PREPARATION OF POLYSULFONE BASED PANI-TiO_2 NANOCOMPOSITE HOLLOW FIBER MEMBRANES FOR INDUSTRIAL DYE REJECTION APPLICATION

Supporting Information

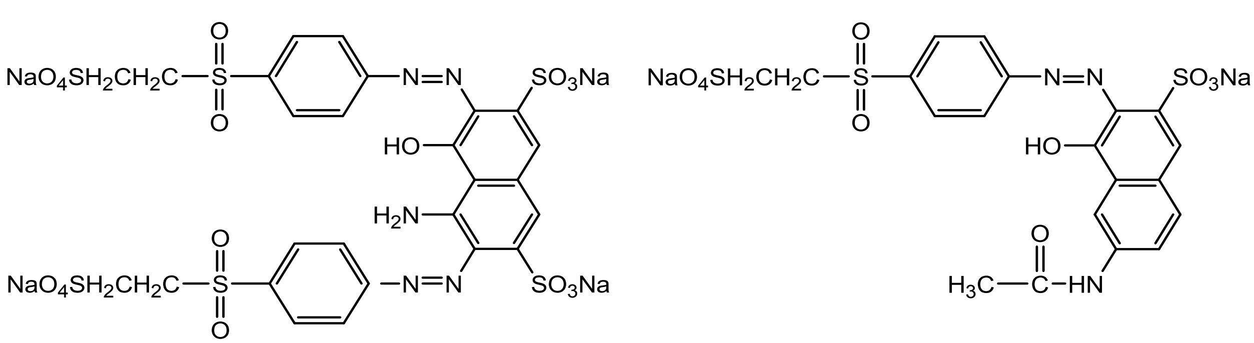
S1 Spinning conditions for hollow fiber membranes

Dope composition	PSf/PANI-TiO_2/NMP PSf/NMP (For Neat)
Dope Extrusion Rate (DER)	5 mL/min
Bore fluid	Distilled water
Bore Extrusion Rate (BER)	5/4 mL/min
Air gap	5 cm and 10 cm
Spinneret Dimension (o.d/i.d)	1.15/0.55 (mm)

S2 Viscosity of dope solutions

Dope solutions of	Viscosity (mPas)
P-A, P-B	1661.9
P-0.5-A, P-0.5-B	1752.4
P-1.0-A, P-1.0-B	1876.5

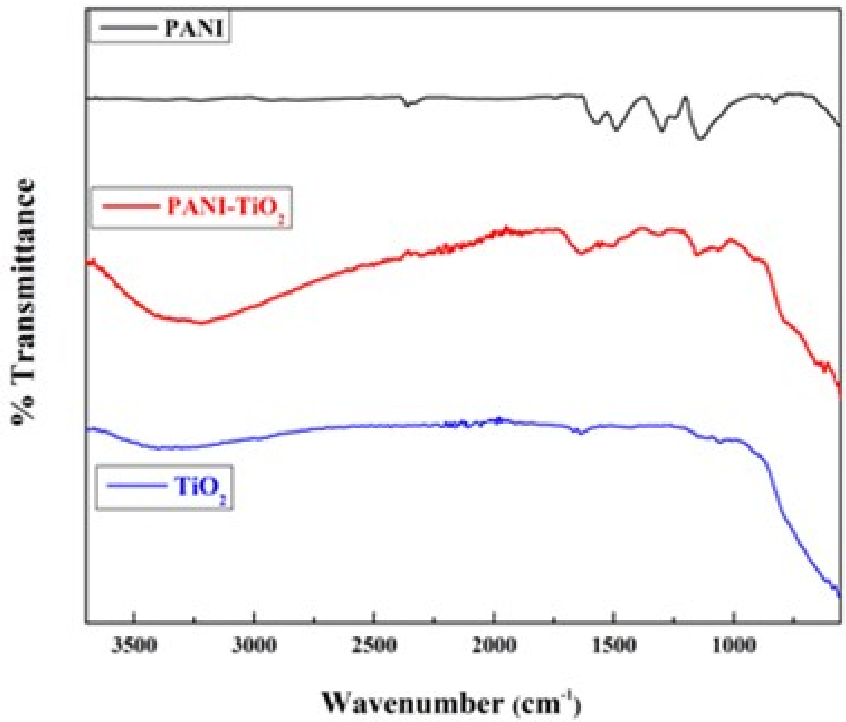
S3



Reactive Black 5 **Reactive Orange 16**

Structures of Reactive Black 5 and Reactive Orange 16

S4

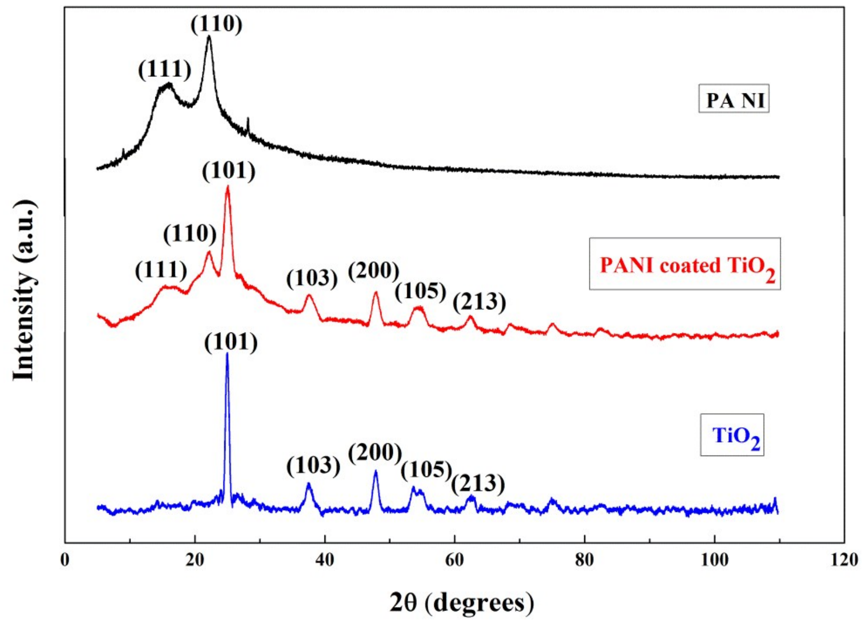


FTIR spectra of PANI, PANI–TiO_2 and TiO_2

A broad peak observed around 3400 cm^{-1} in TiO_2, which can be ascribed to the stretching vibration of –OH group and a minor peak at 1638 cm^{-1} is attributed to the adsorbed water on TiO_2.[1] Broad peak range of 1000 to 550 cm^{-1} can be ascribed to the Ti-O-Ti bonds.

Pure PANI exhibits peaks at 1567 cm^{-1} and 1487 cm^{-1}. These are attributed to the C=N and C=C stretching vibrations of quinoid and benzenoid rings of PANI respectively. The C-N stretching mode of benzenoid ring gave peaks at 1298 cm^{-1} and 1246 cm^{-1}. Further peaks observed at 1141 cm^{-1} and 812 cm^{-1} can be attributed to the C-H in plane and out of plane bending vibrations respectively.[2] The peaks present in pure PANI and pure TiO_2 were also observed in PANI-TiO_2 nanocomposite as shown in the above figure.

S5



X-Ray Diffraction patterns of pure PANI, PANI coated TiO_2 and pure TiO_2

Two broad peaks at 2θ=17° and 23° correspond to the (111) and (110) planes in PANI. Pure TiO_2 exhibits sharp peaks at 25.3°, 37.8°, 48.1°, 54.6° and 62.6° with respect to the planes (101), (103), (200), (105) and (213) of anatase phase of TiO_2 [3,4]. The PANI-TiO_2 nanocomposite exhibited the peaks at 17° and 23° due to PANI, also including all the peaks of TiO_2, confirming the presence of PANI coating on TiO_2 nanotubes.

S6

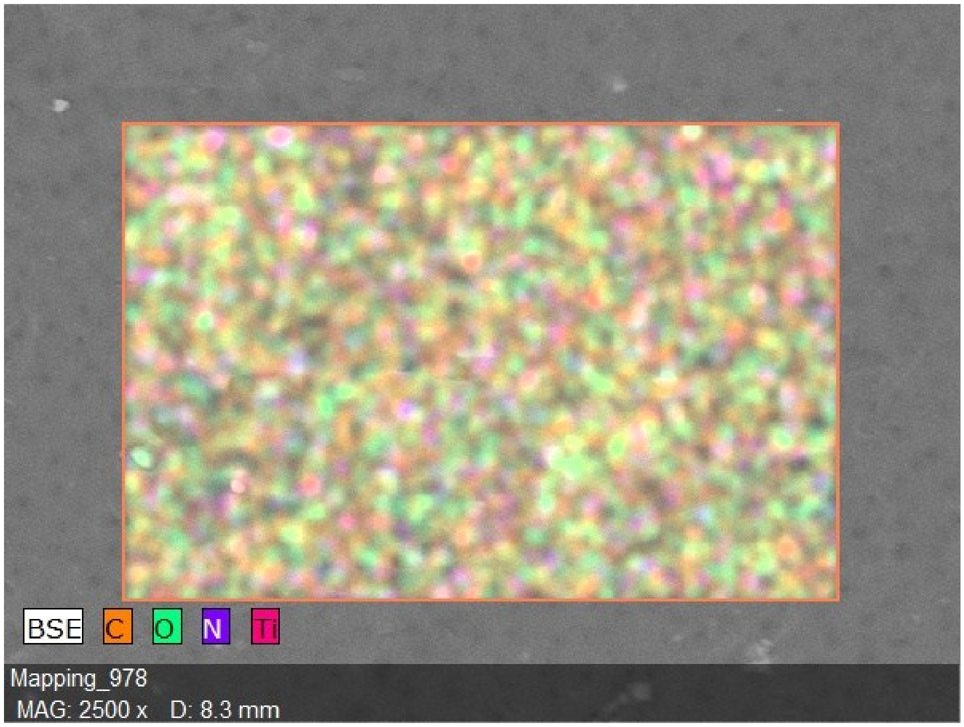
Comparison with the reported data

Literature	Work	For membranes containing 1.0 wt.% of PANI-TiO_2					Reference
		% FRR	BSA Rejection	Pore size (nm)	Contact Angle (degrees)	Application	
Pereira et al.	PSf flat sheet membranes containing PANI coated TiO_2 nanotubes with PEG as pore former	83%	Not Applicable	10.72	64.0	Potentially toxic metal ion rejection for metal ions Cd^{2+} and Pb^{2+}	5
Teli et al.	PSf flat sheet membranes containg PANI coated TiO_2 nanoparticles	79%	95-99%	8.11	52.0	Not Applicable	6
Current work	PSf hollow fiber membranes containing PANI coated TiO_2 nanotubes	90.03%	99.9%	1.88	72.8	Rejection study of Reactive Black-5 and Reactive Orange-16	

Comparison of Pure Water Flux of membranes with reported literature

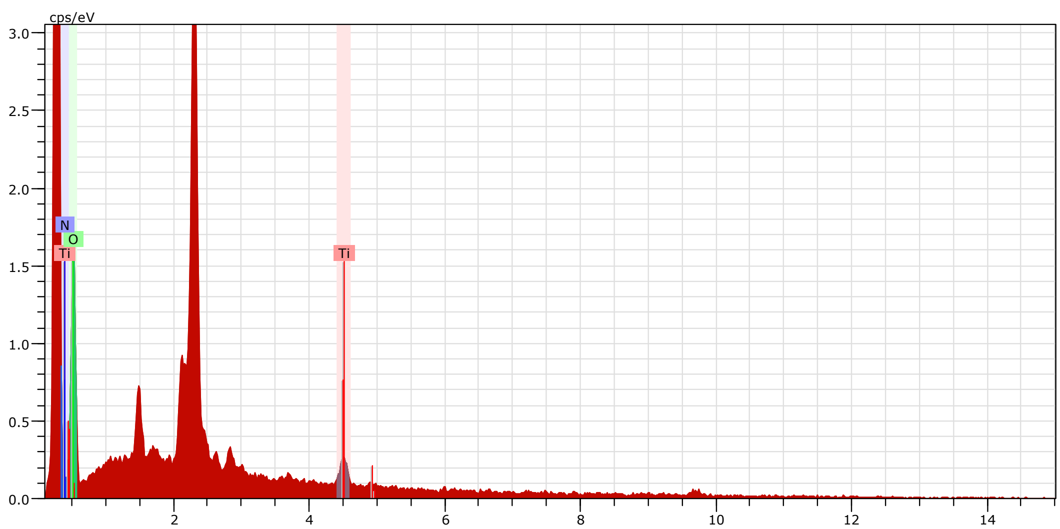
PANI-TiO_2 composition	Pure water flux in $L/m^2/h$ at 0.2 MPa		
	Pereira et al.	Teli et al.	Current work
Neat PSf	18.69	72	65.12
0.5 Wt.%	20.56	-	49.82
1.0 wt.%	65.76	170	27.48

S7



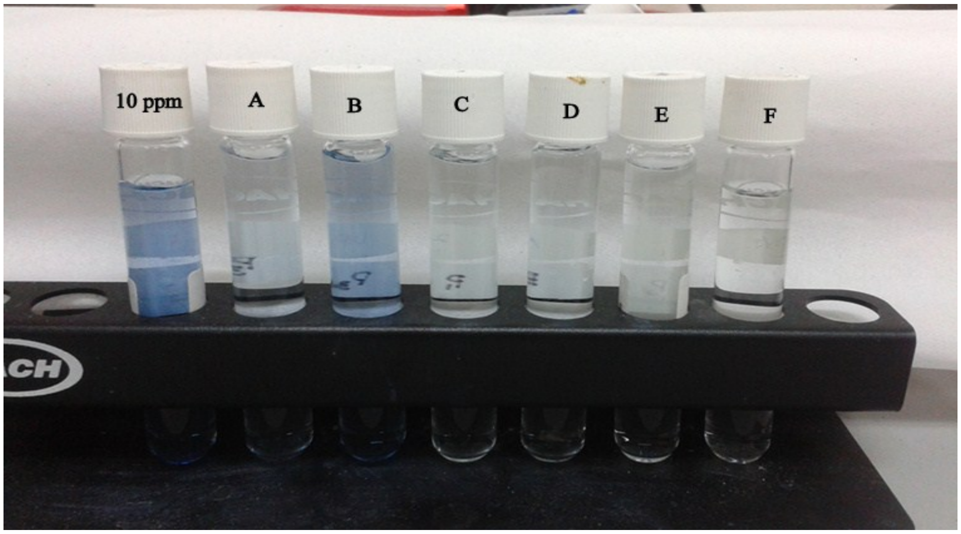
Elemental mapping on P-0.5-A membrane showing uniform distribution of titania

S8

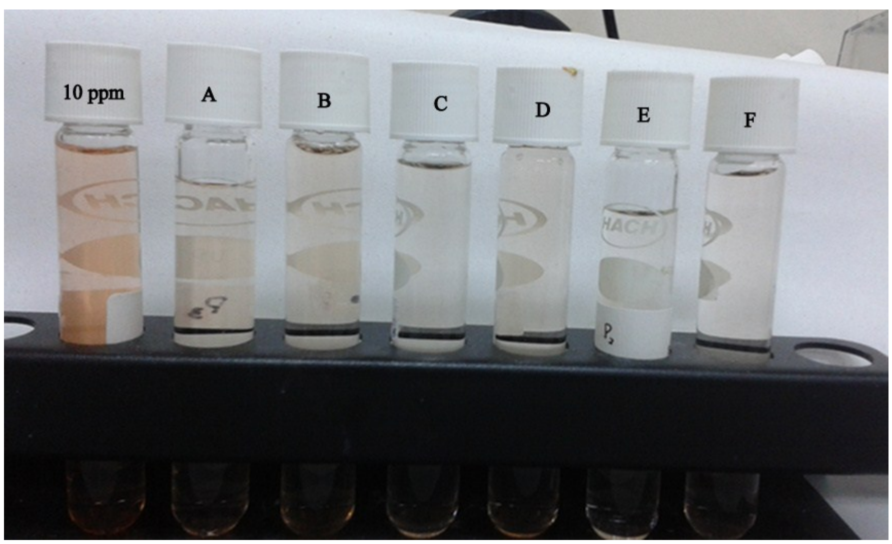


EDX of P-1.0-B membrane

S9



Images showing rejection of Reactive Black 5 by membranes A) P-A B) P-B C) P-0.5-A D) P-0.5-B E) P-1.0-A F) P-1.0-B



Images showing rejection of Reactive Orange 16 by membranes A) P-A B) P-B C) P-0.5-A D) P-0.5-B E) P-1.0-A F) P-1.0-B

References

1. F. Cheng, S. M. Sajedin, S. M. Kelly, A. F. Lee and A. Kornherr, *Carbohydr. Polym.*, 2014, **114**, 246-252.
2. V. R. Pereira, A. M. Isloor, U. K. Bhat and A. F. Ismail, *Desalination*, 2014, **351**, 220-227.
3. Y. Li, Y. Yu, L. Wu and J. Zhi, *Appl. Surf. Sci.*, 2013, **273**, 135-143.

4. S. Nasirian and H. Milani Moghaddam, *Int. J. Hydrogen Energy*, 2014, **39**, 630-642.
5. V. R. Pereira, A. M. Isloor, A. Al Ahmed and A. Ismail, *New J. Chem.*, 2015, **39**, 703-712.
6. S. B. Teli, S. Molina, A. Sotto, E. G. a. Calvo and J. d. Abajob, *Ind. Eng. Chem. Res.*, 2013, **52**, 9470-9479.