Supporting Information

Surprising Transformation of a Block Copolymer into a High Performance Polystyrene Ultrafiltration Membrane with a Hierarchically Organized Pore Structure

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Fig. S1 Top-surface SEM image of the qPS-b-P4VP membrane obtained after quaternization of the PS-b-P4VP membrane in 1% CH$_3$I in EtOH for 24 h.
Fig. S2 The $^{15}$N-$^1$H 2D NMR spectra of (a) PS-b-P4VP (c) PS membrane samples. Group A presents the protons and nitrogen of the P4VP block. The disappearance of group A in (c) is the consequence of the chemical degradation of pyridinium in alcoholic alkaline medium. Figure S2b represents the $^1$H NMR spectrum of the PS membrane obtained after chemical degradation of the PS-b-P4VP membrane. Figure S2d shows XPS spectra of the PS-b-P4VP and PS membranes. Nitrogen is absent in the PS membrane.
Fig. S3 (a) ATR-FTIR spectra of (i) PS-b-P4VP (ii) qPS-b-P4VP (iii) PS membranes, (b) represents the gravimetric analysis data of membranes before and after chemical degradation in alcoholic alkaline solution.
Fig. S3 $^1$H NMR spectrum of NaOH-EtOH treated unmethylated PS-$b$-P4VP.
Fig. S4 DSC thermograms of isoporous PS-\textit{b}-P4VP and PS membranes.
Fig. S5 Dynamic water contact angle of isoporous membranes.
Fig. S6 Optical microscopic images for feed (F) and permeate (P) samples of (a) oil-in-water emulsion; (b) Tween-80 stabilized oil-in-water emulsion and (c) SDS stabilized oil-in-water emulsion; scale bar = 100 μm.
**Fig. S7** Pure water flux of the membranes before and after chemical degradation.
Fig. S8 PEG rejection (%) of the PS-b-P4VP membrane (a) and the isoporous PS membranes at varied pH (b).
Table S2. Water flux comparison of different reported membranes with nanoporous PS membrane.

<table>
<thead>
<tr>
<th>Membrane samples</th>
<th>Water flux (L m$^{-2}$ h$^{-1}$ bar$^{-1}$)</th>
<th>References</th>
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<tbody>
<tr>
<td>Poly(styrene-$b$-polyethylene oxide)</td>
<td>800</td>
<td>1</td>
</tr>
<tr>
<td>polystyrene-$b$-poly(methyl methacrylate)</td>
<td>210-1000</td>
<td>2, 3</td>
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<tr>
<td>poly(styrene)-$b$-poly(4-vinyl pyridine)</td>
<td>600-900</td>
<td>4, 5</td>
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<tr>
<td>Isoporous PS/polysulfone composite</td>
<td>1.15</td>
<td>6</td>
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<tr>
<td>Isoporous PS membrane</td>
<td>2000</td>
<td>This study</td>
</tr>
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References