Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting information for

A bionanocomposite based on 1,4-diazabicyclo-[2.2.2]-octane cellulose nanofibers crosslinked-quaternary polysulfone as anion conducting membrane

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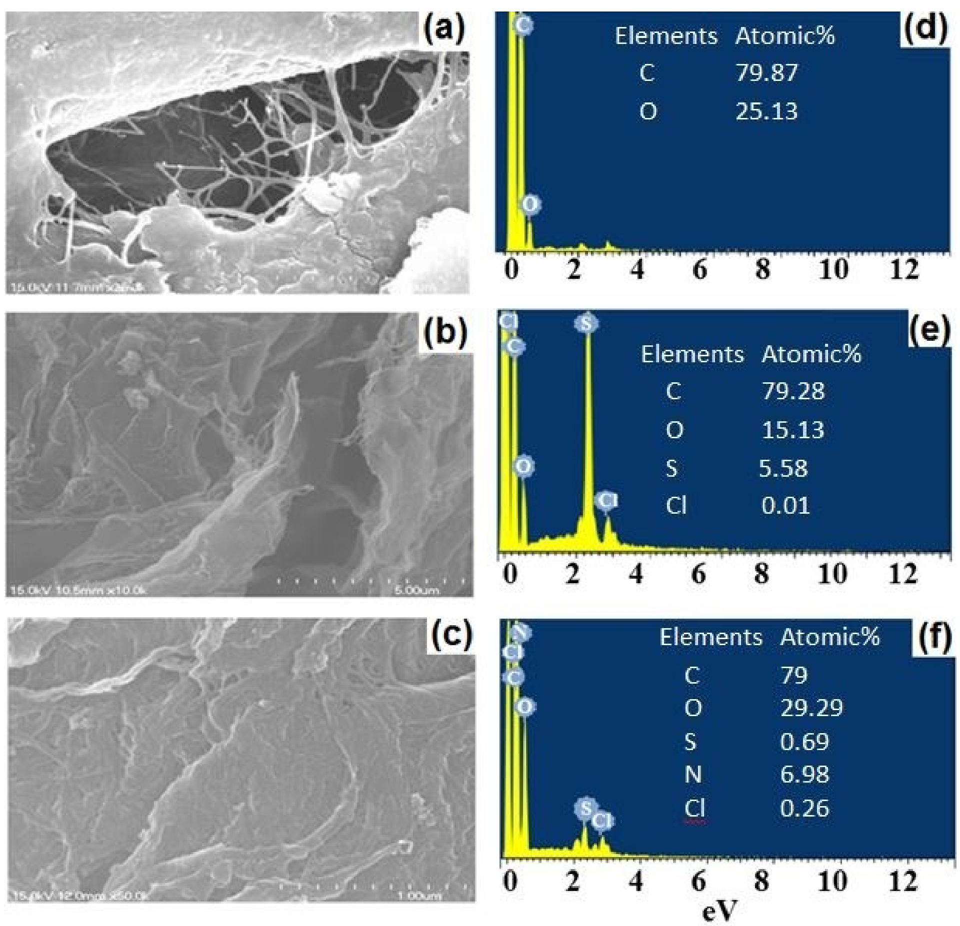

Fig. S1: (a), (b) & (c) SEM micrographs and (d), (e) & (f) EDX spectra of cellulose, tosylated cellulose and, quaternized cellulose, respectively.

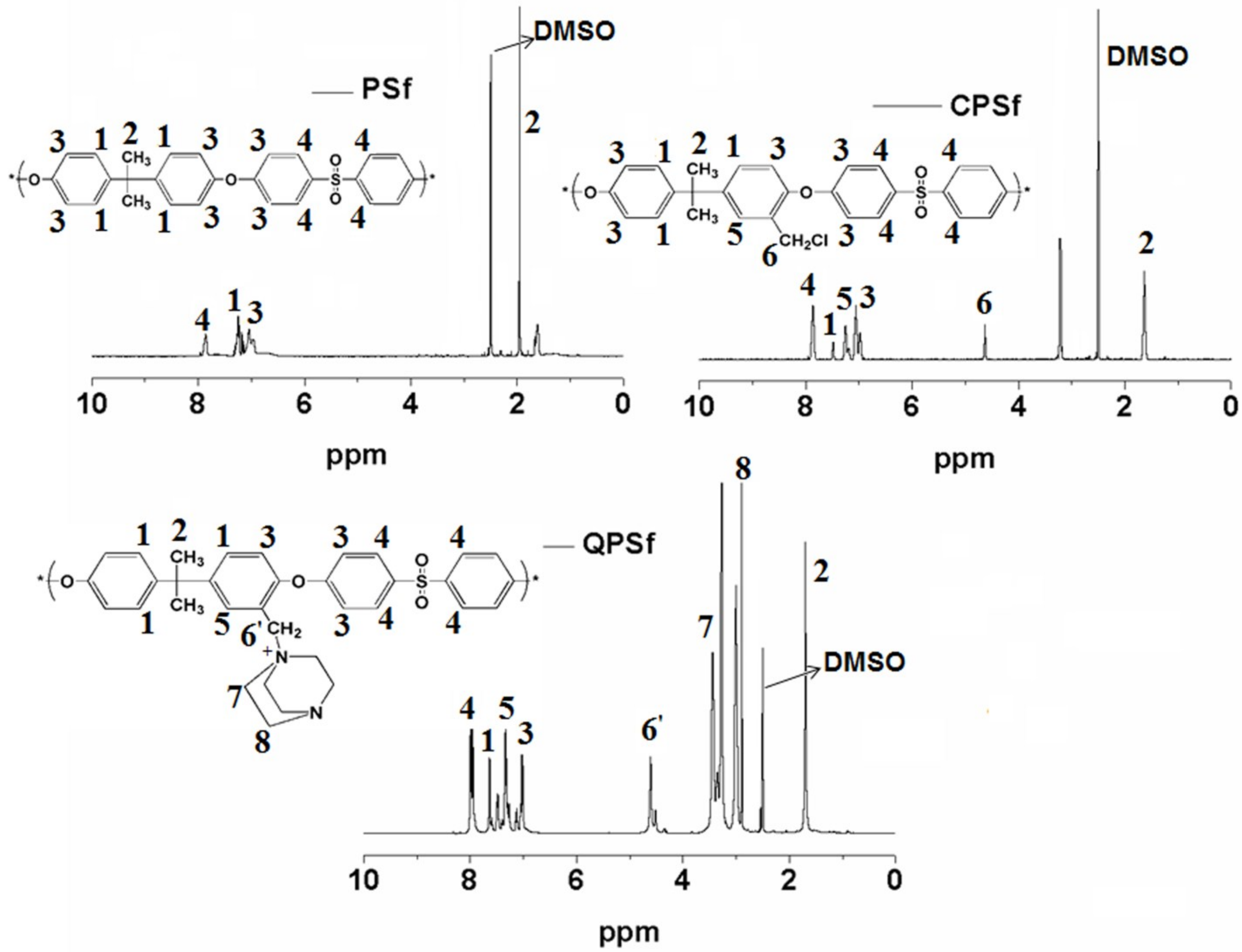

Fig. S2: ^{1}HNMR spectra.

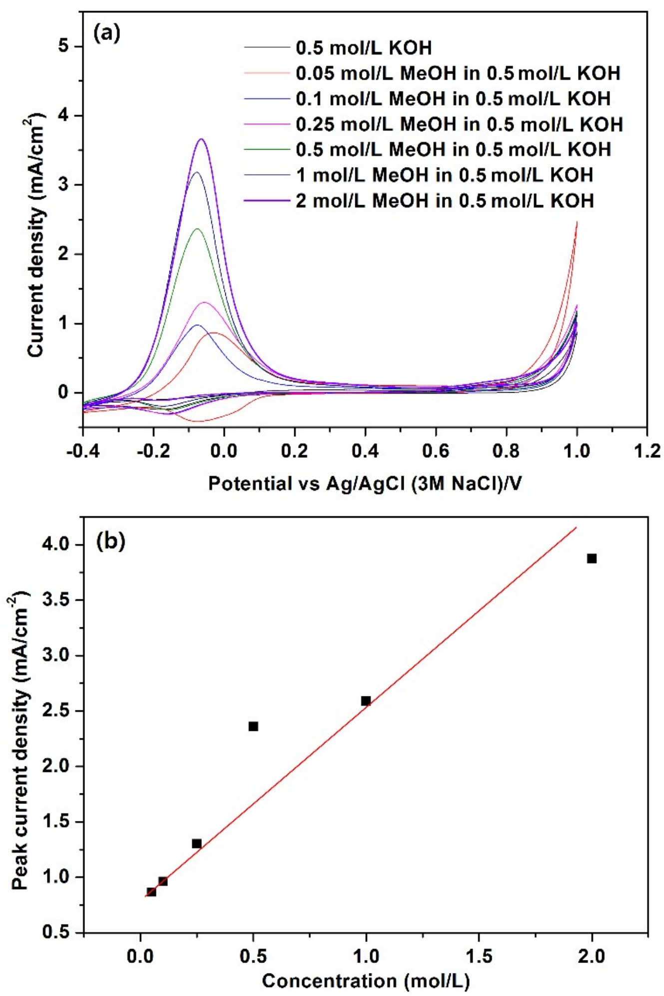

Fig. S3: (a) CV plots of different concentrations of methanol (MeOH) in 0. 5 mol/L KOH at a scanning rate of 20 mV/s, and (b) calibration plot of peak current density with methanol concentration.

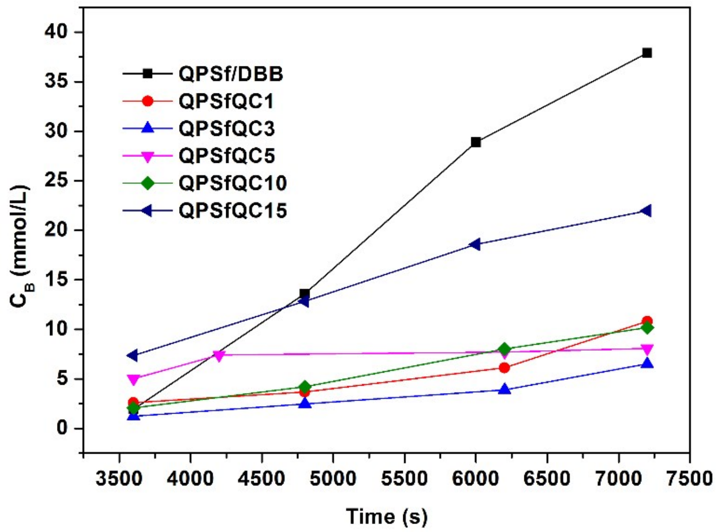

Fig. S4: Plot of methanol (MeOH) concentrations with time in compartment B for different membranes. The methanol permeability coefficient was calculated from the slope of the fitted line of the different membranes following the equation given below,[1,2]

$$DK = \frac{Slope\ \times C_B \times V_B \times L}{A \times C_A}$$

Where, D is the methanol diffusivity, K is the partition coefficient, C_A is the methanol concentration in the feed side of a two compartment H-type cell (compartment A), C_B is the concentration of methanol permeated into compartment B, V_B is the volume of the methanol permeation side i.e. Compartment B, A is the area of the and L is the thickness of membrane that is clamped between the two compartments.

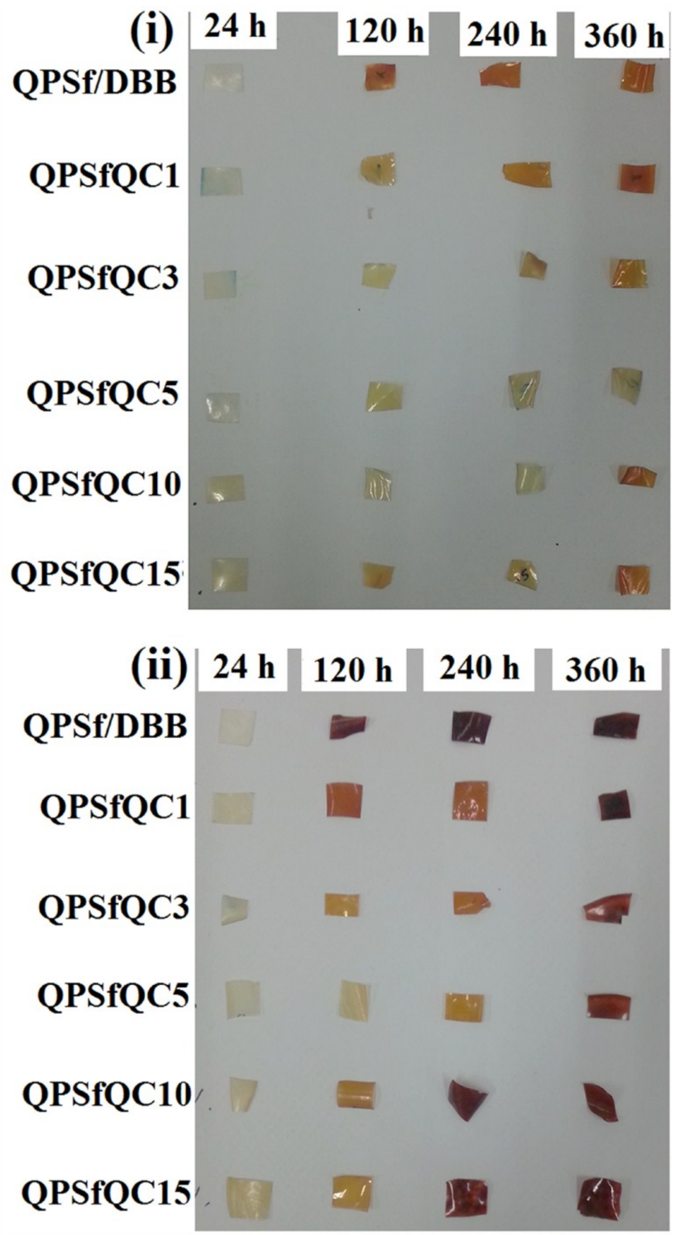

Fig. S5: Optical images of the membranes after treatment with 3 M KOH solution at different time intervals under (i) ambient conditions and (ii) at 60 °C, respectively.

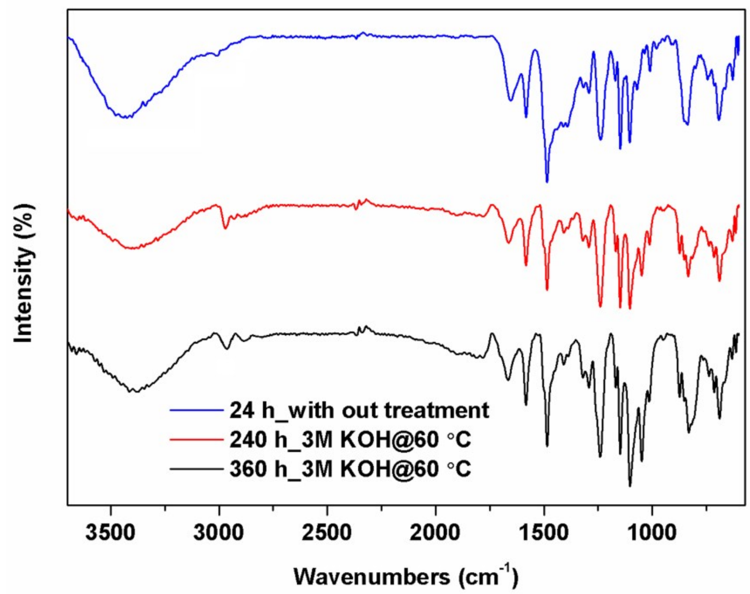

Fig. S6: Representative FTIR spectra of QPSfQC5 after immersion in 3 M KOH solution at 60 °C for different time intervals.

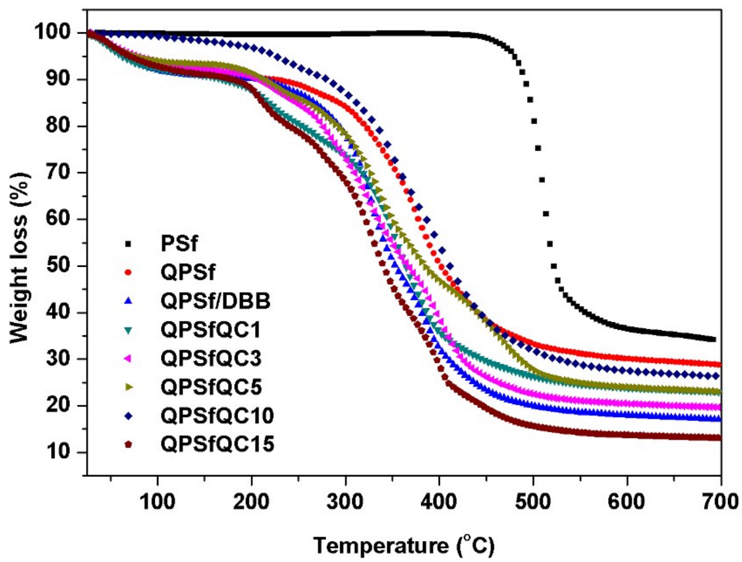

Fig. S7: TGA thermogram of the different membranes.

Table S1. Methanol permeability coefficient for the different membranes obtained from the time vs. concentration plot as shown in Fig. S4.

Sample code	Methanol permeability coefficient (cm^2/s) x 10^{-6}
QPSf/DBB	3.28
QPSfQC1	0.35
QPSfQC3	0.46
QPSfQC5	0.084
QPSfQC10	0.416
QPSfQC15	0.409

Table S2. Mechanical properties in dry state of the membranes

Sample code	Tensile strength (MPa)	Elongation at break (%)
PSf	27.7	9.53
QPSf/DBB	10.93	21.8
QPSfQC1	13.13	21.19
QPSfQC3	15.06	14.02
QPSfQC5	17.44	13.41
QPSfQC10	19.58	13.22
QPSfQC15	19.79	18.56

Table S3. Mechanical properties in wet state of the membranes

Sample code	Tensile strength (MPa)	Elongation at break (%)
QPSf/DBB	3. 83	41.98
QPSfQC1	11.56	9.35
QPSfQC3	4.28	32.14
QPSfQC5	6.75	39.34
QPSfQC10	8.67	29.65
QPSfQC15	6.40	16.04

References

1 K. Ramya and K. Dhathathreyan, *J. Memb. Sci.*, 2008, **311**, 121-127.

2 J. Ling, G. Longtin and O. Savadogo, *Asia-Pacific J. Chem. Eng.*, 2009, **4**, 25-32.