Engineered thin film nanocomposite membranes with polyethyleneimine interlayered sulfonated MXene for superior groundwater desalination

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High-resolution XPS spectra of SPMX:

The Ti 2p spectrum displayed two main peaks at binding energies of 458.86 eV and 464.63 eV, corresponding to the $2p_{3/2}$ and $2p_{1/2}$ electronic states, respectively. The S 2p peak was observed at 168.1 eV, which is attributed to the presence of sulfonic groups. The C 1s peak appeared at 248.8 eV, while the N 1s binding energy was recorded at 399.8 eV. Additionally, the F 1s peaks, representing the AlF and C-F bonds, were detected at binding energies of 689.2 eV and 684.6 eV, respectively. The O 1s peak was identified at 530.7 eV, as shown in Fig. S1.

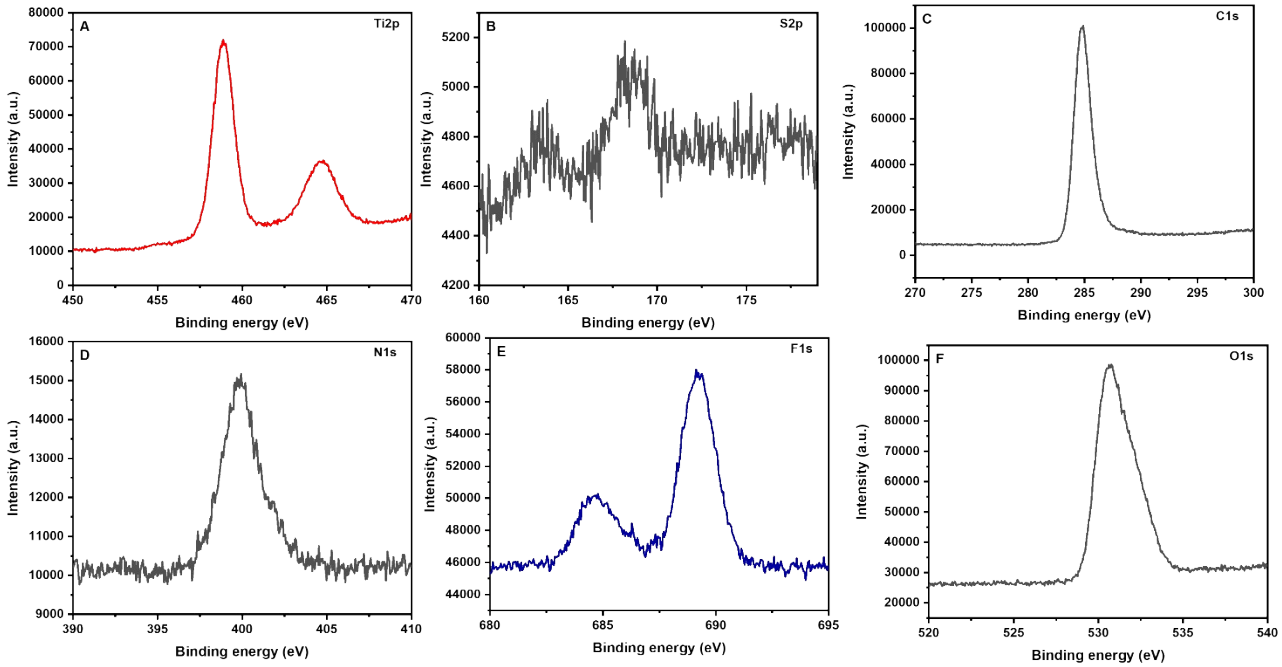

Fig. S1 High-resolution XPS spectra of SPMX (A) Ti2p, (B) S2p, (C) C1s, (D) N1s, (E) F1s and (F) O1s

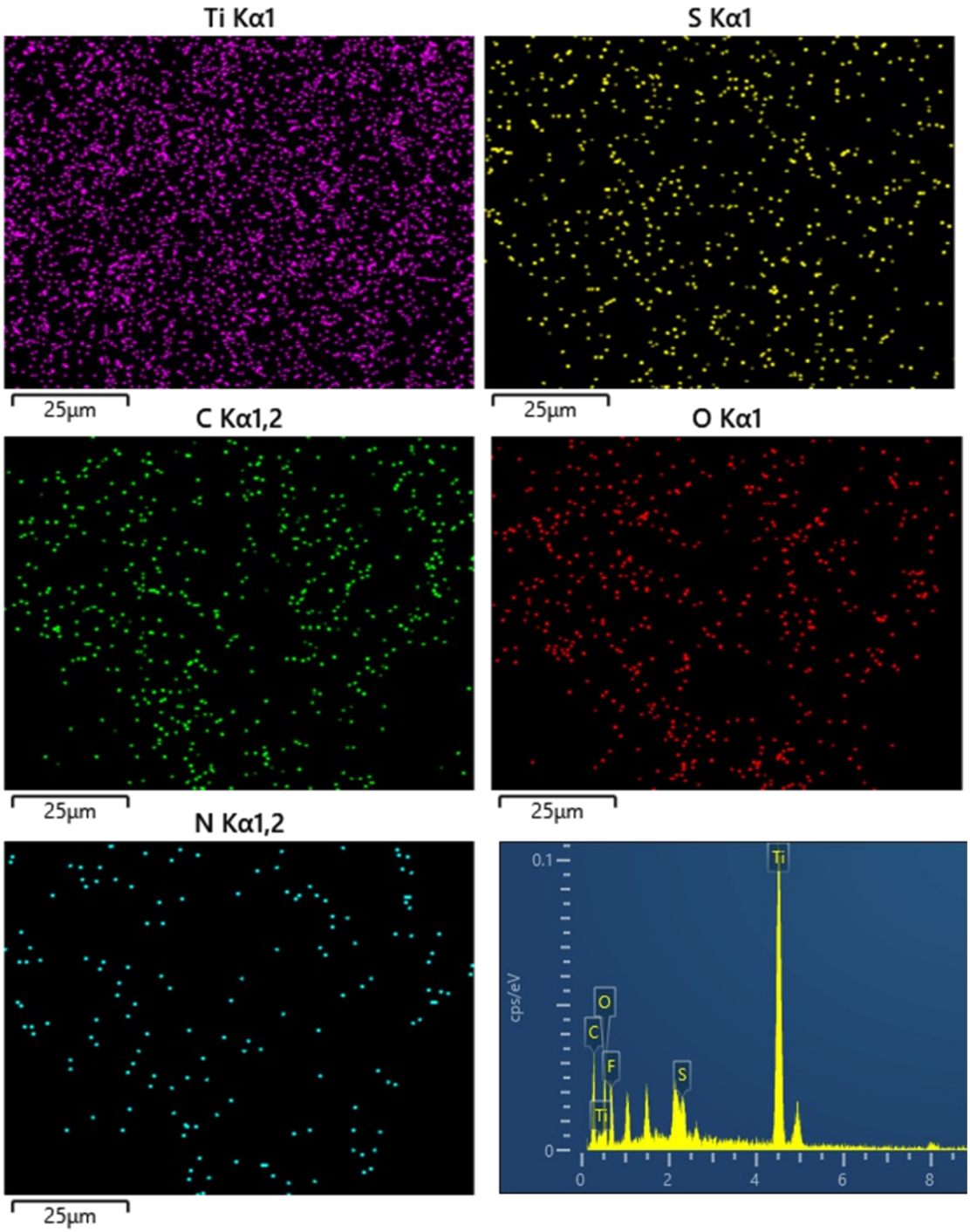

Fig. S2 Elemental mapping and EDS spectrum of SPMX material

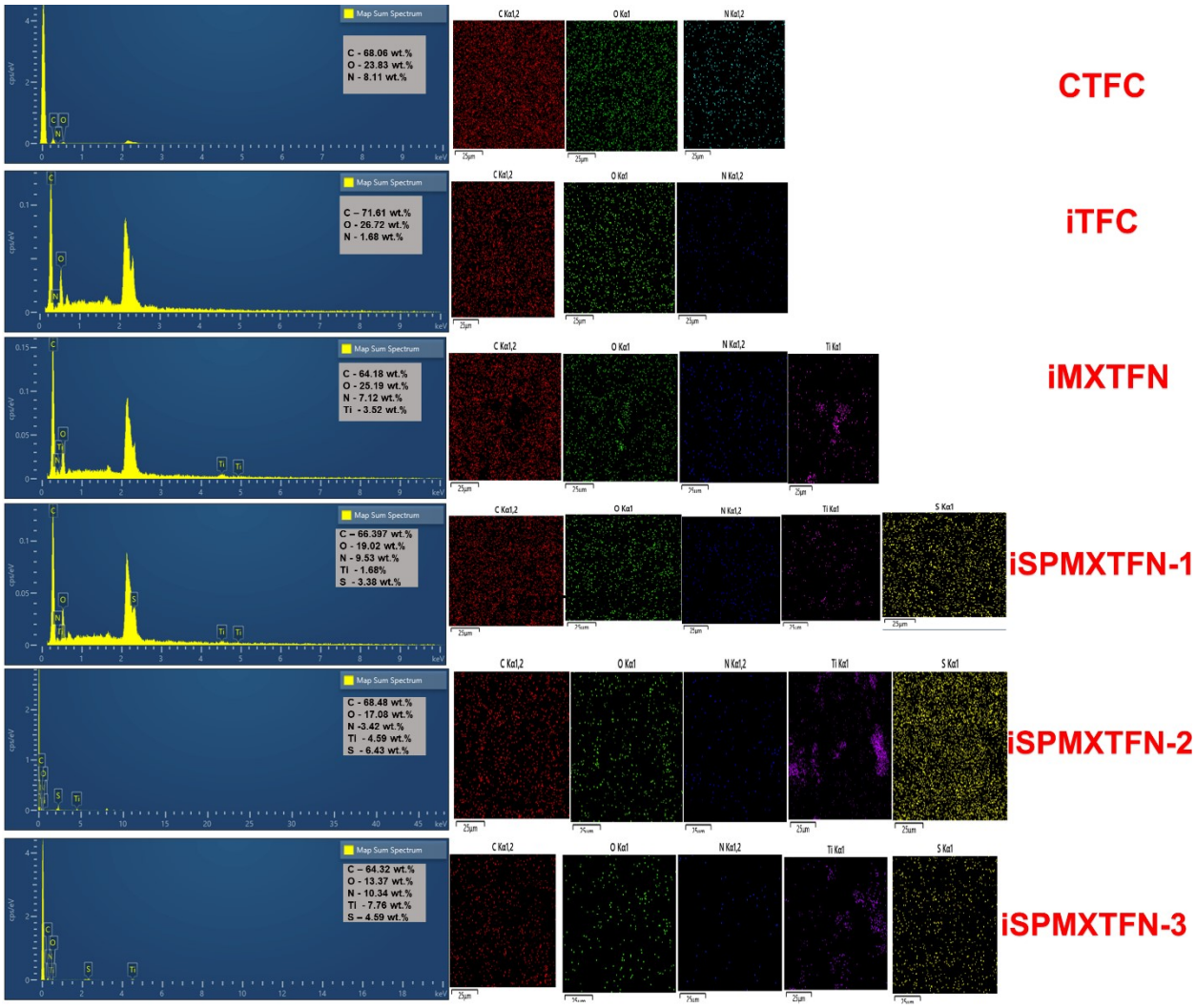

Fig. S3 Elemental mapping of CTFC, iTFC, iMXTFN, and iSPMXTFN membranes.

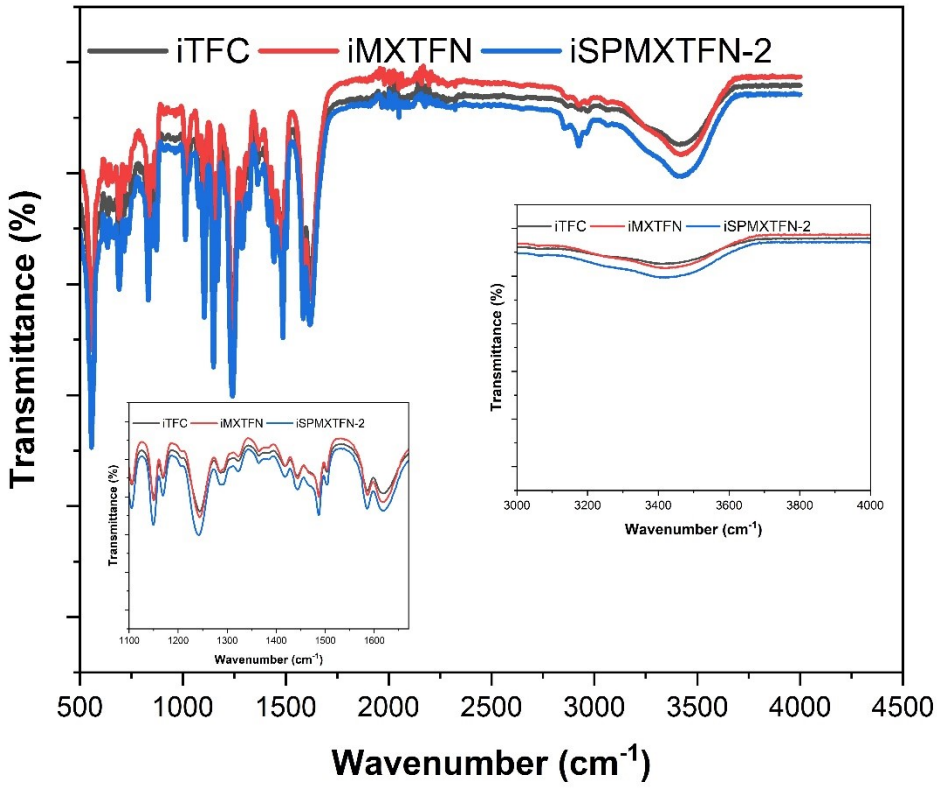

Fig. S4 ATR-FTIR spectra of long-term stability analysis of iTFC, iMXTFN and iSPMXTFN-2 membranes.

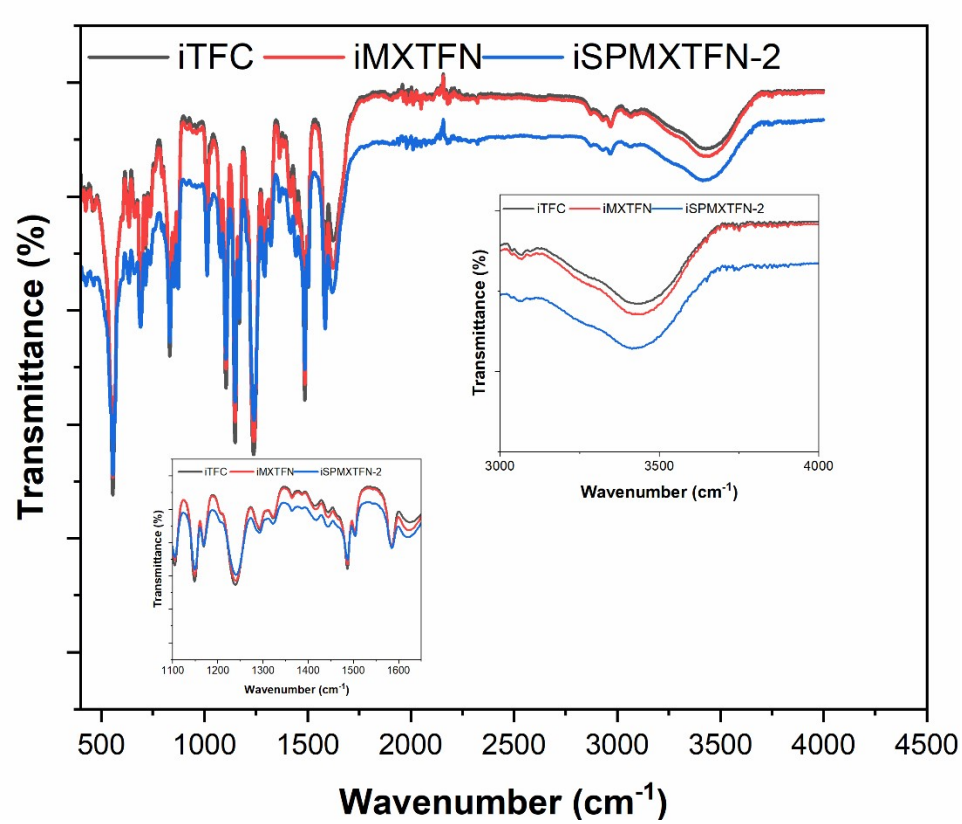

Fig. S5 ATR-FTIR spectra of after chlorinated analysis of iTFC, iMXTFN and iSPMXTFN-2 membranes.

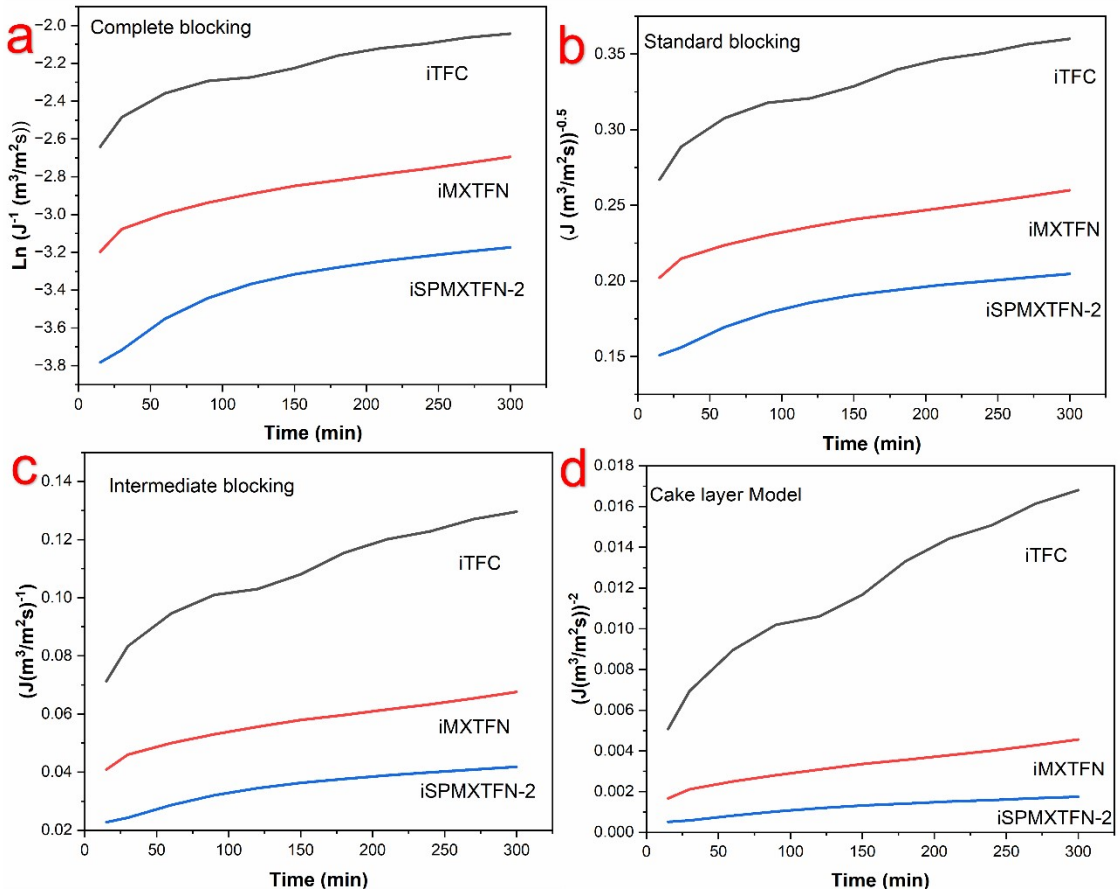

Fig. S6 Pore blocking analysis of iTFC, iMXTFN and iSPMTFN-2 membranes.