Supplementary Information

Separation Behavior of Hydrogen Isotopes via Water Pervaporation using Proton Conductive Membranes

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ESI 1. Through-plane proton conductivity

The proton conductivity of the fully hydrated membrane was evaluated using a ZIVE SP2 instrument (WonA Tech, South Korea) through electrochemical impedance analysis. This analysis was conducted using a custom-made through-plane conductivity cell equipped with platinum electrodes (active area: 1 × 1 cm^2). The fully hydrated membrane was placed between platinum electrodes held by a Teflon holder, and the entire assembly was then immersed in deionized water. The membrane's resistance was measured by identifying the intercept of the high-frequency impedance with the real axis at 25 °C. Specific conductivity (σ) was calculated based on the membrane's thickness (L) and the measurement area (A) using the following formula.

$$\sigma\ (S \cdot cm^{-1}) = L/(R \cdot A)$$

ESI 2. Tensile test

The tensile test of the membrane was conducted using a universal testing machine (Qmesys, South Korea) at ambient conditions. The membrane was prepared by air drying before the measurements. Both ends of the membrane specimen (40 × 6 mm²) were bonded with cardboard end tabs (10 × 6 mm²). The displacement was adjusted at a rate of 10 mm/min to obtain the stress-strain curves.

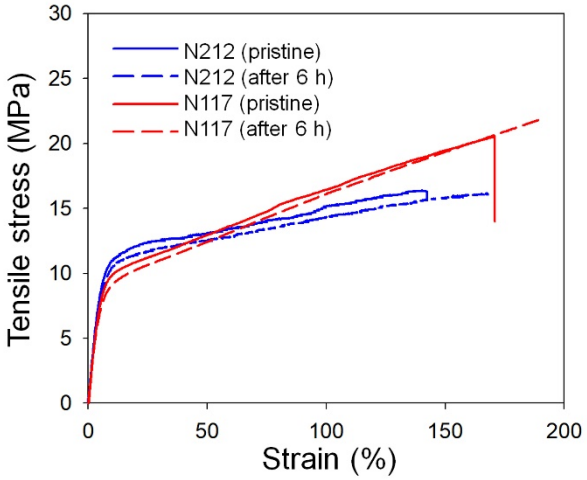

Fig. S1. Tensile stress-strain curves of dried N212 and N117 membranes measured at ambient conditions before and after the water pervaporation test, conducted for 6 hours at 35°C.