# Development of polymeric ionic poly(VBC-co-VI) nanoparticle incorporated thin film nanocomposite membranes for dye and salt rejection

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## Supplementary information

**Molecular weight cut off study:**

In order to determine the molecular weight cut off (MWCO) of the fabricated TFN-2 membrane, 1000 ppm PEG solutions of PEG 200, 400, 600 and 1000 Da were prepared. These solutions were filtered through the TFN-2 membrane at 4 bar pressure after the membranes had undergone compaction at 5 bar pressure. The permeate was collected and the analysis was carried using UV spectrometer. The calibration curve for each PEG solution was plotted by using aliquots of 200, 400, 600 and 800 ppm. The UV analysis of the samples was carried out after complexing them with a 10 mM solution of iodine [1]. From the calibration curves the rejection of each PEG was calculated and the data was plotted in order to determine the MWCO. The Stokes radius ($r_s$) of the PEG molecular weight (MW) which lies at the 90% threshold was calculated using equation (i)

$$r_s = 16.73 \times MW^{0.557} \times 10^{-12} \quad \text{(i)}$$

The MWCO study revealed that molecules having a molecular weight greater than 892 Da were rejected as shown in Figure S1. The Stokes radius was calculated to be 0.74 nm. The Stokes radius for RB5 and SY FCF is 0.78 and 0.50 nm respectively. Hence both sieving and size exclusion mechanism could explain the rejection of the dyes. Since the TFN-2 membrane showed good rejection of $Na^+$ and $Mg^{2+}$ which have Stokes radius of 0.184 and 0.341 nm [2], it

is possible that the electrostatic interactions played a significant role in the rejection of the salts instead of size based exclusion.

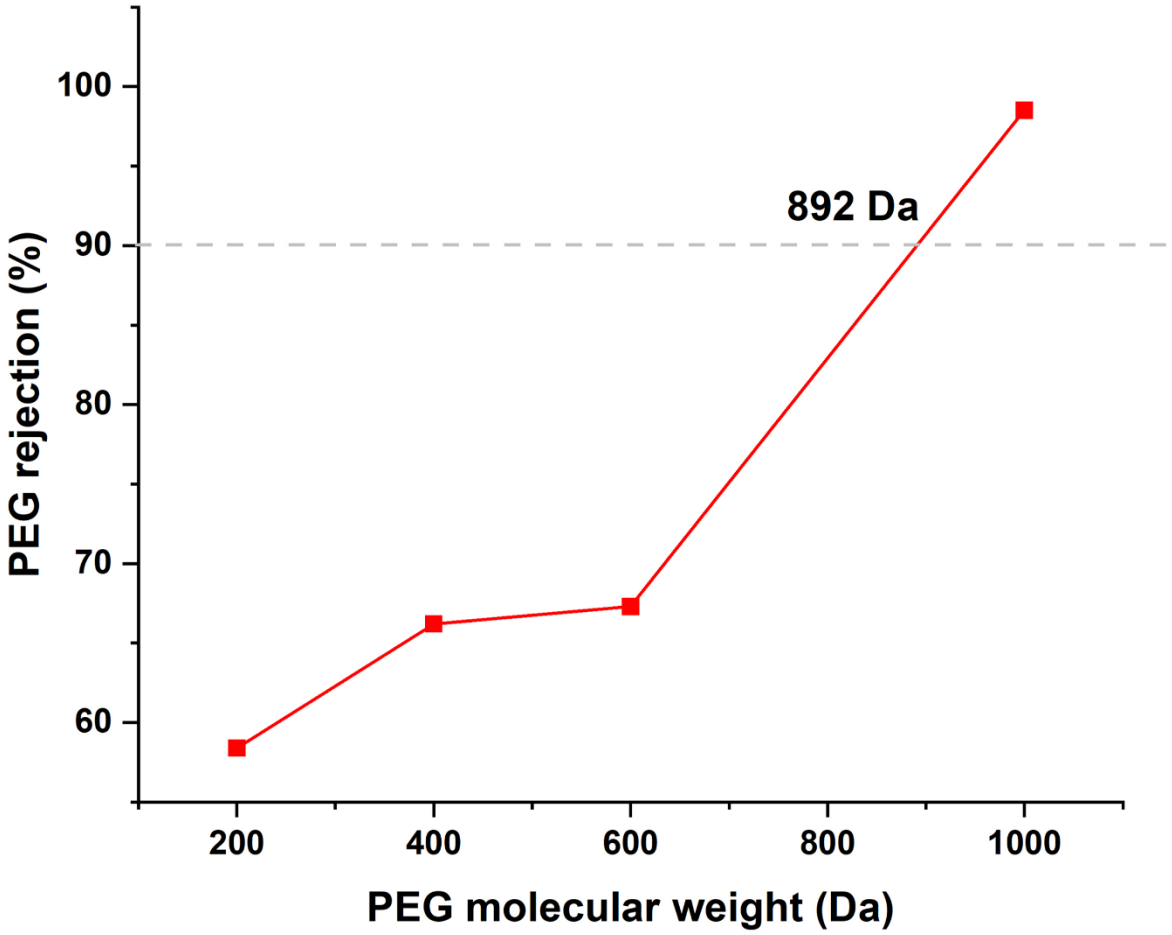


Figure S1: Graph displaying MWCO of TFN-2 membrane

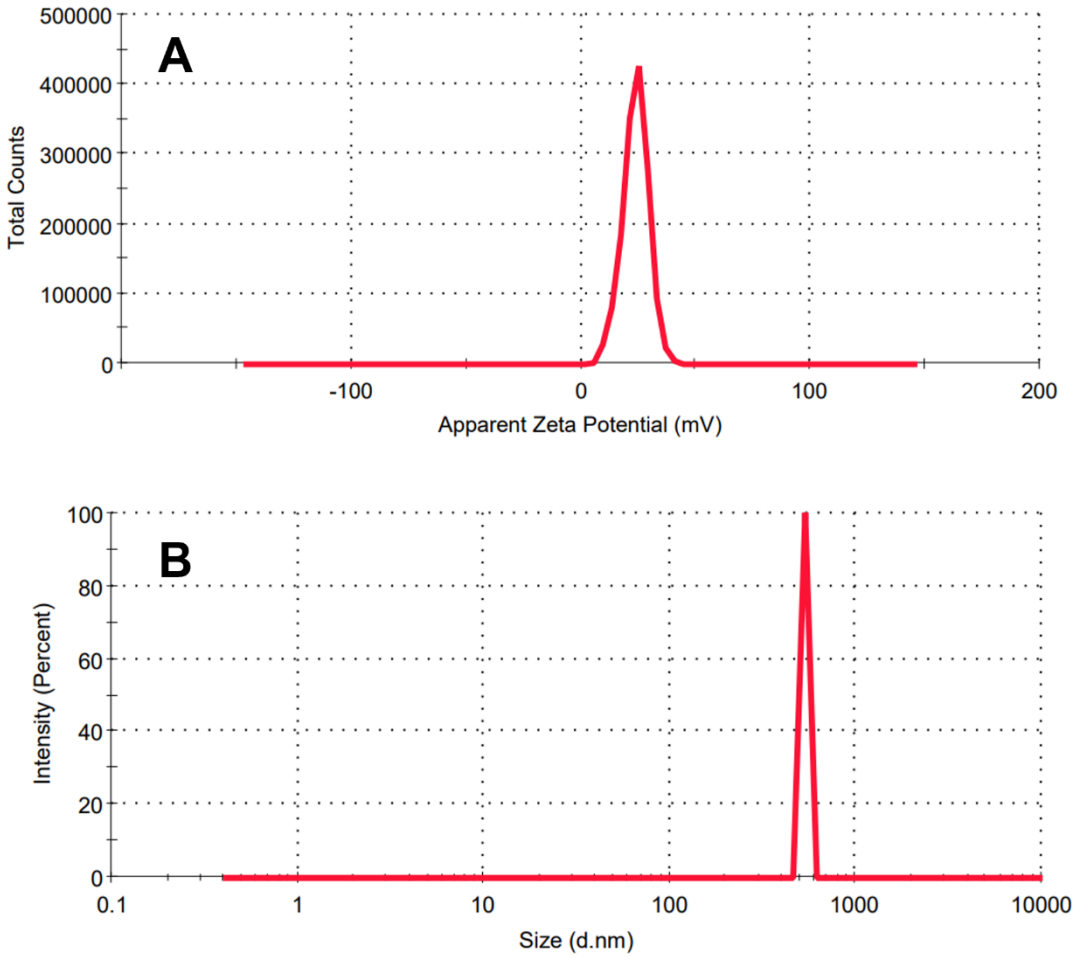


Figure S2: A. Zeta potential and B. Particle size of poly(VBC-co-VI) nanoparticles

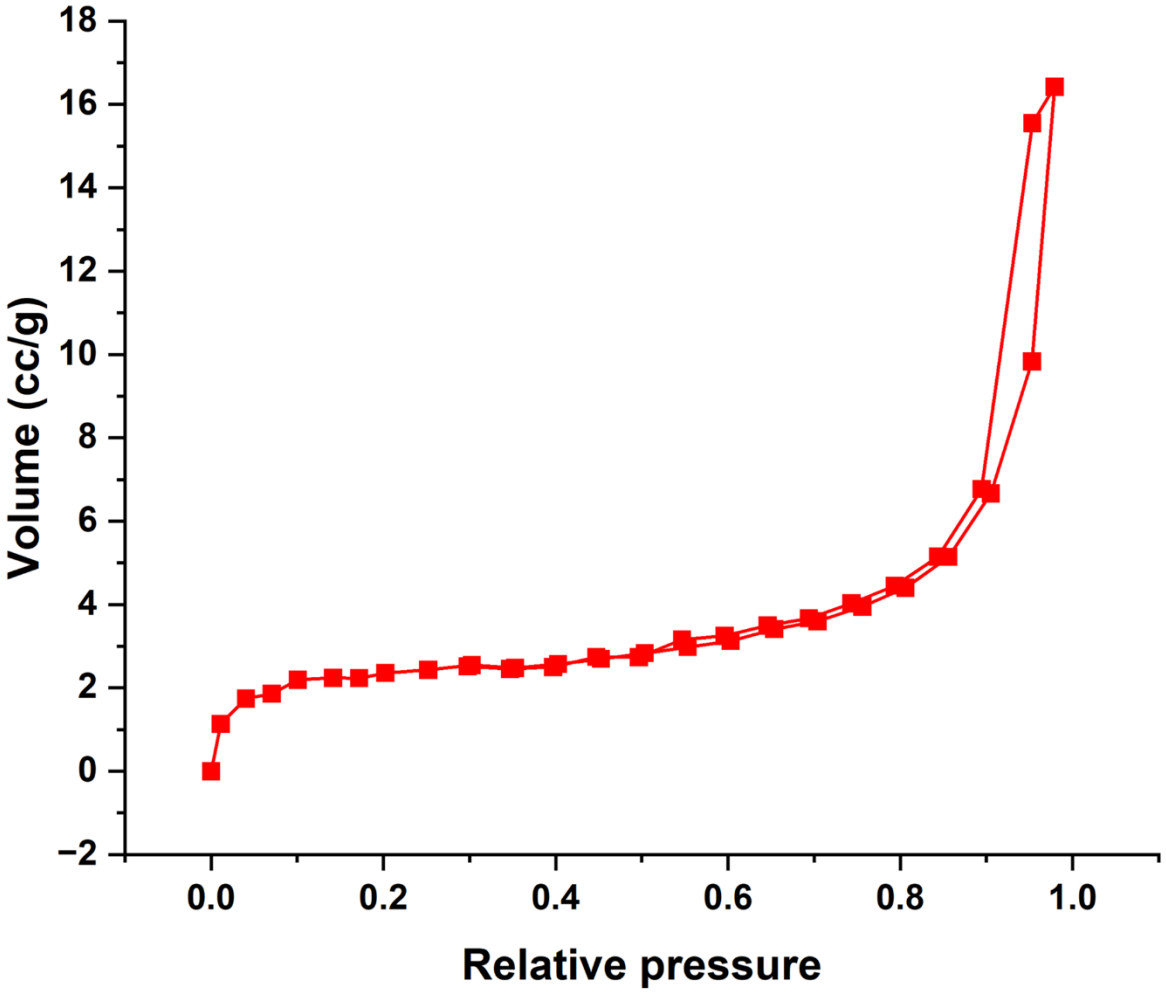


Figure S3: BET hysteresis loop of poly(VBC-co-VI)

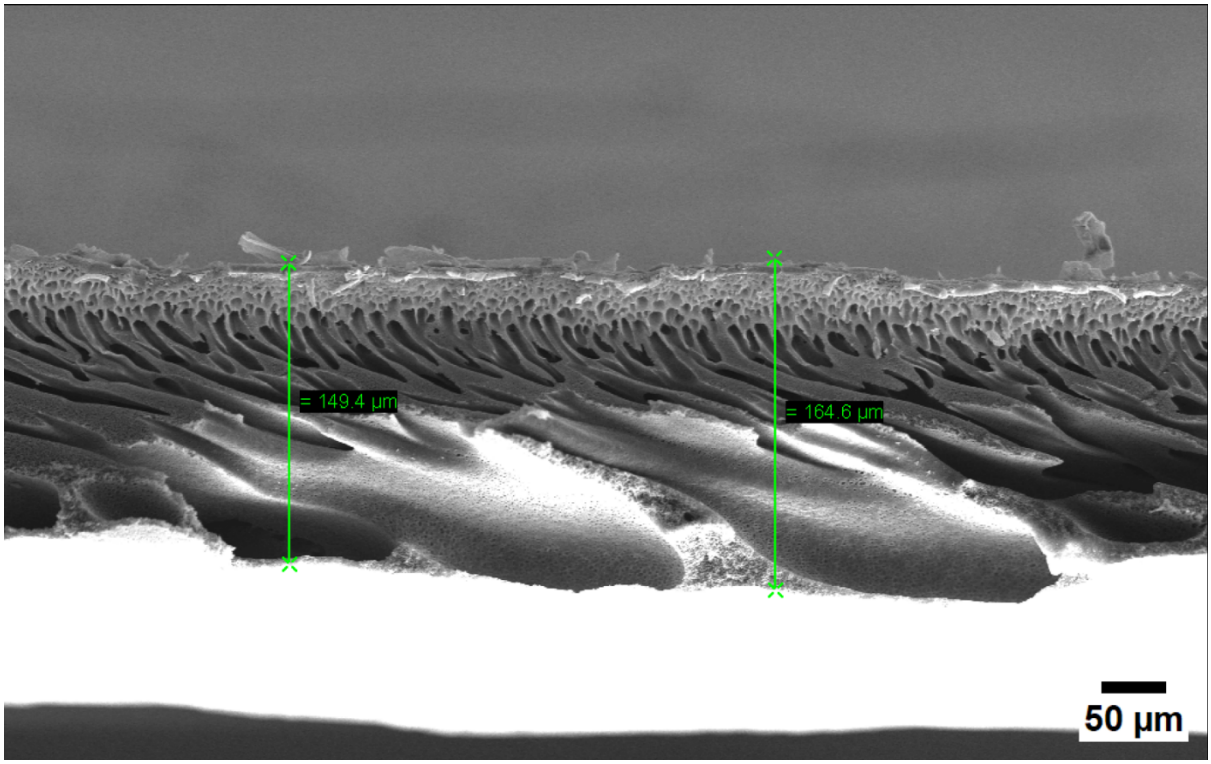


Figure S4: Cross section SEM image of TFC membrane showing the macroporous PSf support and the dense PA layer

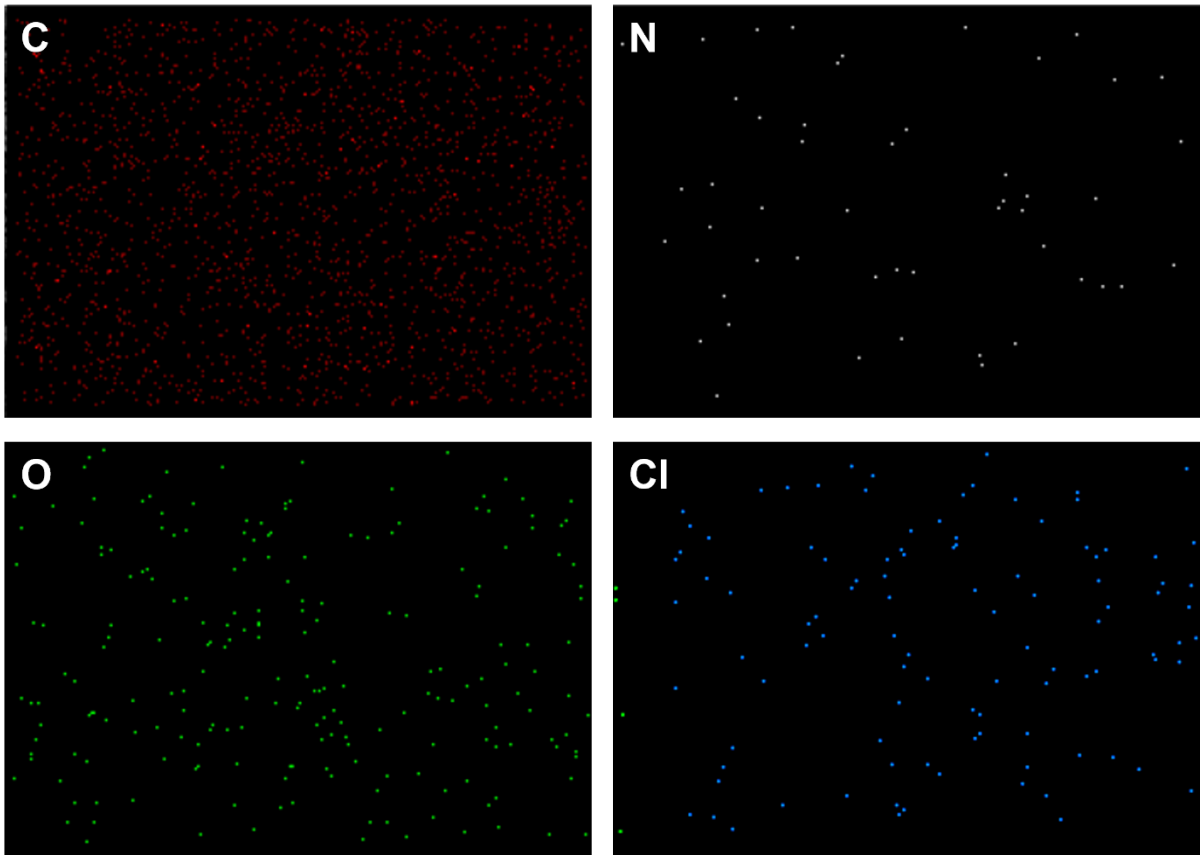


Figure S5: EDS mapping images of TFN-2

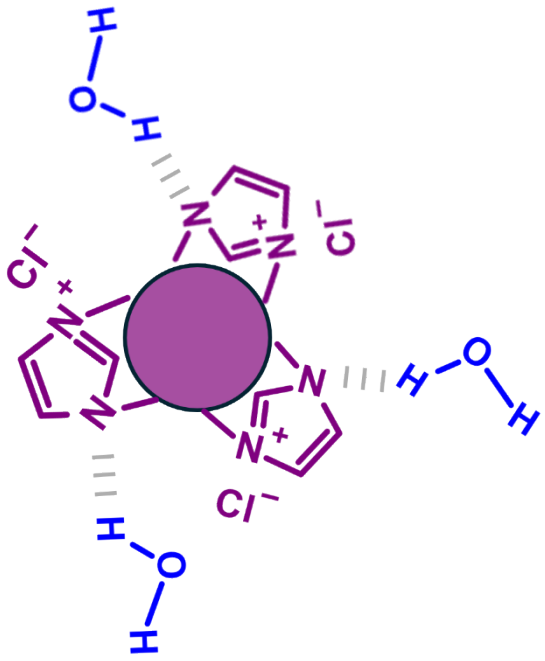

Figure S6: Schematic representation of the mechanism of adsorption of water on the nanoparticle

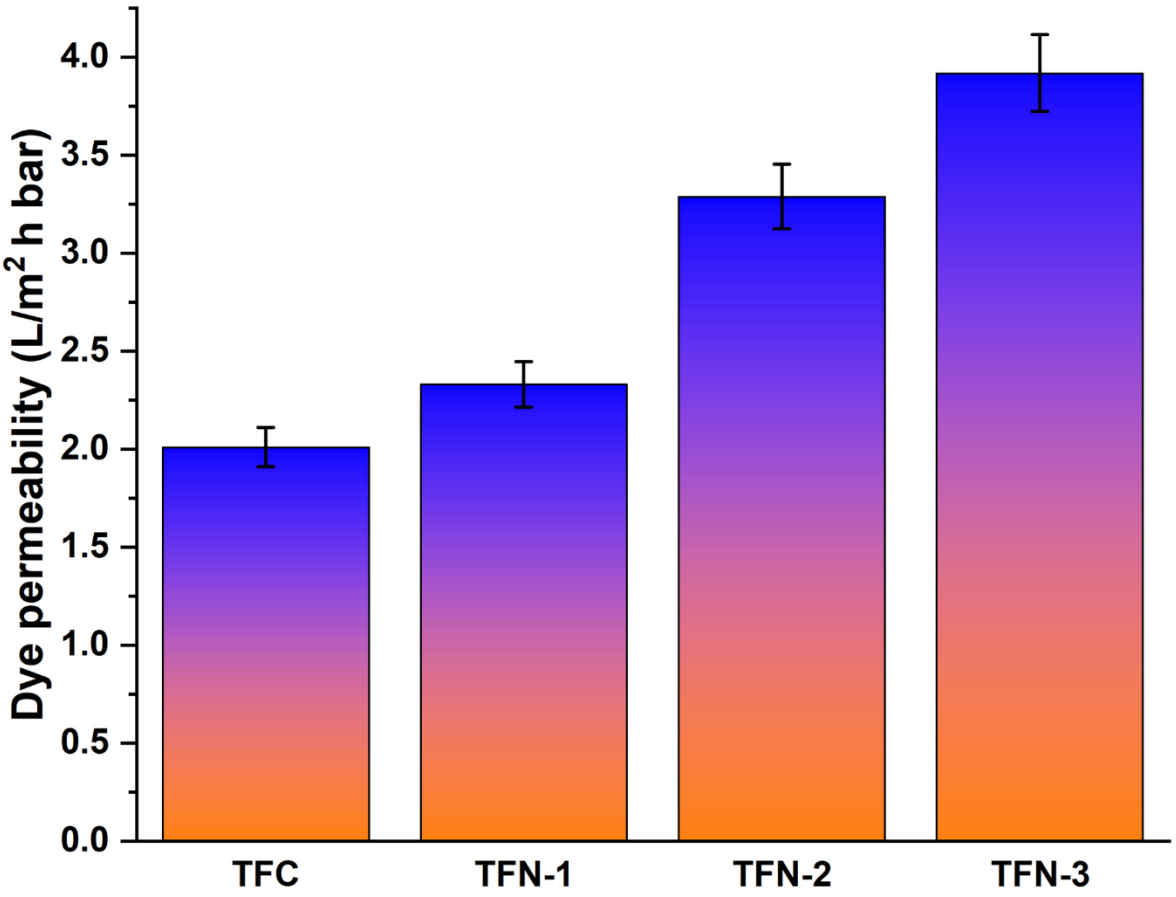


Figure S7: Graph showing the dye permeability of the fabricated membranes

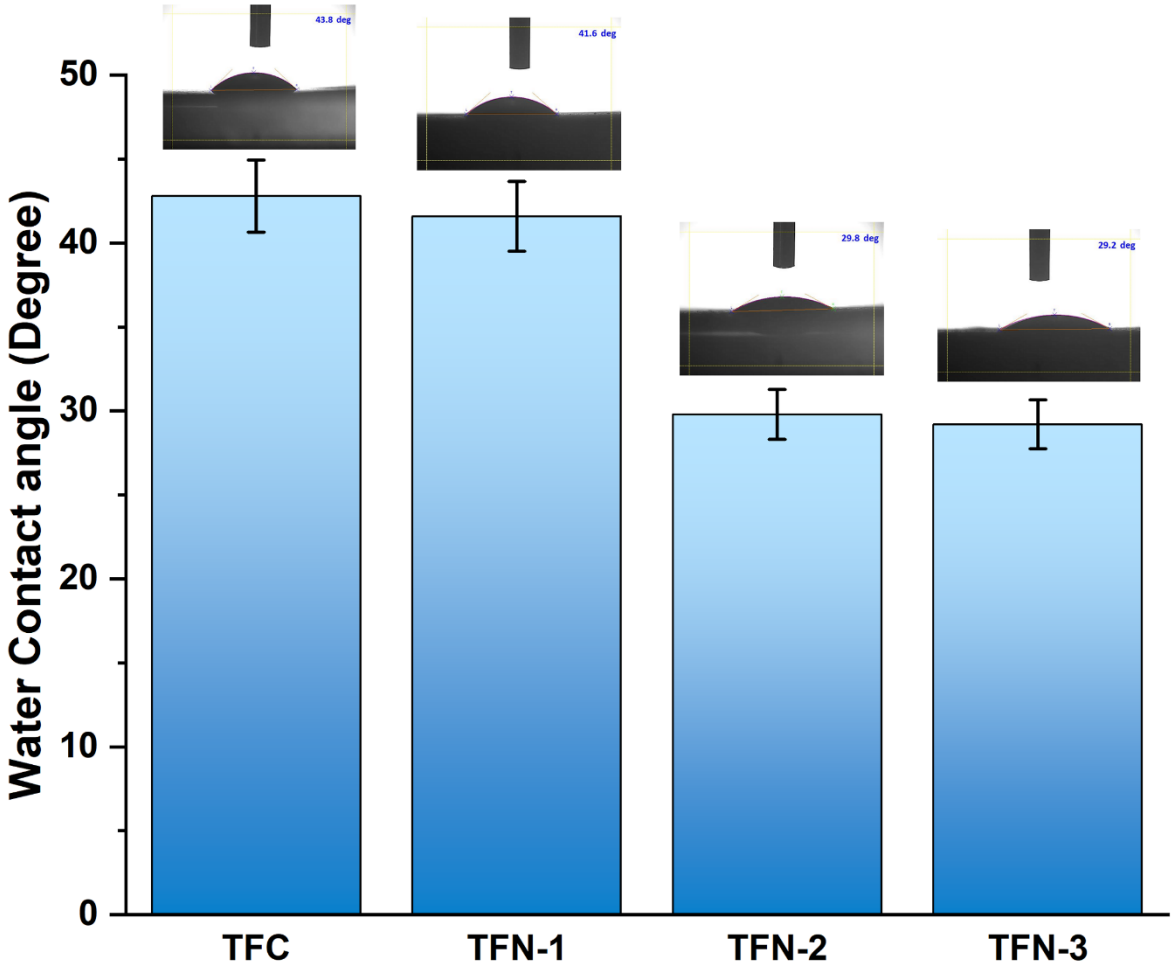


Figure S8: Graph displaying the water contact angle of the fabricated membranes

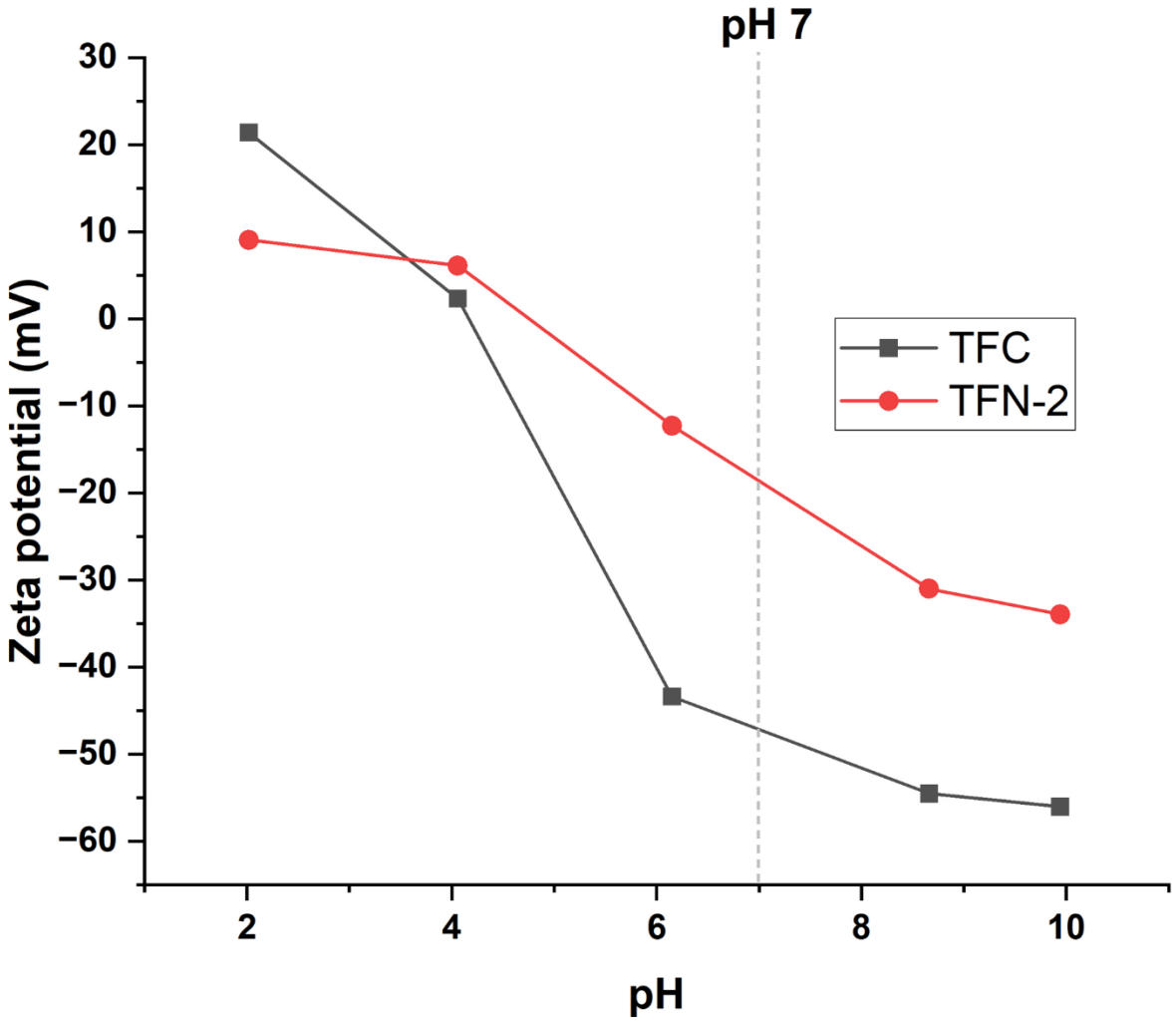


Figure S9: Graph displaying the zeta potential of TFC and TFN-2 membrane from pH 2 to pH10

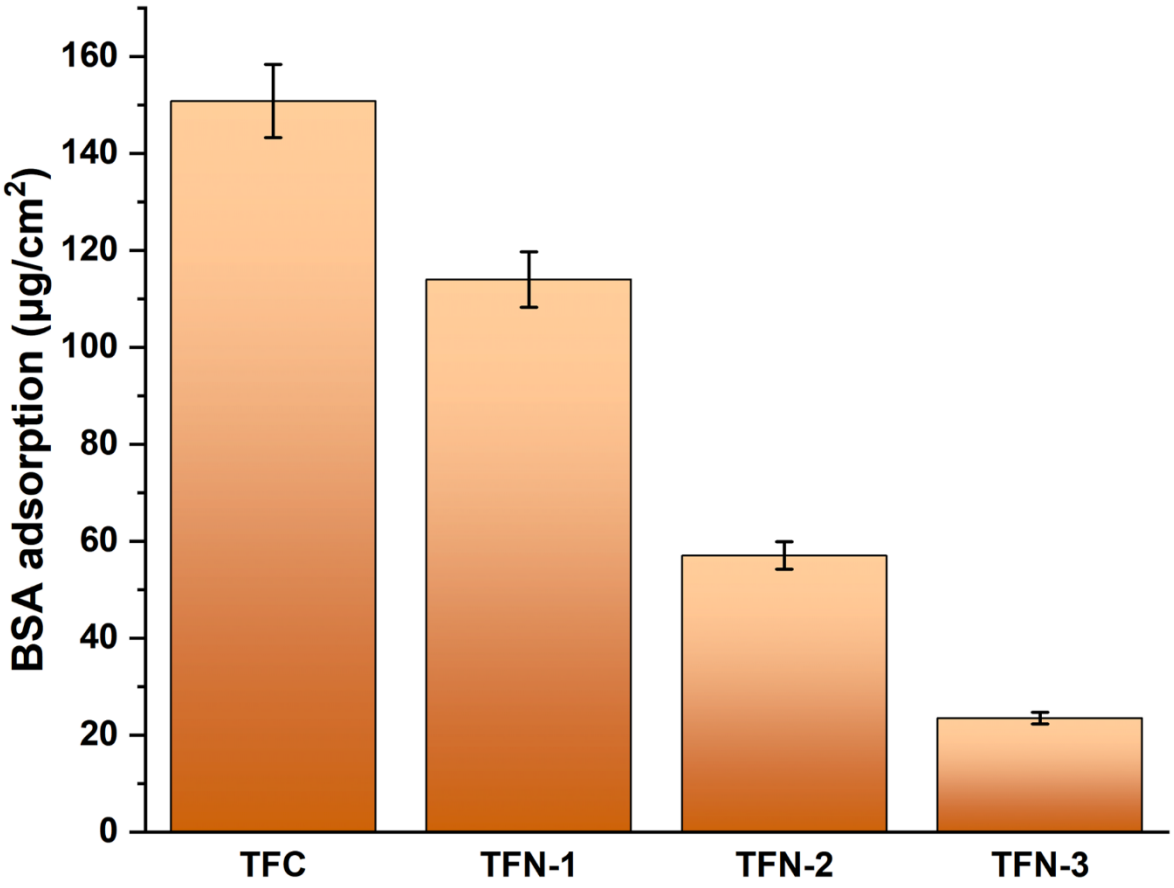


Figure S10: Graph displaying the BSA adsorption of the membranes

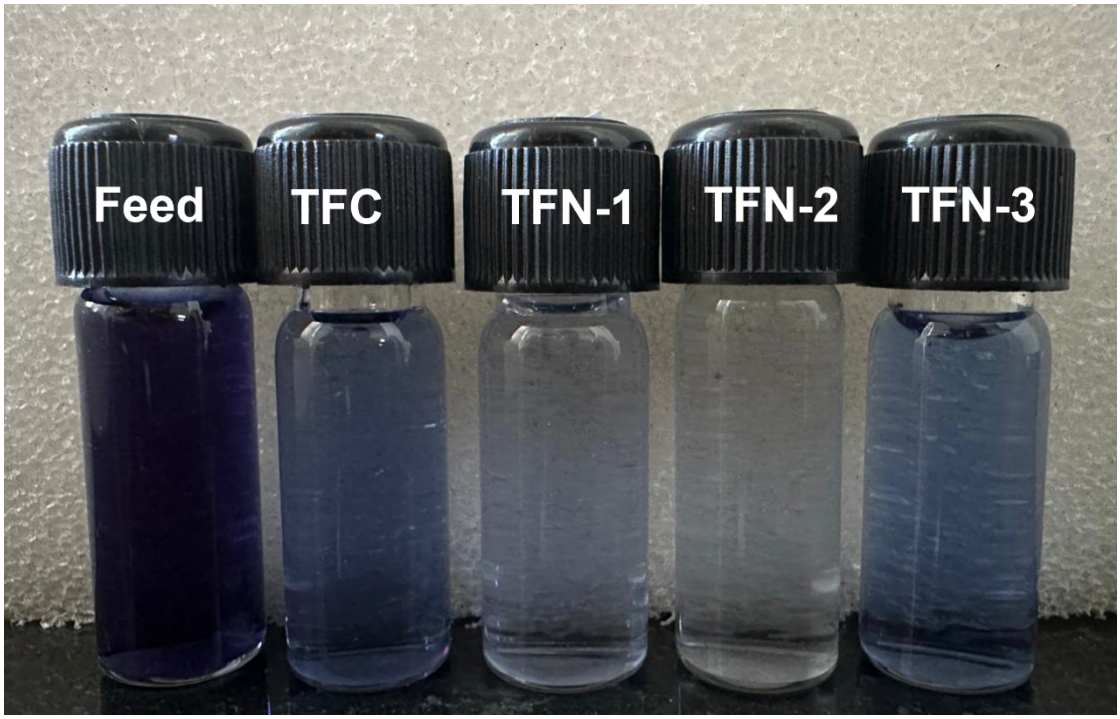


Figure S11: Visual representation of the rejection of 100 ppm RB5 by the fabricated membranes

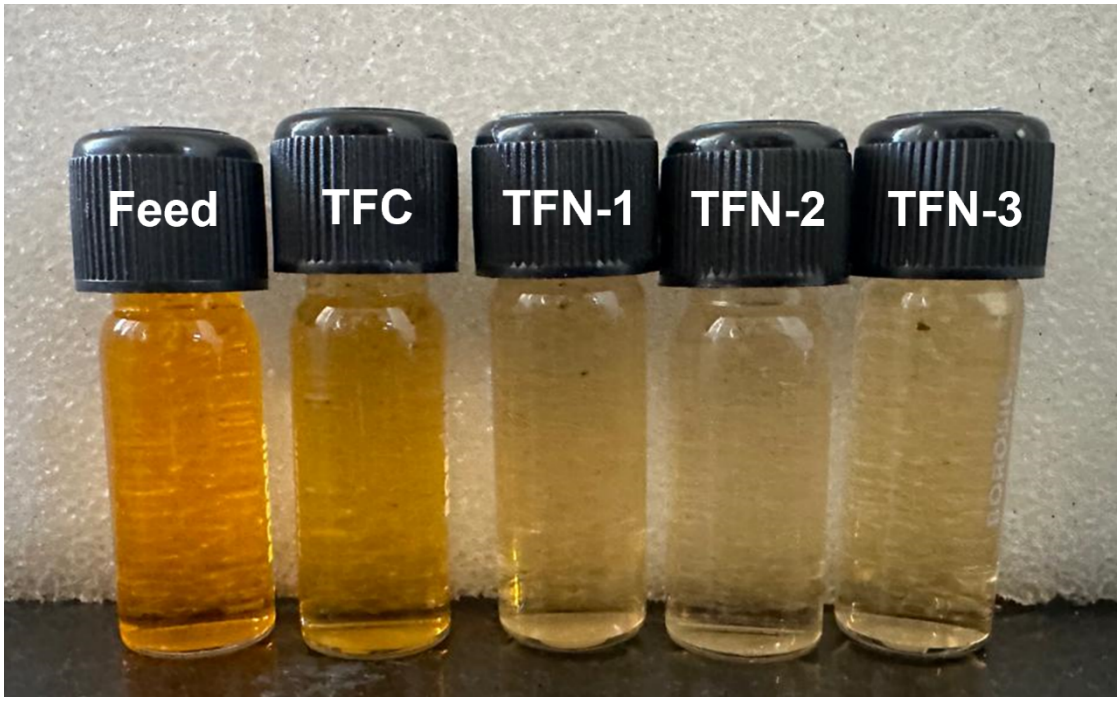


Figure S12: Visual representation of the rejection of 100 ppm RO16 by the fabricated membranes

## References


1 I. I. Yusoff and R. Rohani, Molecular weight cut-off determination of pressure filtration membranes via colorimetric detection method MOLECULAR WEIGHT CUT-OFF DETERMINATION OF PRESSURE ( Penentuan Berat Sekatan Molekul Bagi Membran Penurasan TekananMelalui Kaedah, , DOI:10.17576/mjas-2017-2102-24.

2 A. A. Hussain and M. E. E. Abasharo, Effect of Ion Sizes on Separation Characteristics of N anofiltration, *J. King Saud Univ. Eng. Sci.*, 2006, **19**, 1–18.