Supporting Information

An Efficient and Cost Effective Way for Conversion of Potassium Nitrate from Potassium Chloride using Electro-dialysis

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S1. Chemical and Structural Characterization:

The Fourier-transform infrared (FTIR) spectra of membranes is recorded using KBr pellet method with a spectrum GX series 49387 spectrometer in the frequency range 4000-400 cm^{-1}. Surface characterization of membrane are recorded by scanning electron microscopy (SEM) using LEO microscope after gold sputter coating.

S2. Thermo-mechanical stabilities

Investigation of thermal degradation of membranes were done on thermogravimetric analyser (TGA) under N_2 atmosphere on Mettler Toledo TGA/SDTA851e with stare software, with a heating rate of 10 °C/min from 50 to 600°C. The glass transition behavior of composite membranes was assessed through Differential Scanning calorimetry (DSC) using Mettler Toledo DSC822e thermal analyzer with stare software under temperature range 0 to 200°C. Dynamic mechanical stabilities of the membranes was carried out on Mettler Toledo dynamic mechanical analyzer (DMA) 861c instrument with stare software under nitrogen environment with a heating rate of 5°C/min from 30 to 450°C with 1 Hz frequency. Stress-strain property of membrane samples (2.5 cm long, 0.5 cm width 0.15 mm thick) is determined using Zwick Roell Z2.5 tester. The testXpert II -V3.5 software was used for data analysis. Measurements are carried out with 3 samples, whose average is reported.

S3. Physiochemical Characterization

Ion exchange capacity

IEC was determined by acid base titration by immersing the membranes in 0.1M NaCl for 24h at room temperature, washed with water and then 10 cm^3 solution was titrated against 0.01M NaOH. The IEC was evaluated by the following equation:

$$\boldsymbol{IEC\left(mequiv\ g^{-1}_{dry\ membrane}\right) = \frac{C_{Na^+}V_{sol}}{W_{dry}}}$$

where C_{Na+} is the concentration of Na^+ in the extraction solution, V_{sol} is the volume of titrated or consumed NaOH and W_{dry} is the dried membrane weight.

Proton Conductivity Measurements at different temperature

All the membranes are equilibrated in water at room temperature. Membrane resistance measurements for each membrane are performed The spectrum is obtained as complex impedance with imaginary component of $Z^{"}$ and real component of $Z^{"}$. Membrane resistance was obtained from Nyquist plot by fit and simulation method. Proton conductivity was calculated from the following equation:

$$\boldsymbol{\kappa_m\ (\Omega^{-1}\ cm^{-1}) = \frac{L\ (cm)}{R\ (\Omega) \times A\ (cm^2)}}$$

where L is the distance between the electrodes used to measure the potential, R is the resistance of the membrane, and A is the surface area of the membrane.

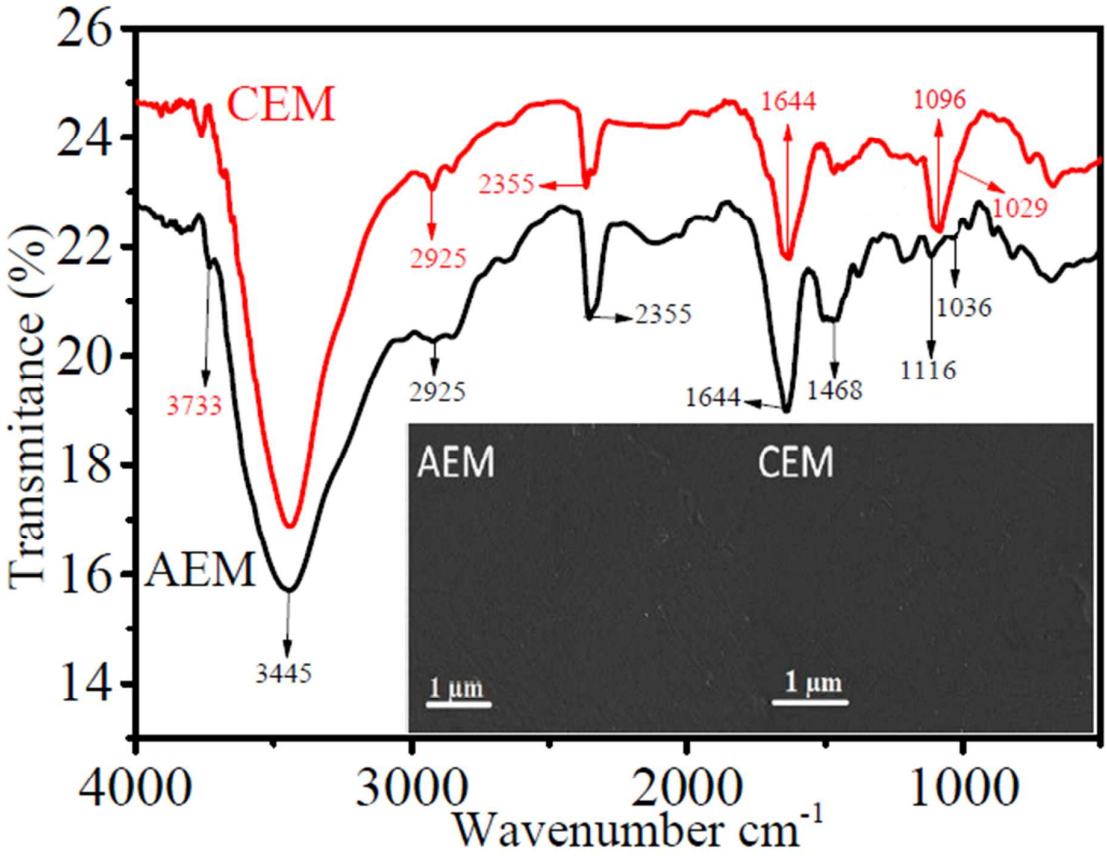

Fig. S 1: FTIR spectra SEM images of for ion exchange membranes.