High impact title that describes the focus of the study in a simple manner (easy to read from a distance)

The poster follows a defined color scheme, which makes it aesthetically pleasing.

Cost Reduction of Batch Electrodialysis Systems using Voltage Regulation

[redacted]

Headers are complete thoughts that help the audience navigate and get the main story. Numbered headers that guides the reader through the poster.

1. Our First Domestic ED Prototype Was Too Expensive

Domestic Reverse Osmosis (RO) systems are widely used in Indian cities to desalinate groundwater but recover only 25 to 40%[1, 2] of the feed, stressing scarce groundwater resources. Our first batch Electrodialysis (ED) prototype acheived a higher recovery of 86% but was too expensive.

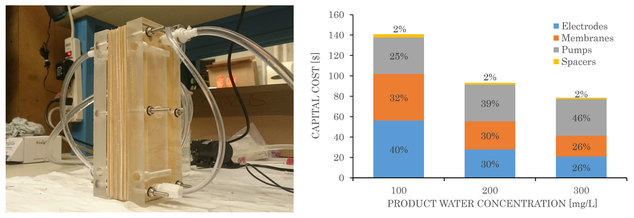

Fig 1. The first ED prototype had an estimated cost of $140 vs. $30 for RO. Cost breakdown assumes 2000 mg/L input, 90% recovery and averaged over 11.5-12.5 LPH production.

2. We Investigated the Design Space

Systems with cost-optimal geometries, flowrates, and voltages for were derived using a Genetic Algorithm.

- Capital cost (*CC*) dominated energetic cost (*OC*)
- Designs for lower product concentrations (C_{prod}) operated at lower current densities (i), resulting in higher *CC*.
- Reduce material costs (lower CC curve) & increase i (push designs right) to decrease cost.
- Designs were banded by C_{prod}.

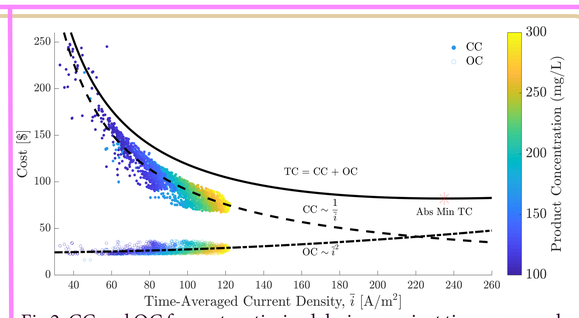

Fig 2. CC and OC for cost-optimized designs against time-averaged i over batch duration. 2000 mg/L to 300-100 mg/L product at 90% recovery & 8-12 LPH.

All sections have at least 50% of pictures

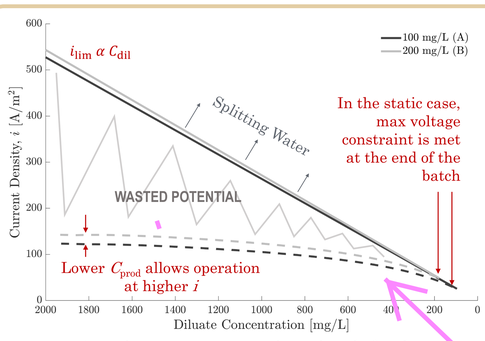

Fig 3. i & i_{lim} during constant-voltage batch for designs optimized to produce 200, 100 mg/L water at 10 L/hr.

3. Discovered Constant Voltage Operation Resulted in Membrane Underutilization

Batch ED is typically operated at a constant voltage both in simulation, and practice[3-5], but this results in "wasted potential":

- Max static voltage constrained by limiting current density i_{lim} at product water concentration C_{prod}.
- Results in operation at current densities i that are far lower than i_{lim} for a majority of the batch process.
- Instead, could regulate voltage to maximize i while maintaining $i < i_{lim}$.

Use of bullet points instead of full sentences that helps the reader scan the poster and get the main points

Use of different colors in the text to put emphasis on the important facts

5. Implemented Voltage Regulation in Second Prototype to Reduce Cost

A 35% reduction in membrane area was obtained for the same production performance by implementing voltage regulation, resulting in a $40 cost reduction.

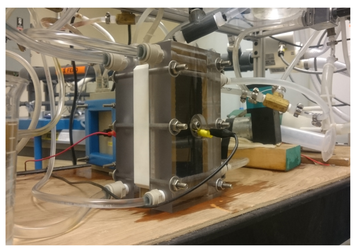

Fig 6. Second prototype implemented a regulator that applied between 0-48V, controlled by an Ardunio microcontroller.

Additional research questions:

- Can alternative electrode materials reduce cost?
- What reduction in cost can be expected with volume?
- How does conductivity sensor accuracy affect voltage regulation?

4. Demonstrated Closed-Loop Voltage Control Yields Higher Production Rates

Voltage, applied to a lab-scale stack, was regulated based on diluate conductivity measurements to obtain a desired instantaneous current.

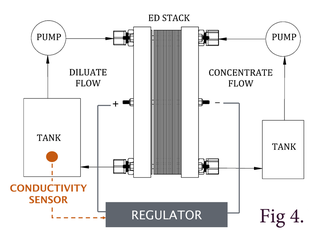

Fig 4. Voltage regulation schematic.

- Batch duration decreased by ~40%.
- Current trajectories matched theoretical expectations.
- Up to ~3x increase in i between static and regulated cases was obtained.

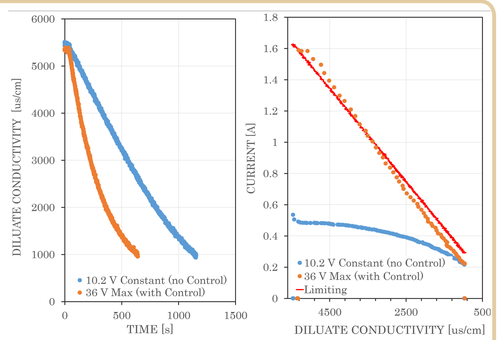

Fig 5. Desalination of 1.4 L NaCl solution from 2000 to 500 mg/L at 70% recovery using PcCell Stack with 18 cell-pairs

Main details are highlighted on the figure to help the reader understand the plots.

Sections are well defined and space is left in between them to make the poster "breathable"

References

[1] Comprehensive Initiative on Technology Evaluation, Household Water Filter Evaluation,"pp. 1-31, 2015.
[2] Wright, N. C., and Winter V., A. G., 2014, "Justification for community-scale photovoltaic-powered electrodialysis desalination systems for inland rural villages in India."
[3] Y. Tanaka, A computer simulation of batch ion exchange membrane electrodialysis for desalination of saline water," Desalination, vol. 249, no. 3, pp. 1039-1047, 2009.
[4] J. Uche, F. Crez, A. A. Bayod, and A. Martnez, On-grid and o-grid batch-ED process: Simulation and experimental tests," Energy, vol. 57, pp. 44-54, 2013.
[5] J. M. Ortiz, J. a. Sotoca, E. Exposito, F. Gallud, V. Garca-Garca, V. Montiel, and a. Aldaz, Brackish water desalination by electrodialysis: Batch recirculation operation modeling," Journal of Membrane Science, vol. 252, no. 1-2, pp. 65-75, 2005.