Improvement of biohydrogen generation and seawater desalination in a microbial electrodialysis cell by installing the direct proton transfer pathway between the anode and cathode chambers

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**ABSTRACT**

We are focusing on the enhancement of microbial electrodialysis cell (MEDC) performance by alleviation of pH gradient between the anode and cathode chambers by setting up a direct proton transfer pathway, which allows protons to migration unconstrainedly, with three different membranes ultrafiltration membrane (UF), anion-exchange membrane (AEM), cation-exchange membrane (CEM)) in the MEDC. Setting up a direct proton transfer pathway between the anode and cathode chamber in the MEDC abated pH gradient by up to about 54%. Also, hydrogen production and salt removal efficiency were enhanced. In a comparison of membranes for a direct proton transfer pathway, an AEM has the best performance for reduction for pH gradient because of a higher proton transfer by phosphate anions, but due to the high substrate permeability of an AEM, the hydrogen production with AEM was lower than that with UF—which highest hydrogen production was observed with UF (5.77 ± 0.54 mL, 0.55 ± 0.14 mL/h). In terms of salt removal efficiency, using CEM as a direct proton transfer pathway showed the highest performance (77.63%).

**Keywords:** Desalination; Direct proton transfer pathway; Hydrogen; Microbial electrodialysis cell; pH gradient

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