Electronic Supplementary Information

Spirocyclic Quaternary Ammonium Cations for Alkaline Anion Exchange Membrane Applications: An Experimental and Theoretical Study

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Figure S1. $^1$HNMR spectra of (A) [ASN]$^+$, (B) [ASD]$^+$, (C) [ASU]$^+$, (D) [BTMA]$^+$,
(E) [BMPy]$^+$, (F) [MAABCO]$^+$ in 4 M NaOH CD$_3$OD/D$_2$O solution (V$_{CD3OD}$:V$_{D2O}$=3:1) at 80 °C for 96 h.
Figure S2. $^1$HNMR spectra of (A) [ASN]$^+$, (B) [ASD]$^+$, (C) [ASU]$^+$ in 8 M NaOH CD$_3$OD/D$_2$O solution ($V_{CD3OD}:V_{D2O}=3:1$) at 80 °C for 72 h.

Scheme S1. Synthesis of spirocyclic QA cation based polymers.
Scheme S2. Synthetic routes of Spiroheterocyclic Quaternary Ammonium-Based Anion Exchange Membranes and the photographs of [PAPi][OH], and [PAHM][OH]. The membranes are transparent, flexible, and could be easily cut into desired sizes.
Figure S3. FT-IR of A) [PAPy][OH], [PAPI][OH], and [PAHM][OH] membranes; B) [PAPI][OH] membrane in 1M NaOH at 80 °C for various time.
Figure S4. SEM of [PAPi][OH] membrane in 1M NaOH at 80 °C for various time: (A) 0 h, (B) 168 h.