Supporting Information

Advanced ultrafiltration membranes based on functionalized poly(arylene ether sulfone) block copolymers

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Experimental part

S1. Gel permeation chromatography: Gel permeation chromatography (GPC) study was conducted in DMF solution containing 0.01g LiBr using a HPLC system equipped with Waters 590 pump, Shodex RI-71 refractive index detector and MZ SD plus columns, which were effective for 50-5000, 1000-70000 and 100-2000000 $gmol^{-1}$ molecular weights. The system was operated at 23^{o}C at flow rate of 1.0 ml min^{-1}.

S2. Determination of the viscosity of casting solutions: The viscosity of the casting solutions containing various fractions of PAES and PAES-CH_2Br block copolymers were determined by using Anton Paar Rheometer Physica MCR301 instrument equipped with rheometer plate of 5.5 cm diameter. For each measurement, 0.60 ml of casting solution was placed on the rheometer plate and the viscosity in a static mode was recorded at various shear rate in range of 0.10 -1000 s^{-1}.

S3. Determination of water uptake and porosity: The membranes were soaked in DI water for 24 h at RT and then membranes were taken out. Thereafter, the surface water of membranes was wiped off with the help of tissue paper. Subsequently, the weight of membranes was measured on the balance. Then, the wet membranes were dried in a vacuum oven at 60°C for 8 h and the weights of membranes were recorded. The water uptake

measurement was performed three times to ensure the reproducibility of data. The water uptake (φ) and the porosity (ε) of the membranes were estimated using Eq. (1) and (2):[24,28]

$$\varphi(\%) = \frac{(W_w - W_d)}{W_d} \times 100 \quad (1)$$

and

$$\varepsilon(\%) = \frac{(W_w - W_d)}{A \times L \times \rho} \times 100 \quad (2)$$

where W_w and W_d are the weight of membrane (g) in wet and dry state, A is the membrane area (cm^2), L is the membrane thickness (cm) and ρ is the density of pure water (g cm^{-3}).

S4. Determination of swelling ratio: This was estimated from the changes in volume (ΔV) in dry and wet states. The length, thickness and width of membranes in were recorded in wet and dry states. The obtained values were used to determine the change in volume of membranes in wet and dry conditions. The swelling ratio (S_r) of membranes was estimated using Eq. (3):[29]

$$S_r(\%) = \frac{(\Delta V_{wet} - \Delta V_{dry})}{\Delta V_{dry}} \times 100 \quad (3)$$

where ΔV_{wet} and ΔV_{dry} are the volume of membrane in wet and dry conditions.

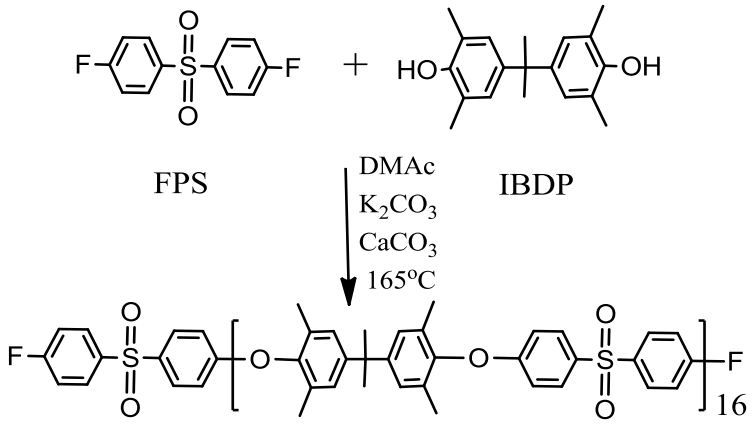
S5. Determination of ion-exchange capacity: IEC of membranes was estimated by back titration method.[30] The membranes were placed into the conical flasks containing 50 ml of 0.1 M HCl solution for 24 h and then membranes were taken out. Afterwards the ion-exchanged solutions were titrated with 0.01 M NaOH solution using phenolphthalein as an indicator. The wet membranes were dried in vacuum oven at 60°C for 6 h and the weights of membranes were recorded. The IEC of membranes was estimated using Eq. (4):[29,30]

$$IEC(meqiv.g^{-1}) = \frac{V_{O,NaOH} C_{NaOH} - V_{x,NaOH} C_{NaOH}}{W_d} \times 1000 \quad (4)$$

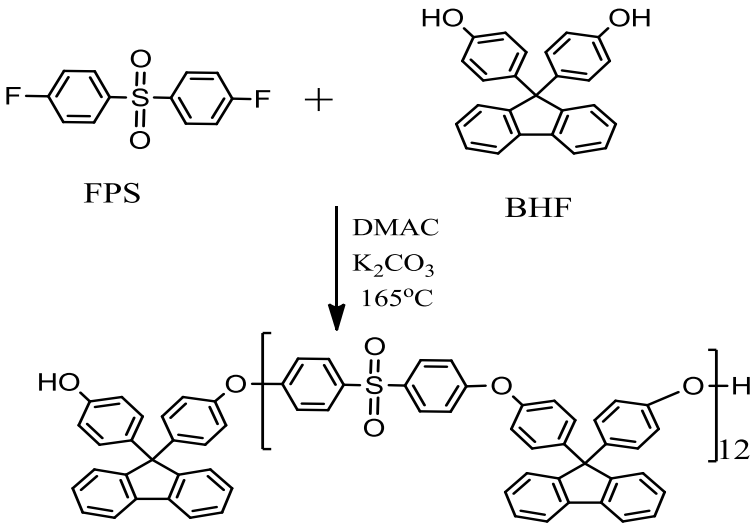
where $V_{0,NaOH}$ and $V_{x,NaOH}$ are the consumed volume of the NaOH (ml) in titration without and with membranes. C_{NaOH} is the concentration of NaOH solution (mol ml^{-1}). Three

replicates measurement were performed for each membrane to ensure the reproducibility of data.

Results and discussion



Scheme S1. Reaction route for the synthesis of A_{16} oligomer.



Scheme S2. Reaction route for the synthesis of B_{12} oligomer.

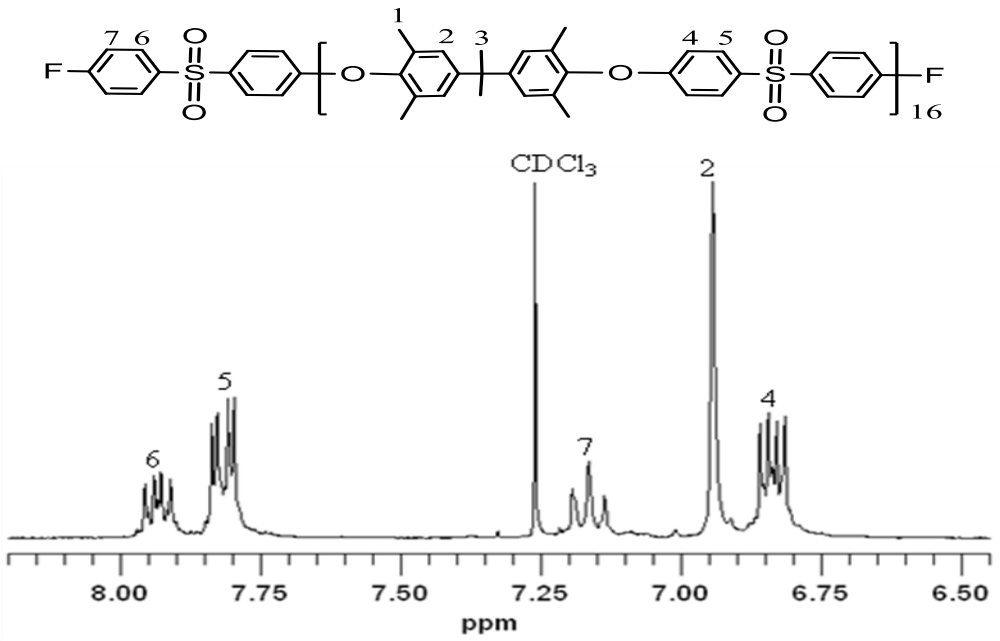


Figure S1. ^{1}H-NMR spectrum of A_{16} oligomer.

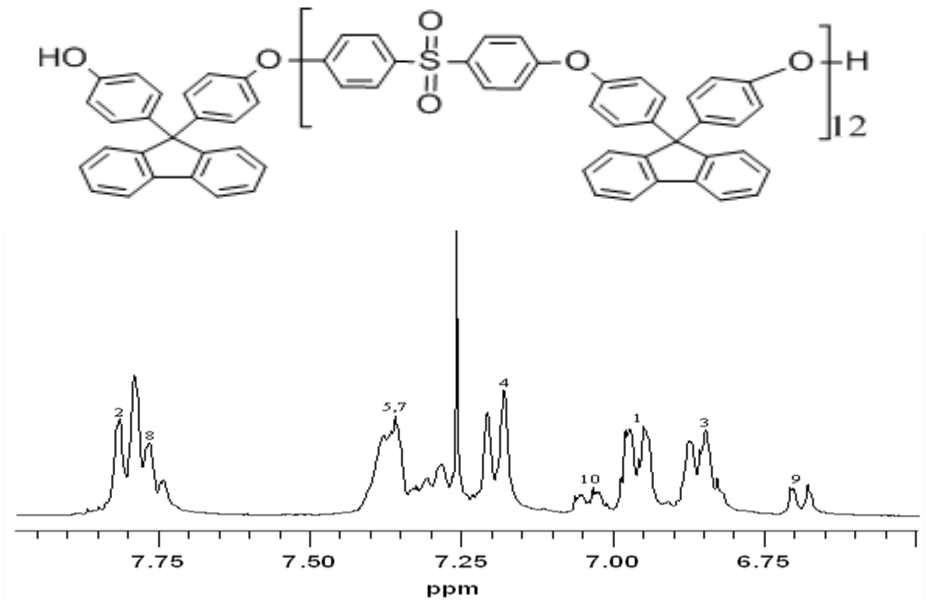


Figure S2. ^{1}H-NMR spectrum of B_{12} oligomer.

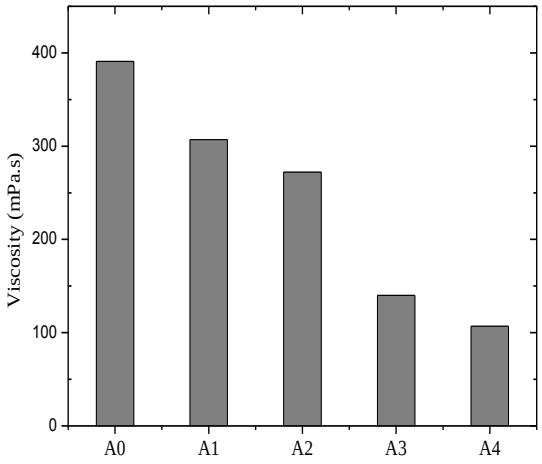


Figure S3. The viscosities of casting solutions containing varied fractions of PAES and PAES-CH_2Br block copolymers (wt %) at shear rate of 108 s^{-1} and 25^{o}C.

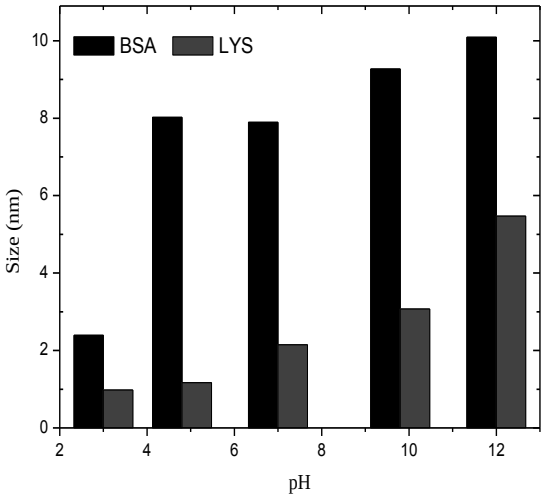


Figure S4. The variation in size of BSA and LYS (1 mg/mL phosphate buffer solution) at varied solution pH.