-1}$ , 2.6 times greater than unmodified PES-TA membrane ( $10.7 \text{ L m}^{-2} \text{ h}^{-1}$ ). The rejection of salts and dyes of PES-TA-PAA membrane improved compared with PES-TA membrane and the rejection to  $\text{MgCl}_2$ ,  $\text{MgSO}_4$  and  $\text{Na}_2\text{SO}_4$  were measured above 93%. The PES-TA-PAA NF membrane was shown to have stable performance in the pH range from 1 to 9 and maintain stable NF performance 100 hours of filtration.

Keywords: polyacrylic acid; ionic complexing; nanofiltration membranes; water purification.

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