Sulfonated polyethersulfone based cation exchange membranes for reverse electrodialysis: tradeoff between electrochemical properties.

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Reverse Elecrodialysis (RED) is a promising sustainable membrane based technology that can harvest mixing energy of solutions. Unfortunately, currently available commercial ion exchange membranes – being not specifically designed for RED – are far from satisfying the requirements of this operation. In this work, to overcome the membrane related problems in RED, sulfonated polyethersulfone cation exchange membranes (CEM) were produced by solvent evaporation and wet phase inversion methods. Effect of co-solvent, evaporation time, coagulation bath composition and concentration were investigated to optimize the membrane electrochemical properties. Optimized membrane (SPES-P) was further characterized for different feed solutions that can represent RED conditions better. In addition, it was compared with CMX by Neosepta and custom-made membrane prepared by solvent evaporation (SPES-D). Based on the electrochemical properties, theoretical maximum power density of three membranes were estimated. Comparing the custom-made membranes, permselectivity of SPES-D outperformed SPES-P in 0.1M/0.5M, 0.1M/1.0M and 0.5M/1.0M NaCl solution pairs while conductivity of SPES-P was superior in 0.5M and 1.0M NaCl solutions.

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Keywords

Reverse electrodialysis, salinity gradient energy, sulfonated polyethersulfone, electrochemical characterization, phase inversion