# Electrodialysis Efficiency in Desalination for Electrolytic Fuel Cell

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As non-renewable energy and fresh water resources rapidly deplete, countries are utilizing electrolysis to attain potable water and renewable energy; however, many developing countries warrant accessible, saltwater bodies for electrolysis, which yields toxic chlorine gas and kills over 155 workers annually. This experiment was conducted to present experimental data, proving the efficiency of electodialysis desalination—compared to reverse osmosis (RO)—in application of hydrogen fuel cell (HFC). An electroldialysis cell was initially built that employed semipermeable membranes to electrically deionize eight different saltwater concentrations and pure water as the control. Then, the HFC was constructed to split water molecules into water's component gases within the anode and cathode chambers. When the external circuit was removed, the recombination of gases yielded electrical output (two electrons per water molecule) and potable water without carbon emission. After conducting eight trials, the electrodialysis cell 96.8% successfully desalinated all varying saltwater solutions to 0.12% +/- 0.008% brine, which is 64.5% more effective than RO before electrolysis. The HFC produced a maximum voltage of 3.56V from 0.00311 mol H2 with average of 3.28 V +/- 0.16V—10.7% efficiency compared to voltage input to sustain both cells—within ten seconds of operation and further desalinated solution to 0.09% brine, ensuring no production of chlorine gas. The researcher concluded that electrodialysis is a more efficient and cheaper method of desalination than reverse osmosis when coupled with electrolysis, which can provide sustainable energy and water purification for future implementation.

**Awards Won:**